

**Reconceptualising the Visual World of
the Embodied Human Being:
A Philosophical Study of the Problem of
Visual Perception**

**A THESIS SUBMITTED FOR THE PhD.
DEGREE (ARTS) IN
PHILOSOPHY
JADAVPUR UNIVERSITY
2020**

**By
Arpita Sarkar
Department of Philosophy
Jadavpur University
Kolkata – 700032
India**

Certified that

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Arpita Sarkar 27/11/2020
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Countersigned by the supervisors

P. Sarkar 27/11/2020
Professor Proyash Sarkar

Professor
Department of Philosophy
Jadavpur University
Kolkata-700 032

Maushumi Guha 27.11.20
Professor Maushumi Guha

Professor
Department of Philosophy
Jadavpur University
Kolkata-700 032

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["Affordances and neuroscience: Steps towards a successful marriage", Neuroscience & Biobehavioral Reviews, 2017](#)

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[Sanja Kiš Žuvela. "Body part terms in musical discourse", John Benjamins Publishing Company, 2020](#)

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[Aaron Ben-Zeev. "J.J. Gibson and the ecological approach to perception", Studies in History and Philosophy of Science Part A, 1981](#)

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To
Arpita Sarkar
Ph. D. Research Fellow
Department of Philosophy
Jadavpur University
Kolkata 32

17th April 2019

Dear Madam,

With great pleasure we want to intimate you that your paper “‘প্রত্যক্ষের প্রকল্পঃ রিচার্ড গ্রেগরী ও ধর্মকীর্তির প্রত্যক্ষ তত্ত্ব অবলম্বনে এক পর্যালোচনা’ has been accepted for publication in the forthcoming issue of *Darshan Bikkha*, year 2018-19.

Thanking You

With best wishes
Yours sincerely,

Madhumita Chattopadhyay
Professor Madhumita Chattopadhyay
Chief Editor
Darshan Bikkha

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দাম তিনশত টাকা

সূচিপত্র

সংঘাতবাদ হইতে বিবর্তবাদ	সীতানাথ গোস্বামী	৯
আকাশ প্রকৃতির বিকার	অপরাজিতা কুণ্ডু	১৩
উদ্ভবতত্ত্ব ও মানস কারণতা	সৌতি বসু	২৬
প্রত্যক্ষের প্রকল্প : রিচার্ড গ্রেগরী ও ধর্মকীর্তির		
প্রত্যক্ষ তত্ত্ব অবলম্বনে এক পর্যালোচনা	অর্পিতা সরকার	৪৬
তৃতীয় লিপ্সের প্রেক্ষিতে সমকামী নারী নৈতিকতা	সানন্দা সেন	৭২
মহিষ জাতকঃ একটি দার্শনিক তত্ত্বালোচনা	মৌমিতা রায়	৮৪
স্বামী বিবেকানন্দের চিন্তায় প্রায়োগিক বেদান্ত	সমর কুমার মণ্ডল	৯৫
কাললক্ষণবিমর্শ— খগুনশৈলীর একটি অনুধ্যান	প্রীতম ঘোষাল	১০৯
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অর্পিতা সরকার

ভূমিকা

প্রত্যক্ষ কী? কীভাবে এই প্রত্যক্ষ সাধিত হয়? মনোদর্শন, কগ্নিটিভ সায়েন্স, এমনকী মনোবিজ্ঞানের কিছু কিছু ক্ষেত্রে এইরকম প্রশ্ন অত্যন্ত গুরুত্বপূর্ণ গবেষণার বিষয় বলে বিবেচিত হয়। পাশ্চাত্য বা ভারতীয় নির্বিশেষে জ্ঞানতত্ত্বের আলোচনায় জ্ঞানলাভের উৎস রূপে প্রত্যক্ষ স্বীকৃত হয় এবং সেইসঙ্গে প্রত্যক্ষকে যথার্থ জ্ঞান লাভের অন্যতম নির্ভরযোগ্য উপায় বলে স্বীকার করা হয়। যথার্থ জ্ঞান লাভের আর যে সকল উপায় আছে সেই সকল উপায় প্রাথমিকভাবে প্রত্যক্ষের উপর নির্ভর করে বলে প্রত্যক্ষকে আনুমানাদি অন্যান্য উপায়গুলির তুলনায় উপরে রাখা হয়। কিন্তু এই জ্ঞান লাভের উপায়-রূপ যে প্রত্যক্ষ সেটি কীভাবে সম্পাদিত হয়, কী প্রকার ক্রমের মধ্যে দিয়ে গিয়ে প্রত্যক্ষ-প্রক্রিয়াটি (the process of perception) সাধিত হয় এবং জ্ঞান উৎপন্ন হয়, সেই দিকগুলির উল্লেখ বা আলোচনা প্রথাগত জ্ঞানতত্ত্বে সেভাবে পাওয়া যায় না। উক্ত জিজ্ঞাসাগুলি ছাড়াও আরও এমন কিছু জিজ্ঞাসা আছে যেগুলি জ্ঞানতত্ত্বের সীমানারই অন্তর্গত হলেও জ্ঞানতত্ত্বের আলোচনায় এগুলির সমাধান মেলে না। যেমন, প্রত্যক্ষ পদ্ধতি দ্বারা যে প্রত্যক্ষজ্ঞান উৎপন্ন হয় তার লক্ষ্য কী, অর্থাৎ মানুষের ব্যবহারিক (empirical) জীবনে এই প্রত্যক্ষ জ্ঞানের ভূমিকা কীরূপ, কী উদ্দেশ্যে একজন সাধারণ মানুষ কোন জাগতিক বিষয়ের যথার্থ জ্ঞান লাভের জন্য প্রত্যক্ষকেই প্রাথমিকভাবে বেছে নেয়, ইত্যাদি। যদিও ভারতীয় জ্ঞানতত্ত্বের আলোচনায় একটু ব্যতিক্রম পরিলক্ষিত হয়। এখানে দেখা যায় যে বিভিন্ন সম্প্রদায়ের দার্শনিকগণ তাঁদের জ্ঞানতত্ত্বের আলোচনায় যথার্থ জ্ঞান লাভের উপায় বা প্রমাণ পর্যায়ে যথার্থ প্রত্যক্ষজ্ঞানের স্বরূপ বর্ণনা করার পাশাপাশি কীভাবে এই প্রত্যক্ষজ্ঞান উৎপন্ন হয় সেই বর্ণনাও প্রদান করেন। প্রথাগত জ্ঞানতত্ত্বের ক্ষেত্রে প্রত্যক্ষের এমন কোন স্বতন্ত্র তত্ত্ব মেলা ভার, যেখানে কেবলমাত্র প্রত্যক্ষ বিষয়েই বিবিধ আঙ্গিক থেকে আলোচনা আছে। এই কাজটির কিন্তু দেখা মেলে কিছু মনোবিজ্ঞানী ও কগ্নিটিভ সায়েন্টিস্টের লেখার মধ্যে দিয়ে। এরকম কিছু কাজের দৃষ্টান্ত স্বরূপ হারমন্ড ভন হেল্মহল্টজ-এর প্রত্যক্ষের অচেতন অনুমানের তত্ত্ব (theory of unconscious inference), জেমস্ জেরম গিবসনের প্রত্যক্ষের নৈস্বর্গিক তত্ত্ব (ecological theory



Two-day State-level Seminar

On

The Concept of Body in Buddhist Philosophy and Culture

Organized by

The ICPR Center for Buddhist Studies, Department of Philosophy, Jadavpur University

*This is to certify that...Smt. Arpita Sarkar..... of
...Jadavpur University.....has presented a
paper entitled From the Concept of Body to the Idea of Embodiment..... in this
Seminar on 3rd October, 2016.*

Madhumita Chattopadhyay
Madhumita Chattopadhyay
Co-ordinator


Gangadhar Kar
Head



WORLD PHILOSOPHY DAY 2018

Organized by

Department of Philosophy, Jadavpur University

This is to certify that Smt. Arpita Sarkar participated in the one day state level seminar, titled **PHILOSOPHY: THEN AND NOW** held on the occasion of World Philosophy Day on 21st December 2018 at Department of Philosophy, Jadavpur University and presented a paper on Perception is Something that We Do: A Realist Account of Direct Visual Perception

P. Sarkar.
Prof. Prayash Sarkar 21/12/18

Head

Dr. Preetam Ghoshal
Dr. Preetam Ghoshal

Coordinators

Dr. Gargi Goswami
Dr. Gargi Goswami

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Contents

Page No.

<i>Preface</i>	I-IV
List of Figures	
Introduction	01-23
Chapter 1: Gibson and the Process of Direct Visual Perception.....	24-65
Chapter 2: Analysis of the Process of Direct Visual Perception under the Framework of Nyāya Theory of Perception.....	66-110
Chapter 3: Gregory's Constructivism: A Theory of Indirect Perception.....	111-173
Chapter 4: Sautrāntika Theory of Perception: A Constructivist Perspective of Indirect Perception.....	174-220
Chapter 5: Direct Perception as Embodied Perception: Reflections from Gibson and Nyāya.....	221-259
Conclusion.....	260-281
References.....	282-286
Appendix-1	
Appendix-2	

Preface

I got introduced with the term and matter called ‘perception’, philosophically, almost from the early days of the study of philosophy. I had a kind of attraction towards the matter of perception. The diversity in the thought and expression regarding one particular means of cognition, named perception, used to impinge my interest and curiosity. In the tradition of Indian philosophy, perception i.e. *pratyakṣa* is considered as the most basic source of cognition. All other means of cognition necessarily consider perception as the ground, depending on which the means can proceed further. Whereas, in western philosophy perception is mostly considered as a causal process. According to (most of) the western theories, perception causes following the method of unconscious inference, information processing, representation, or computation. The mystery of perception and its process gradually become clear to me while studying M. Phil, by the help of Professor Amita Chatterjee. She introduced me with a new spectrum of the realm of perceptual mechanisms and theories. During that period I discovered that, the theories of perception, primarily can be categorised as direct perception and indirect perception, depending on the way of describing the perceptual process. During the course, I was introduced with the categories following some theories, among which the theories of James Jerome Gibson, Richard Langton Gregory, David Marr, are some mentionable ones. Apart from the western theories, I learned to explore some Indian theories of perception from a new perspective. Careful guidance of professor Chatterjee encouraged me to discover the versatility of the matter and to go to deep into it. Her inspiration and influence worked during choosing area for Ph.D. research. The philosophical insights in the study of perception surprise me a lot. Usually the study of the

process aspect of perception is considered as the matter of Psychology, Neuroscience, or Cognitive Science. However, this matter involves undeniable presence of the reflections of some core philosophical thoughts, too. On the other hand, the study of perception in the domain of core philosophy, from the cognitive aspect, there remains a covert (or overt) presence of the explanation of the process aspect. These facts can be counted as the reasons behind choosing the area of problem of perception for my Ph.D. research.

Problem of perception is an enough wide area. It includes various aspects and all the aspects are important. Among all the aspects, I chose the process aspect for my Ph.D. thesis. In the thesis, I have dealt with the theories of perception of James Jerome Gibson, the Nyāya school of philosophy, Richard Langton Gregory, and Sautrāntika Buddhists' view from Sarvāstivādi school of Buddhist Philosophy, respectively. The former two theories represent the direct models of perception and the latter two represent the indirect models of perception. The basic theme of this thesis claims that a person experience her surroundings as well as the world from her very own first-person viewpoint. She becomes the subject in respect of the percept or the object of perception. Therefore, as the result of perception, the perceiver earns knowledge and experience about the objective and the subjective both aspects of the percept.

In the study of perception, both the approaches, direct and indirect, have their own strong point of views and arguments for explaining the world of experience as well as the action of experiencing the world around us. However, between the two, the direct one seems more logical and parsimonious for exploring the process of experiencing the world visually. In this research work, I have chosen James Jerome Gibson's theory of perception as the source of the most basic idea of direct perception. This theory covers the physics of perception, which includes the physical facts of ground and surfaces. His version of physics is recognised as the ecological

physics. It explains facts of the existence and perception of surrounding physical objects, lights and optics, etc. Along with that, the theory also involves some relevant facts of biology and ecology of the terrestrial environment of the earth¹. The innovative thoughts and arguments of Gibson's theory regarding direct perception, in a sense, shook the ground of the traditional thoughts and theories of perception. The model of Gibsonian direct perception strictly maintains realism for direct approach towards the world. In order to highlight the importance of the direct perceptual process, in the thesis, I have focused on the Nyāya theory of perception, apart from Gibson's theory. The Nyāya model of direct perception is essentially different from the model of Gibson's. The differences have been clearly shown in the discussion of the main body of the thesis. Despite the differences, both the models accept the importance of the bodily presence of the perceiver, as the subject as well as the object of perception, in accordance of the cases and corresponding situations.

The future and scope of this research work is quite wide, positive, and promising. The main or fundamental claim of this research, i.e. 'perception is embodied', has a great practical impact. This thesis argues in support of the fact that every human organism perceives the world as a conscious and independent being, following her own desire and need. This issue can be explored further from different aspects, like social, ethical, etc. Many social or ethical issues can be explained from the perspective of the embodied perception. Since, the social, etc. perspectives are not concern of this research, therefore, I have consciously sidestepped the contexts. But there is no scope to deny that what has been referred in this thesis repeatedly by the term 'environment', 'surroundings', or 'the world' essentially involves the society, social behaviours,

¹ In the book *The Perception of the Visual World* (1950), Gibson introduced the geometry of the physical world in a special manner that is famously called the ecological geometry. Again, in the book *The Ecological Approach to Visual Perception* (1979) Gibson explained the laws and facts of physics in a certain manner that is well known as the ecological physics.

cultures, etc. in it, as a great significant part. Therefore, quite naturally there remains a social impact on the embodied presence or first person stance of an individual who belongs to the environment. For, according to the thesis, the personality and/or the 'I'-hood of a person is shaped being influenced by that person's own mind and body, kin and family, society and culture, time and space, etc. various factors.

Apart from the social and ethical perspectives, from the perspectives of Cognitive Science, Neuroscience, and Phenomenology, the scope of this research also seems open. Among all the possible and promising perspectives, I am quite interested about two perspectives. One is the perspective of the (MerleauPontian) Existential Phenomenology. The second one is the perspective of the Philosophy of Mind, especially the issues of self-knowledge or self-understanding, and understanding other minds. I would like to explore my interests in my postdoctoral research works.

List of Figures

Page No.

Figure 1: Diagram of the role and position of intermediate cause i.e. <i>vyāpāra</i>	78
Figure 2: Diagram of the causation of determinate perception	80
Figure 3: Diagram of the process of perception following the Nyāya Theory.....	92
Figure 4: Diagram of the general idea of a graph that metaphorically refers to the brain state that is ready to process perception	125
Figure 5: Diagram of the static simulation of the process of perception	126
Figure 6: Diagram of the illusory contours and regions of modified brightness	132
Figure 7: Diagram of ambiguity in perception	145
Figure 8: Diagram of distortion in visual perception	146
Figure 9: The image of the stick is located where the refracted rays intersect	148
Figure 10: Image of Penroz Tribar as example of paradox in perception	150
Figure 10.1: Image of the replica of Penroz Tribar	150
Figure 10.2: Image of experimenting Penroz Tribar	151
Figure 11: Image of the hollow-mask experiment for <i>extremely unlikely perception</i>	153
Figure 12: Diagram of Cognitive (subjective) contour	155
Figure 13: The Diagram of Constructive Theory of Information Processing View.....	159
Figure 14: Diagram of J.J. Gibson's Theory of Visual Perception.....	160
Figure 15: Diagram of the proposed model of Embodied Perception	269

Introduction

How does perception occur? Perhaps this is one of the most well-known and over discussed questions in the domain of the philosophy of perception. This query is there in the root of this research work and thesis, too. This research work has begun and moved forward to find out the answer to two related research questions: i) How does a human being perceive or know the world in which she lives? ii) Is it at all possible to define or explain the process of visual experience of the world of an embodied human being? In the thesis, I have used the phrase ‘human being’, not to refer to a person’s random presence as merely a material body made by physical elements like the atoms of air, earth, water, fire, etc. or as an instrument. Instead, I intend to present a human being or a person as a conscious entity, who deliberately or actively takes part in the process of perception. By taking part in the process, the person sees and knows the environment or world around her, being aware of the situation and other present conditions. She earns experiences from that perception in respect of her own understanding and bodily existence. At this part, it is necessary to mention that in the thesis, by ‘perception’ I solely mean visual perception; nothing else is my concern here.

In the domain of the philosophy of perception, all the available theories, broadly, can be categorised under two heads, ‘indirect perception’ and ‘direct perception’. The terms, ‘indirect’ and ‘direct’, clearly refer to the nature of perception and its approach towards the world. The study of the philosophy of perception, irrespective of the classification into Indian or Western Philosophy shows that the indirect approach to perception is taken to be or accepted as the classical or official one. The classical or traditional approach maintains that perception is an indirect and mediated process (of cognition), although, regarding the issue of the nature of the

medium there may be differences among the different theories of indirect perception. Despite the differences, all the theories of indirect perception agree that perception is necessarily *mediated* and therefore, *indirect*. It is impossible to know or grasp the material objects in the external world as well as the external world itself as they are, directly. According to the indirect theories, in general, it is only possible to know the external world and its objects through the process of inference. Sense organs of a person passively receive some objective information from the surrounding environment in the form of sensory information, sense-data, or representations, which make it possible for the person to *infer* the existence of the world or its object(s) that is the content of that person's perception. On the other hand, the claim of the direct approach to perception challenges the monopoly of the traditional approach in the domain of the philosophy of perception. The basic claim of the theories of direct perception is: perception occurs directly, unmediated by concepts or percepts or representations or inferential processes. A perceiver perceives objects in the world without any mediation. She experiences objects as they are. Traditionalists consider the position and claim of direct perceptual approach as naïve and therefore, less important. In this thesis, I have argued on behalf of the alleged naïve approach to perception with conscious intent¹.

The fundamental argument of the so-called establishment - the views of indirect perception theories - is that the method of perceiving the external world is indirect. The representation, image, or pattern of material objects in the form of sense-data (or some such) enter through the retina of the visual sense organ i.e. eye and perception is produced based on that. In the process, sense-data (taken as an example) play the role of mediators between the external world i.e. the object of perception and the perceiver. For the supporters and followers of indirect theories of

¹ I would like to add here that the context of direct perception includes the philosophy of direct realism (naturalism, and phenomenology).

perception, the external world as well as its objects cannot be the content of knowledge or experience directly. It is only through inference that they can be known. Russell, Austin, Fodor, etc. are some famous names among the proponents of indirect theories of perception.

American psychologist James Jerome Gibson (1904-1979) is considered to be the first to attack the position of indirect perception from almost all of its aspects. Gibson's theories contain strong arguments with logical grounds and scientific explanations that there remains no scope to overlook or refuse him and his views on perception. In support of the position of direct perception, Gibson argues that the process of perception is not indirect. The directness of perception or perceptual process can be realised directly and the matter can be proved, too. More specifically speaking, a person can see the world and worldly objects directly as they are. The relation between a perceiver and her object(s) of perception is true, real. It is not a mental construction. Following this context, it can be added that the cogency of the logical arguments and scientific explanations make Gibson's theory of direct perception a revolutionary movement against the traditional established position of indirect perception in the realm of philosophy of perception.

One of the main features of Gibson's theory is that it treats the environment as an important and significant element in perception. Due to the deep involvement of this factor, the environment, along with the involvement of other factors that he calls 'ecology' and 'ecological values', Gibson's approach is famously called the ecological approach towards visual perception. Gibson pays great importance to the coupling of the environment and its inhabitant organisms. To describe visual perception Gibson uniquely says, when she perceives something, a person not just sees the object of perception alone or receives sensory expressions or impulses, she simultaneously sees the surrounding environment in respect of that object. In the process, she has

the realisation or awareness that she is also another object in the same environment as the object of perception and occupies some position in that very same ecological space. During perception, the person carefully picks up information in respect of the object as well as her own bodily presence or existence from the environment in which she and the object of her perception are both present at the moment of occurrence of the perceptual action. According to Gibson, in the process of perception the perceiver gets connected with space, time, the surrounding environment, and everything around and about her, *directly*. That includes the feelings, experiences and other sensations that occur inside her. Therefore, the argument is that in the context of the process of perception it is unnecessary to accept the presence of any medium like sense-data or whatever the indirect theories may elicit.

Gibson's theory and its approach have been criticised by the supporters of indirect perception in both during his time and later on. Some argue that Gibson's theory represents merely a naïve, uncritical, unphilosophical position (as if, philosophy has decided its true colour once and for all!). Some theorists object by saying that the fundamental arguments in the Gibsonian thesis are quite trivial. But despite all objections, even at present time, acceptance of Gibson's theory is in place. In this thesis, I aim to show the pertinence and acceptability of direct perception theories in a roundabout way rather than trying to establish it directly and to do so I have elaborately discussed the points raised within theories of indirect perception. In the thesis, I have started discussion of indirect perception and the process whereby it occurs, following the theory of British psychologist Richard Langton Gregory (1923-2010). Among the different types of the theories of indirect perception, Gregory's theory represents such a kind that is known as the 'information processing approach'. To refute the directness of the perceptual process, Gregory portrays the alleged details of the process of perception as minutely as possible. Being a staunch

supporter of indirect perception, he admits that sensory information enters the brain where it gets processed and perception is caused as a result of such mediated processing.

At this point in the introduction, for the sake of logical contextuality, one thing can be discussed that is the reason behind choosing Gibson and Gregory's theories for the research. It is not difficult to understand or at least guess the reason for selecting Gibson's theory. In the search of direct perception's theory Gibson's name and the mention of his ecological approach, along with his theory of perception appears as the pioneering one. Gibson is considered as the pioneer of direct approach in perception. His logical, sharp, and scientific arguments have retained the acceptability of his theory until today. Therefore, in the discussion of the process of direct perception selection of Gibson's theory seems obvious. On the other hand, Gregory's theory of perception as the opposite position of Gibson's view represents one of the models of the established or traditional view of perception and its claims. At this point, we can give a look into some aspects of Gibson's and Gregory's life and career for having some ideas regarding their orientation.

It is known from Gibson's autobiography that from childhood he used to live close to nature, away from the noise and crowd of urban life. There is a great influence of nature and the natural environment in his life, thought, and vision. Through wandering and playing in the environment, he learned to see and feel the environment. It seems from his description that between the terrestrial and aquatic environment he used to be attracted towards the former one, the most. He used to like to have a view of the surrounding environment, from the top of some big tree or standing in the middle of some open place, like a field. One may not find any significance or connection of this kind of discussion with the main fact and discussion of my thesis. My argument in this regard is, this kind of discussion is not meaningless. From this aspect about

Gibson's life, the reason(s) behind his interest in observing and feeling the environment so deeply, his attachment with nature can be found. We can have some idea, how he learned or earned the skills of observing the environment and discovering relevant meanings for behaving in that environment from different aspects by discovering its various layers. From his autobiography (1967) and biographical memoir by Julian Hochberg (1994), his attachment and love towards the act of discovering or finding innumerable information and selecting desired ones to inhabit or live *in* the environment and to live the surroundings of that dwelling space is felt quite prominently. These descriptions reflect how he earned the practice of directly seeing the advantages, disadvantages, etc., in some environment that he named at far later 'affordances' (1979). In this context, it is to add that Gibson's addiction for adventure, for discovering and perceiving nature represented a new dimension regarding the range of vision or visual field before him. Gibson's father was a railroad surveyor. When he used to go for the work of railroad survey, sometimes little James Gibson used to go with his father to enjoy the journey. During the trip (for little Gibson) of railroad survey, being inside the railroad train, Gibson used to notice the fact that the range of our vision is limited. Standing at a certain point in the environment if someone looks forward then she can perceive only until a certain distance clearly, and beyond that (invisible) limit, everything appears as blurred gradually. As the person moves or shifts from one point to another point (in respect of the distance between the two standing points) the limit of vision also shifts. As a result of that, some of the objects or areas in the environment that previously was outside the range of vision comes inside the range of vision and some portion of the visual field that was inside the range previously goes outside of the range of vision of the perceiver. She cannot see that part (partially or entirely) anymore from the new standing point without moving her head backwards. As the visual field expands, the objects that were at the

edge or margin of the field enter *in* the field, the opaque portion of the environment becomes completely or partially visible. From this perspective, it can be surmised that this kind of interaction with the environment, perhaps, worked behind the development of Gibson's very original notion of the ecological approach towards the visual world for living life as it appears before a person. I am commenting here depending on the information I gathered from Gibson's autobiography, biography, and especially from his famous book *The Ecological Approach towards Visual Perception* (1979).

Apart from the description of childhood activities, Gibson, in the autobiography, has talked about his education and works, too. From all these things, his orientation towards some core philosophical thoughts, like realism, empiricism, etc., reflects clearly. Gradually with time and training, the influence of these philosophical views quite naturally kept enriching Gibson's thought, attitude, vision, and perception towards the world. From his description, it seems as if the nature in her own hand has contributed to his orientation. Later in his career, this attitude towards the world, instead of changing, became firmer, logical, and scientific.

Let us have an idea about Gibson's academic career, in brief. After secondary school, in 1921 Gibson went to Northwestern College. After completion of his first year, in 1922 he took a transfer from Northwestern college to Princeton College. There he did a Major in Philosophy, though, later he graduated in Psychology. It helped him to bring a taste for pragmatism in Philosophy, which in turn influenced to feel attracted to him towards the behaviourist revolution. In the autobiography, Gibson described himself as a radical empiricist like one of the influencing personalities in his life, Professor Edwin Bissell Holt (1873-1946), who came to Princeton from Harvard in 1926. Gibson learned radical empiricism from Holt. He was quite enthusiastic about the doctrine. As a radical empiricist, Gibson used to believe that the behaviour of a human being

is not some innate matter that she was born with. Instead, she learns to behave following the regularities of the world or the environment, where she inhabits. In the context, it is to add that the Gibsonian sense of behaviour includes the ways of movements and activities of the nervous system of a human being along with motor activities and expressions of that of her body. Radical empiricist Gibson used to value a lot to the matter of situated social behaviour. He used to consider the factor called 'awareness' as an activity. This *activity* indeed is a form of adjustment that enhances the skill or mechanism of information pick-up, instead of a kind of behaviour that alters the world. Gibson was very much interested in the matter of the differences between observational activities and performative activities more than the matter of contrasting between consciousness and behaviour. From Gibson's description, it seems that his dedication and enthusiasm for empiricism provided him with a stronger ground for developing the matter of experiencing the visual world directly as it is, including grasping and interpreting its meaning from objective and subjective both kinds of viewpoints.

In 1942, as the US joined World War-II, Gibson entered the Army Air Force as a psychological experimentalist. He was stationed at Washington for some months as a part of a program of the psychological research unit, organised in the Army Air Force. Then he spent eighteen months in Fort Worth, Texas, at the headquarters of the Flying Training Command. Later, he was stationed at Santa Ana Army Air Base in California for some more time. Gibson was director of the Motion Picture Research Unit in the Aviation Psychology Program. The motion picture unit was meant to develop visual aptitude tests for the screening of pilot applicants. Towards the end of the war, this motion picture experiment for the pilot screening program became an immensely important question regarding its method. It is to add here that the central aim of the program and its related experiments were to train the pilots to identify enemy aircraft to destroy or escape

them. The aircraft identification research work and its related matters were published in 1947 and 1948 in collaboration with Robert M. Gagne (1916-2002). These experiments and researches added some remarkable dimensions to Gibson's very own notion of the ecological approach to the visual world. During the period of the pilot training program, he realised how does the world, especially the terrestrial environment looks like from the top, from a flying (or having dynamic motion) bird's point of vision, and how to pick up information from a bird's position to see the world directly and to attain own purpose.

Moreover, in the context, one more aspect of Gibson's life or character can be mentioned, relevantly. Gibson was very fond of acting in amateur theatre. From the school days until the days in Cornell University, before becoming deaf, Gibson used to perform in theatres consistently. Probably his passion for acting made him understand or realise the role of an individual's body for representing his/her own identity to others in a convincing manner. In a play, an actor is supposed to represent some character through enacting that character's (scripted) activities or behaviour and embodying its identity or existence. During a play, the actor is supposed to believe in the existence of that character to establish it as real. For that, the actor is supposed to perceive the character as *the other* through the process of intercorporeality to communicate with the character.

Richard Langton Gregory, on the other hand, proposes a view according to which the world is a matter of indirect perception. British psychologist Richard Gregory was a pioneer of cognitive psychology. Unlike Gibson, Gregory focused on describing the scientific works involved the development and interpretation of visual illusions. To explain the perceptual mechanism of perceiving the visual world normally, Gregory used the fact of visual illusion as one of the important tools.

Richard Gregory was born in England. His father was an astronomer and the first director of the University of London observatory. Gregory was educated at King Alfred School in Hampstead. Among other subjects, he became interested in simple electronics. In 1941, he joined the RAF in Canada, in the Signals branch for working on communications and radar. In 1946, the air ministry gave Richard the job of explaining radar to passing public at the bombed site of John Lewis store in Oxford Street. In 1947, Gregory went to Downing College, Cambridge. He received a scholarship from RAF for studying in moral sciences. First two years in college, he mainly concentrated in philosophy and got the opportunity to be taught by the legend Bertrand Russell. In the final year, he learned experimental psychology from Frederic Bartlett. From 1950 to 1953, Gregory worked as a research worker in the MRC Applied Psychology Unit in Cambridge. During researching in Cambridge, Gregory became increasingly interested in a visual illusion. He used to believe the idea that most illusions are not simply perceptual defects. They are the product of atypical errors in the operation of mechanisms that normally result in the appropriate interpretation of the information from the eyes. Regarding the issue of very common geometric illusions of space and size constancy, he introduced a novel theory (“Distortion of Visual Space as Inappropriate Constancy Scaling”) that was published in *Nature* in 1963. This theory left significant influences for his later works and subsequent thinking.

In the context of the issue of illusion in perception, Gregory says perceptions are essentially hypotheses because they contain a lack of certainty. Scientific hypotheses are predictive and go beyond sense evidence. Therefore, perceptions are risky. Gregory admits that his account of perception is derived largely from the work of German physicist Hermann Von Helmholtz (1821-1894), who describes perception as the result of unconscious inductive inference.

In most of the discussions or debate about relation or differences between direct perception and indirect perception the account of the perception of Gregory as the representative of indirect perception, along with the account of J. J. Gibson, the legendary representative of direct perception, are mentioned together. Among other reasons, here I can talk about two. One, many theorists have criticised the position of direct perception and Gibson's theory in particular, but Gregory's constructivist theory of perception is considered as if it represents a proper opposition of Gibson's frame of perception. It is noticeable from different works of Gregory that he had tried to cover almost all flaws of Gibsonian position of direct perception. Two, in the context of the perceptual process, both have shown their intense concern about the geometry of the earth and earthy objects, on one hand, and the constancy in perception, on the other. For Gibson, depth and form both are obtained directly from the visual image that remains there in the patterns of lights and shades i.e. technically called 'the ambient optic array'. According to Gibson and his account of direct perception, there is no obvious scope (at the objective level) for ambiguity in perception and action. According to Gibson visual cues to navigate the environment successfully remain there in the ambient optic array independently. The dynamicity of optic flow in the array, being consistent with locomotion of a perceiver's body, provides information that is/are to be picked up by that perceiver in respect of her own need, desire, and intension. To Gibson, this kind of visual cues or *information* requires no processing. Whereas Gregory claims the flow in the environment, created by the relative change of motion by the perceiver's position shifting, depends on prior assumptions about the relationships in space.

At this point of my introduction, it is important to mention that this research work aims to find a model of perception that is capable of explaining the process of experiencing the visual world directly by an embodied human being. For that reason throughout the thesis, I have analysed and

explained several theories that may serve this purpose. Some of the theories argue in favour of direct perception and others for indirect perception. I am giving this clarification in the introduction because one should not take the thesis as merely a piece of comparative discussion between the theories. This thesis indeed is a result of deep philosophical study combined with argumentation and rational imagination. In Chapter 1 and Chapter 2, I have described the account of direct perception through a detailed analysis of James Gibson's theory of perception and Nyāya theory of perception, respectively. These two theses represent two types of models of direct perception. Later, in Chapter 3 and Chapter 4, I have explored two separate kinds of models of indirect perception following Richard Gregory and Sarvāstivādi (Sautrāntika) Buddhist's accounts of perception, respectively. Through this journey, I wanted to examine the hypothesis that the matter of the perception of the visual world of the embodied human beings is best explained through the process of direct visual perception.

Since I am working mainly on the process aspect of perception and in psychology (usually) the process aspect is studied quite closely, therefore, in this research I intended to see the 'how' aspect of perception following some such theories from psychology that are capable of representing the map of the methods or ways following which the process of perception occurs. Moreover, I also intend to derive a more or less complete model of perception from the extant theories. For discussion of the process of direct perception I have picked up Gibson's theory and for indirect perception, I have selected Gregory's theory, which are representative of the two sides of the debate.

On the other hand, I have selected the Nyāya theory of perception and Sautrāntika Buddhist's theory of perception to see how a completely different stream of study i.e. philosophy, different tradition, i.e. Indian (philosophy) of thought and culture describes the direct-indirect difference

in perception and how they define or explain its mechanism. At this point, I can anticipate one's curiosity about choosing two models of perception from Indian philosophy? when there are plenty of perceptual theories available in the domain of Western philosophy, counting pure philosophical perspective. My answer is: it is true that there are such theories of perception in western philosophy, some of which says perception is direct and some claim perception is indirect. However, in the Western philosophical tradition, the indirect perception is considered as an ideal kind of approach to perception and the related theories are subjects to be concerned or talk about. On the contrary, the direct perceptual approach is considered naïve ones. Nonetheless, in Indian philosophy both the approaches have been accepted, analysed, and defined with the proper value.

Among other theories of Indian philosophy that describes the perceptual process as direct, the Nyāya model of perception reflects the directness, in a literal sense. The Nyāya theory holds a realistic and empirical approach. Although, the aim of the Nyāya theory is to explain the way of the occurrence of perceptual cognition i.e. *pratyakṣa pramā*. Unlike some core psychological theory of perception, the Nyāya theory does not pay that much concentration on explaining the mechanism that happens *in* the body of the perceiver during perceiving something. The theory neither focuses on the perspective of the reaction of the perceiver that she expresses, intentionally or by reflex, during perceiving, desiring, grasping, or using some object to serve some purpose(s). Despite the fact, from the elaborated explanations of the Nyāya account of perception, the process aspect can be extracted smoothly. It is visible that the model or structure represented by the Nyāya theory of perception is radically direct, like Gibson's model of perception. In this context, it can be mentioned just as a piece of information that very strangely, there are so many similarities available between Gibson's description and Nyāya's description

regarding the perceptual process, including the approaches towards the visual world for knowing or experiencing it.

Apart from the Nyāya theory, in the thesis, I have taken another view of perception from Indian philosophy that is the Sarvāstivādi view of perception. It is to clarify here that between the two branches of Sarvāstivāda i.e. Vaivāṣika and Sautrāntika, in the thesis, I have selected the Sautrāntika view of perception to explore. According to Sarvāstivāda, the external world and its objects exist indeed and people can know them. Regarding the process of knowing the world, the supporters of the Vaivāṣika school argue that the process is perception. Whereas, the Sautrāntikas' claim that the process is inference. There are reasons for dealing with the Sautrāntika view of perception, between the two systems of Sarvāstivāda. Among a number of reasons, two can be mentioned here for instance. First, the Sautrāntika position is one that describes the perceptual process as direct but practically it fits in the frame of the indirect perceptual process. second, they claim that the empirical aspect of perception i.e. the matter of experiencing the object of perception by sense organs directly or considering the objects as real is nothing but mental construction, instead of real. Even the realisation of one's own existence, mental states like pleasure, pain, etc., of a person, are also treated by Sautrāntikas as mental constructions. Therefore, I consider the Sautrāntika model of perception as a challenging one to prove that it indeed represents a complete model of indirect perception.

Let me now introduce the matters of the chapters one by one. In Chapter 1, I have discussed the theory of visual perception of J. J. Gibson. Gibson's theory is such an ideal theory that represents the perfect connection between the concept of direct perception and the concept of embodiment. It refers to the direct and active role of the organism's body in the process of perception. By 'active role', Gibson means the involvement of the body in the process as a conscious and

intentional object, instead of a mechanical sense-less device. According to Gibson in the process of perception ecology as one of the essential elements matters a lot. An organism being a part of some environment sees some other object that is also part of that same environment. Therefore, naturally, when she sees the object, it appears before her with some background, foreground, horizon, etc., which are also part of that same environment. It is to remind that in most of the cases, objects of perception do not appear before the perceiver as showpieces are displayed in the showcase of one's living room. Objects remain there in the environment being cluttered with other objects, etc. For that reason, she perceives some objects as partially revealed and some as opaque or hidden behind other objects, etc. The perceiver, being driven by her need, sees the environment to find out the right object that can serve her purpose. To find out the right object the perceiver moves around the environment, shifts from one position to another, observes the object from every possible perspective, and for collecting maximum information makes required body gestures. Therefore, for having a complete vision of some object, broadly, two factors are quite important. One, the bodily presence of the perceiver by herself in the process of perception and two, having a physical perspective in respect to the position of the percept. Both factors refer to the involvement of the notion of embodiment in the Gibsonian concept of direct perception.

In Chapter 2, I have described the Nyāya theory of perception. Like Gibson, Gautama argues for directness in the perceptual process. However, they describe the perceptual process in two completely different ways. Gibson considers perception as action. For him, perception and its application i.e. behaviour, are not two separate things. Perception and behaviour are two aspects of one action. Taken together, action is perception and perception is action. In short, for Gibson, action *consists in* perception. On the other hand, for Gautama, action is the *outcome of* perception. There is a *causal* relationship between perception and action, though this relation

does not represent indirectness in the process of perception. The Nyāya theory explains that for the application of perceptual cognition, the process involves the internal factors of a perceiver like desire, will, volition, effort, etc. In this stage, the body and the mind of the perceiver work together in harmony. The Nyāya theory also accepts the involvement of factors like experience, the first-person stance, non-mechanical activities of the body in the perceptual process. These factors refer to the involvement of the notion of embodiment. Being operated by the mental factors of desire, will, and volition of the perceiver her body efforts either to have or to shun the object of perception. In the Nyāya context, effort i.e. *cheṣṭā* is the action that is caused as the result of perception.

Let me now summarise Chapter 3 and Chapter 4. In these two chapters, I have discussed the process of indirect perception. It has already been mentioned before that the fundamental claim of the theories of indirect perception is that perception has to occur indirectly, being mediated by some extra-element in the entire process. The process of perception is mediated by the objective information from the external world, which is called by Gregory, sensory information (i.e. data from the sense or sense data). The supporters of the notion of indirect perception argue that real objects can only be inferred, though the inference does not get registered in anybody's awareness. According to Gregory, the entire process of perception is a kind of *construction*. The brain processes perception depending on the newly entered information and previously stored data i.e. memories. The brain processes the information following the method of inductive reasoning. According to Gregory, whether the perception is veridical or illusory, except the brain, nothing has any control over the process of perception. First, based on information the brain interpolates perception and later depending on the interpolated result, the brain extrapolates a consistent behaviour i.e. the application of perception.

Another constructive theory of perception can be extracted from the Sautrāntika Buddhist Dharmakīrti's description of perception, following the text *Nyāyabindu*. In Chapter 4, I have explored the Sautrāntika view about perception. In the first half of the chapter, there is an analysis of Dharmakīrti's theory of perception where only the process of the occurrence of perceptual cognition has been emphasised. In *Nyāyabindu* Dharmakīrti has elaborately described the method of processing perception. In that text, he argues that by the direct contact of a person's visual sense organ and object immediately perception of the object occurs. This immediate state of perception is indeterminate (*nirvikalpaka*) and for that reason, it is the true and pure state of perception. According to the Buddhist philosophical thought in general, and Sautrāntika thought, in particular, the term 'object' exclusively refers to the bare particular (*svalakṣaṇa*) of an object, which is momentary and non-eternal. The name, form, colour, etc. that is, the various qualifications of the object are merely mental construction. Moreover, Dharmakīrti argues that perception of one object and serving a purpose by that same object is not possible in a true sense, because an object of perception, being a bare particular, exists only for a single moment, which is the moment of perception. Therefore, the use of that very object cannot happen in that very one moment. Logically, it is supposed to happen in the immediate next moment or at some far moment, in respect of that exclusive 'one' moment (of perception). Therefore, at the moment of the use of that object instead of the bare particular, there remains the universal character of the object (*sāmānyalakṣaṇa*), which represents nothing but a pseudo or unreal object. Since in the case of perception of an object, neither the object nor the perceiver, exists for more than a moment, therefore, the idea that they are permanent is nothing more than a mental construction. However, the empirical aspect of the world as well as one's life cannot be denied or overlooked. Therefore, there should be some explanation in this regard from the

Sautrāntikas' side. The account of the empirical aspect of perception has been provided quite elaborately by another Sautrāntika Buddhist, Vasubandhu. In the second half of Chapter 4, I have analysed and explained the empirical aspect of perception according to the contextual need of my research work. For that, I have pursued the text, named *Abhidharmakośa* by Vasubandhu. The interesting thing is that the Sautrāntikas interpret the empirical version of perception as '*saṃjñā*', instead of '*pratyakṣa*'. According to *Abhidharmakośa*, empirical perception involves a person's bodily presence. Apart from the physical features, like the activities of sensorimotor systems, the function of motor organs, etc., the mechanism of empirical perception also involves internal factors like mental states, emotions, etc. of a perceiving agent. It also talks about the importance of experience and stored knowledge to deal with the present situation and surroundings, in the form of behaviour of that agent. Despite these facts, Vasubandhu admits that none of these is real (*sat*) in the true sense but figurative sense only. Only to have some explanations of empirical life, personal or subjective experiences, the realisation of embodied-'I' it becomes necessary to prioritise the unreal mental constructions as real (figuratively). Another reason for giving importance to the empirical perception and its related issues is: unless knowing or realising the futility of the notion of permanence or persistence, as well as the permanent empirical world, object, body, emotion, and all, no one will move on towards the reality of unreality and momentariness of the entire physical world. No one will feel the urge to internalise or incorporate the sole truth of the principles of four noble truths in their own lives and practices.

In Chapter 5, I have talked about the notion of embodied perception. The notion of embodied perception is a combined form of the notion of direct perception and the notion of cognitive embodiment. The notion mainly highlights the role of the body in the perceptual process, in

which it works anonymously being integrated with the environment to find the fittest place to survive. Perception is situated action. According to the situation, for fulfilling the need of a perceiver, her body as well as the perceptual system(s), interprets the present environment (in respect of the situation and intensity of the perceiver's need) in such a manner that does not always involve concepts or metaphors.

At this point, I can say that through the research work I have achieved the fact that from the empirical perspective, the concept of perception essentially involves action. The term 'action' in this context refers to the direct and active movements and activities of the entire body of the perceiver. This involvement does not occur merely at the physical level but it goes far beyond the level. The level that is beyond the reach of physicality can be understood in terms of the notion of embodiment. During perception, the body of a person works as a physical matter and the motor actions drive it. Simultaneously, the same body performs some other kinds of actions, which are also natural but difficult to explain in terms of physicality. For example, sensing vibes, coping with the environment and situation, are two the most mention-worthy actions of the body among many. These actions are inseparably associated with the process of perception. At the moment of conscious perception, the intention, desire, etc. mental content, happiness, pleasure, etc. mental states of a person affect and control to some extent her body and activities. This action of controlling or affecting the body by some mental states, which occurs inside the body, is also natural. Depending on the elaborated discussion, it can be said that one should not differentiate between the two aforementioned kinds of actions of the body. For, both kinds are inseparably dependent on each other. The intention, desire, etc. influence the body and, of course, perception. As the owner of the body, the consciousness, the self, or the 'I'-hood, takes the responsibility for all of the actions. More specifically speaking the owner i.e. the embodied

‘I’ recognises only those actions as ‘mine’, which occur in the state of reflected consciousness. The owner is not aware of the actions that occur in the pre-reflective state of consciousness, like reflex actions, coping, etc. Therefore, to experience the world the perception has to be described in terms of the direct perception that essentially involves the participation of the body. This form of the notion of perceptual process justifiably can be called as the notion of embodied perception.

The notion that I am calling ‘embodied perception’ is a combined presentation of the models of the Gibsonian theory of direct perception, the Nyāya theory of direct perception, and the theory of embodiment. Before describing how the notion of embodied perception is the triad that I planned to propose at the end of the thesis let me remind the connection between the three theories of Gibson, Nyāya, and embodiment.

Gibson’s theory of perception and the Nyāya theory of perception, both represent models of direct perception. Despite differences between the two theories and their approaches, both the models share many common features and aspects, which connect them together. Therefore, depending on this projected connection, it is possible to build a model of direct perception that includes all the core features in a generic form (Chapter 5). Besides, both Gibson and Nyāya latently and silently involve the notion of embodiment in order to explain the role of the body of the perceiver in the process of perception. This aspect of both theories brings them even closer to each other and to the notion of embodiment. On the other hand, surprisingly the features of the process of direct perception, especially Gibson’s, are explicitly available in the notion of embodiment. That is why there is no such remarkable difficulty in connecting links between the notion of direct perception and the notion of embodiment. This connection makes me think that there should be a model of perception that emerges from the triad of Gibson’s theory of

perception, the Nyāya theory of perception, and the notion of embodiment. This new model should be able to explain three main things simultaneously: i) it should explain the role of a person in the process of perception as an active embodied human being, ii) the process of experiencing the visual world, and iii) the ways of perceiving the world and worldly objects for a person and behaving towards the environment to grasp or use a perceived object. Now, one may wonder that if such a proposed model of perception is a mere mechanical combination of the three aforementioned theories. If so, it is redundant to talk about a fourth possibility as a serious contender in this debate. My answer to the query is no, it is not. The notion of embodied perception has its own contribution.

The notion of embodied perception has indeed been constituted depending on three pillars: Gibson's theory of visual perception, the Nyāya theory of perception, and the theory of embodiment. However, it does not mean that the fourth kind of notion i.e. the notion of embodied perception is merely a repetition or copy of those three theories. Instead, I have taken such a stand through the notion that it can show the fact that in the process of perceptual experience the mechanism of direct perception and the mechanism of embodiment, work together, almost being merged. Apart from that, the notion of embodied perception highlights the strong but latent connection between the three constituting theories. There is a close and steady connection between the notions of direct perception (in general) and embodiment. The support regarding this fact is available in different writings of Gibson. Apart from that, some other theories argue in support of the connection. For example, the writings of Alva Noë (2004), Claire F. Michaels and Claudia Carello (1981), Anthony Chemero (2009) are some names worth mentioning. On the other hand, in the writings of M. Merleau-Ponty (1945/2012), H. L. Dreyfus (1963) and others on the notion of embodiment, the presence of the description of direct

perception and some of its related issues is truly astonishing. John T. Sanders, in one of his works (1993), has talked about the closeness of the connection between Gibson's thought and Merleau-Ponty's thought. In fact, in the paper, he claims that Gibson brought modification in his view regarding the external world as well as the ecological physics and ecological geometry being influenced by Merleau-Ponty's thoughts on perception and the structure of the environment. Again, in the field of Indian philosophy, these kinds of examples are also available. In the article named 'Some Indian Theories of the Body' (1988), the author Sibajiban Bhattacharyya has beautifully described the role of a perceiver's body in perception. He has shown that according to the Nyāya thesis, in the direct process of perception, the body acts consciously on its own. The cases of knowledge of desirability, etc. (*upādānādibuddhi*) are the most prominent instances of the active role of the body of a perceiver in perception.

As I have already mentioned that, the fundamental contribution of the notion of embodied perception is: it represents three theories from three completely different cultures, backgrounds, traditions, together, in tandem. Technically Gibson's theory is considered under the category of psychology (or more specifically speaking ecological psychology), but no one can deny that his arguments regarding the description of perception contain realistic and empirical approaches. His denial of the concept and process of indirect perceptions hits all the advocates of the indirect theory of perception equally, irrespective of the category of psychology or philosophy. Despite the fact, to establish the practical relevance of direct perception strongly, through philosophical research, at least one serious support from the domain of philosophy itself was needed. That support is quite available in the Nyāya philosophy. But the categorical difference makes the job difficult. The Nyāya theory of perception brings a completely different and unique tradition of thought. It is a core philosophical tradition. Like Gibson's theory, the Nyāya theory of perception

also represents an empirical and realistic standpoint. However, the theory contains arguments regarding the process aspect of perception so latently that one is supposed to extract that aspect quite carefully and consciously by avoiding the crowd of metaphysical and epistemological arguments. The notion of embodied perception does the task successfully. Therefore, the notion of embodied perception presents Gibson's technical theory of ecological psychology wrapping inside the cover of a philosophical approach. Simultaneously, the notion represents the philosophical theory of Nyāya system in terms of the technicality of the process aspect that is so close to the psychological explanations. Apart from that, to prove the hypothesis the notion extracts the phenomenological aspect from both the theories of Gibson and Nyāya, which is hidden there in both the theories. This phenomenological aspect represents the notion of embodiment.

On the other hand, the embodiment thesis also comprises the notion, approach, technicality, etc. of direct visual perception. The notion of embodied perception highlights that aspect, too. Here is the significance of the notion. This notion is important and significant because it represents the process of perceptual experience clearly and distinctly. It shows that for perceiving and recognising the world, to survive and live in it, to behave properly it is necessary to pay importance to the presence and individuality of every single perceiving organism. It is also important to accept that every individual is supposed to be a part of her act of perception because the rest of the process of perception continues being related to her cultural, social, and educational orientation. For that reason, many people may perceive an object, but every person's perception is unique to her own.

1

Gibson and the Process of Direct Visual Perception

What is visual perception? Visual perception is the act of seeing. It is a process, by which we see the environment around us, observe our position in it, and note our movements towards various objects in the environment and all such related things. The usual assumption is that the act of vision depends on the visual organ, eye, which is connected with the brain. James Jerome Gibson says that the brain is only the central organ of a complete visual system (1979/1986: 1). According to him, natural vision depends on the eye in the head, which is located at the top of the body, which is supported by the ground. By natural vision, Gibson means the following: a situation in which our vision is free from any constraints, during which we look around freely, move towards a chosen object, have a complete view of it from all sides, and freely have a panoramic view of the environment in which the object is placed (1979/1986: 1).

Gibson, at the earlier stage of his work on visual perception, rejected behaviourism, which was the primary paradigm in psychology during the period 1920 - 1950. Behaviourism says that the environment instead of the will of organisms in general, determines behaviour; it is learned from the environment. Behaviourism is primarily concerned with external behaviour, which is observable, as opposed to alleged internal occurrences like thoughts, emotions, etc. According to the theory, thinking and other internal states should be explained in behavioural terms or be subjected to elimination altogether. At a later stage, Gibson's approach shifted from experimental psychology to philosophy. At this stage, he criticised a view called cognitivism. Cognitivism is an approach within psychology and philosophy of mind (that led to the

philosophy of cognitive science) that focuses on mental processes, including the ways of perceiving, thinking, remembering, learning, etc., and how they are directed to one stimulus rather than another. Cognitivism is a response to behaviourism, in contrast to which it deals with the internal states of people as having a causal role in the production of external, observable behaviour. Cognitivism studies how people process information as computers do, in accordance with a set of rules. Gibson strongly denies and criticises this type of view. Cognitivism practices a form of indirect perception. Gibson advocates direct perception, which is famously known as his ‘ecological approach’ to visual perception.

1.1: The Internal Mechanism of Perception

According to Gibson, senses are not mere producers of sensations that are passive outputs of sensory impingements but are rather active mechanisms that are directly involved in looking, listening, etc. Gibson’s understanding of the senses is such that the sense organs receive holistic data from all the modalities like looking, listening, tasting, etc. and actions are performed not on the basis of some theoretical or physical segregation between them but on the basis of differences in degrees of impingement under specific circumstances. At the same time, one must not think that the data from various modalities arrives at the mouth of a singular central processing system from where they are discharged after the application of a layer of conceptualisation. This point will be explained in great detail later.

Gibson introduces a notion of constant perception, which is necessary for effective action, and which involves a tendency called ‘constancy’, which makes a person perceive an object as the same, despite changing sense-impressions. Gibson introduces the notion to explain how we see a constant size, shape, or colour of any object even from different observation points at varying

distances. Though there may be a large set of constancies in perception, Gibson points out three gross constancies, namely, size constancy, shape constancy, and colour constancy. For Gibson, “the perception of reality is not something assembled or computed by the brain from an ever-varying kaleidoscope of sensations” (Carmichael 1966: v).

Perception is not mediated by sensory impression or sensation. Our visual system directly picks up information from the environment in order to perceive an object. Here, it must be mentioned that Gibson only denies the presence of sensation or sense impression as a mediator in the process of perception. He never claims that perception is extra-sensory; in fact, that is not possible. For him, the meaning of the verb ‘to sense’ is ‘to detect’ something, instead of ‘to have a sensation’. Our perceptual systems sense or detect stimulus information, though, we are not aware of this act of detection. At the moment of perception, it remains beyond our consciousness, exactly which sense organ has been excited. Even we are not conscious of the quality of the (active) sense organs. From this perspective perception seems senseless but that “does not mean that perception can occur without stimulation of receptors; it only means that organs of perception are sometimes stimulated in such a way that they are not specified in consciousness” (Gibson, 1966: 2). This fact can be well explained by the example of the obstacle sense of the blind. Blind people (even people with normal eyesight in darkness) perceive or sense obstacles by facial vision. “Facial vision refers to the subjective experience of the blind of perceiving objects as though through the skin of their faces” (Ono, Fay, and Tarbell, 1986: 57). In the case, blind people perceive the obstacle like a wall, etc. by detecting echo that is received by auditory sense organ; but they feel only facial vision. They pick up information by obstacle detection without sensing or realising exactly which sense organ has been stimulated at that

moment. It means, “there can be sensationless perception but not informationless perception” (Gibson, 1966: 2).

1.1.1: Sense Organs: Receptors or Systems

According to Gibson in the case of direct perception that leads to action, the sense organs work not as passive receptors but as active systems. The concept of receptors is a classical thought. It is a popular concept to psychologists, physiologists, and philosophers as well. This concept describes sense organs as a passive mechanism that only receives imposed stimuli. Here the term ‘imposed’ refers to the fact that stimulus energy *intrudes* the nervous system through the gateway of receptors. Gibson says sense organ does not always play a passive role as a receptor. Here we can look towards the difference between receptor and system, in short. The receptor is a type of single-cell that responds to mechanical energy, chemical energy, or light. Its structure is microscopic. Physiologists consider it as an energy transducer that responds to the appropriate energy. The receptor cells that are of a common category are usually grouped together into receptive units. Every group of cells or receptive unit is connected to the branches of a single ingoing nerve fibre (afferent neuron), which is the smallest single pathway into the central nervous system. These units are functional, not anatomical.

A sense organ is a structure that contains many energy receptors and many receptive units. Except that an organ must have muscles, which must be supplied with efferent fibres from the central nervous system. Being supported by the muscles and efferent fibres, the structure of the organ adjusts the job of the modification of input from cells to units. The afferent or incoming fibres and the efferent or outgoing fibres may be accumulated in a single bundle that is a nerve, like the nerve from each eye. On the other hand, they may be distributed in many bundles or

nerves like the nerves from the skin. In this context, Gibson has warned us: “The generally accepted picture of a sense organ as a mosaic of energy transducers each connected to a distinct nerve fibre and thereby to a distinct cell in the brain is quite wrong” (1966: 41). An organ has two parts, one is the receptive part (constituted by receptor cells), and another is adjustive part (constituted by receptive units, muscles, and efferent nerves). These two parts may be in the same place, like the gustatory organ that is called the tongue, has its receptive parts and adjustive part in the same place, inside the mouth. On the other hand, in the case of an olfactory organ, that is called the nose, the receptive part is rooted in the facial bones while the adjustive or motor part is in the chest muscles that help to breath and sniff. “The receptive and adjustive part can be understood in relation to one another” (Gibson, 1966: 42).

Gibson is not convinced to call sense organs as ‘receptors’, for it is an ambiguous term (1966: 40). The term actually refers to two different matters. On the one hand, it implies a passive mechanism that starts with nerve impulses being touched off by a stimulus while on the other hand, it indicates an active mechanism that accommodates or *adjusts* itself to the possibilities of stimulation. To avoid this ambiguity Gibson prefers to use the word ‘receptor’ to mean “the immobile parts of the input system and word “organ” will be used for the mobile parts” (1966: 40). In this regard, he introduces the term ‘System’, which possesses a great significance in the context of the ecological perceptual mechanism. Gibson describes sense organ as a *system*. According to him the terms like ‘receptor’, ‘channel’, etc. are not sufficient to describe the sense organ thoroughly. These terms represent sense organs as passive parts of the body that have only one role, to get stimulated by external stimulation. Indeed, the role of the senses is not so limited. As *systems*, the sense organs are not mutually exclusive, but they are interrelated. Active systems function to pick up information. Gibson denotes by ‘perceptual system’, these functions.

Perceptual system(s) passes only functional reality instead of anatomical reality. In order to establish the relevance and significance of the 'perceptual system,' Gibson has shown the futility of two statements which were followed as conventions by psychologists and philosophers. According to the first one, sense organs are the only sources of knowledge, and the second one claims that sense organs are channels for special qualities of experience. Gibson finds the conventions not just confusing but also contradictory. He explains that the first one describes sense organs as the *instrument* through which knowledge can be obtained, whereas the second one represents sense organs as the *conveyers* of mere sensory qualities. But the fact is a sense organ is unable to play the two roles simultaneously because those are contradictory. To avoid the contradiction Gibson provides a suggestion. He says the conventions should be denoted by two different terms, for they are referring to two different positions. In Gibsonian terms, the first position may be modified this way: the senses as perceptual systems are the sources of knowledge. And the second position can be re-presented as the channels of sensation are the sources of conscious qualities. Behind these interpretations and modifications, Gibson's logic is, the inflow of information never coincides with the inflow of sensation. The inflow of information is completely independent, but the inflow of sensation is semi-independent.

According to Gibson, at the primary stage of the perceptual process, a person sees the environment in order to find some information to pick up. When the person moves in the environment, various stimulus energies or stimuli, from that surrounding environment, reach her sense organ. The stimuli reach every sense organ simultaneously at the same time. However, the stimuli have the ability to stimulate a particular sense organ among others and to involve it in the job of picking up information or sensation. In that case, the entire perceptual process and its consequence(s) are known by the name of that very sense organ, like visual perception, etc. In

the process, the sense organ plays two different types of roles. In the beginning, the senses work as receptors and get stimulated by the external stimuli. In the part, they remain passive, and stimuli are imposed on them. But immediately after that the person, especially her senses become conscious and start to pick up the required information from those stimuli, and interpret them accordingly. In the later part, the sense organs perform as an active and conscious system i.e. perceptual system. As receptors, the sense organs are mutually exclusive. Every receptor has its own stimulating limit or *measuring point* (Gibson, 1966), under which it does not get stimulated. On the other hand, perceptual systems have no such measuring point; they can pick up information even from the stimulus of lower intensity. All five systems are interrelated, for that during the obtainment of information they may overlap. Information always appears as general, instead of being categorised as visual or auditory information. One more point is to note that due to the interconnection, the information is grabbed by every system simultaneously and for that, *the perception* as a consequence of perceptual process provides us with a holistic vision regarding the aimed object that in turn provides a platform for the action, which is intrinsically connected with the perception. For example, during visual perception, along with the visual system other perceptual systems also simultaneously get invoked and analyse and interpret the same obtained sensation or *stimulus information* in order to pick up their own relevant parts such that the perceptual process can cause a complete action. During the perceptual process, at the beginning information appears before a perceiver without being categorised as the information for visual perception, or else. Therefore, every perceptual system simultaneously receives and analyses that information. As a consequence of this process, perception occurs. Now, the point is, since no particular perceptual system alone processes the information, therefore, the form of perception supposed to be general, it is not supposed to be categorised by the name of one

particular perceptual system among the five. However, this does not happen indeed. Instead, every perception appears before the perceiver as categorised according to their nature and by the name of the processing perceptual system. Why does it happen so? Following Gibson it can be answered this way: at the beginning state of the perceptual process, where sense organs work as receptors, there following the nature of the stimulus, only the sense organ that is categorically compatible with the stimulus, among the five, becomes stimulated. Later, that particular sense organ, as a perceptual system dominates remaining four systems and leads forward to pick up relevant information. And as a result, the very perceptual process, as well as its consequence, are categorised by the name of that particular leading perceptual system. For example, if the impinging stimulus is a light, colour or something related to the light then definitely it will be received by eye i.e. visual sense organ. In fact, in the case, the visual perceptual system will proceed to pick up visually perceptible information. Therefore, in this case, the perception will be called visual perception.

1.1.2: Perception: A Conscious Action

Perception is intrinsically connected with action – from this expression, one is not to understand that action is a mere consequence of perception. Perception consists *in* action and to some extent, vice versa. Perception i.e. perceptual process is in itself a type of action and apart from that, its primary and necessary steps, like locomotion or movements of the agent, information pick up, etc. are also counted as actions. Perception is not passive. There is a myth that the stimulus comes from the environment, stimulate a person, and following that the process of perception gets started. But the fact is stimulation is not a subject of imposition, rather it is the subject of obtainment. People are seldom passive and only in the passive moment's stimulation may impose on and stimulate them. For example, we can talk about the relaxing moments of a person, like

sleeping or some intense moments, like reading an interesting book or listening to some enchanting music. These are some moments, in which generally people remain *unaware* and *passive* to the surrounding environment. In these types of passive moments, an unexpected event like screaming or odour of burning may awake or distract a person. In the case, the stimulus of sound or smell in the form of scream or odour is imposed on the (temporarily) passive agent. But immediately after that sudden impingement the agent becomes conscious and active and tries to find out the source of the sound or odour. She moves her body and motor organs to pick up the required information to perceive the root-cause. Here following the context we can talk about the internal stimuli apart from just mentioned external stimuli. The internal stimuli, which arise from the inside the skin of an organism, like bellyache, muscle cramp, or sudden loss of support, may be *imposed* on a person and arouse her. In these cases also people right after the sudden attack become conscious and actively get involved to find out some way to get rid of the problem. In Gibson's words "[i]mposed stimulation is produced by some state of affairs (outside or inside the individual) that does not depend on the individual's own action. The event intrudes upon the course of action. Obtained stimulation is produced by his own action or in the course of action. ...A pure case of obtained stimulation would occur when an active individual moves his limbs or head, stretches his muscles or scratches himself; or when, on the other hand, he pushes into the prod, looks at the light, listens to the sound, sniffs the odour, or seeks the draft of air" (1966: 32). The fact of the obtainment of stimulation is intrinsically dependent on the flow of activity of human beings.

In Gibson's defence, there is another argument to show: the intensity of the sensation, richness of the information can never be measured in an actual sense; it always varies from point to point and from time to time in the natural environment. Therefore, for a locomotive individual, the

stimulation of receptors and the intensity of sensation cannot be presumed unless they are experimentally controlled in the laboratory, in the process of perception that produces action.

1.2 Environment: The Ecological Ambience

The *environment* is one of the key terms of Gibson's theory of perception. In his theory, the term refers to the surroundings of the organisms that perceive and behave. In this regard, he talks about only those living beings that possess sense organs and muscles, which have locomotion, and top of it all who perceive and behave. To Gibson plants, vegetations, and organisms with lower cell structure and physical structure “[as] if it were lumped together with the inorganic minerals of the world, with the physical, chemical, and geological environment (1979/1986:07)”. The plant, etc. lack necessary structural conditions like having sense organs, muscles, developed nervous systems, etc. For these flaws, in the context of the ecological theory of visual perception, they are treated as mere objects in physics or geology.

According to the ecological approach, the environment is incorporated in the process of *direct visual perception*. Gibson says “[t]he environment of animals and men is what they perceive. The environment is not the same as the physical world ... The observer and his environment are complementary... The components and events of the environment fall into natural units. These units are nested. They should not be confused with the metric units of space and time” (1979/1986: 15). By the term ‘environment’ Gibson refers to the combination of the surfaces, substances, and medium which shape the ecology. Gibson’s concept of environment is completely different from the concept of the environment in physics. In physics, the *environment* is quite widespread. It includes everything, from atom to galaxies. Here every animate or inanimate object is granted as a physical reality that owns physical structure with a particular

size, mass, weight, etc. The capability of the perceptual system of human beings is limited. It only can detect a certain range of things or events. No one can perceive atoms or galaxies with bare eyes, but one can see the mountain from an enough far distance or a grain of sand from a close distance. From an ecological perspective, grossly, the world can be divided into two parts – terrestrial and aquatic. Each of these parts has its own environment, own system. Here our main concern is the terrestrial environment and human beings as one of the groups of inhabitants of the environment. Gibson describes the term *environment* differently; he thinks that we do not get a sufficient description of the mechanism of perception by Physics alone. Some more factors should be explored to have a proper idea of the mechanism of human perception. Gibson has called his ‘environment’ as an *ambient environment* that contains a well-formed combination of surface, substance, and medium. Gibson consciously separated it from the *physical environment*. “The world of physical reality does not consist of meaningful things. The world of ecological reality...does” (1979/1986: p.33). In physics animals, plants, natural or artificial inert objects, even light, air, fire, sound, everything is counted as a physical object that occupies some space and exists in a particular time. To avoid the confusion regarding the use of daily language it is necessary to explain a few of the words or terms clearly. We already have said that the term environment does not refer to the same thing as it does in the context of physics. For Gibson environment is the ecological ambience that is surrounding to an embodied human being.

Space and time are the most prominent and obvious matters found in physics. But Gibson showed that though space and time have been accepted as matter, practically, none of them can be seen. We only perceive the surface or the layout of the ground instead of space. For, *space* has no physical appearance, it is abstract; but the surface has the appearance, it is tangible. The surface is non-transparent, opaque, and solid in the case of the terrestrial domain and liquid in the

case of the aquatic domain. To describe surface physicists or geometer use the term ‘plane’. *Surface* and *plane* do not refer to the same thing; there are clear differences between them. The *plane* is an abstract concept of geometry but the *surface* is not so, it has substantial existence. The surface is textured, structured, and the subject to be seen. On the other hand, the *plane* is perfectly transparent. One can only visualise the plane, instead of seeing it. Again, according to the geometrical definition, a plane has to be conceived as a very thin sheet that must contain two sides; convex on one side and concave in other. But a surface is either convex or concave because it possesses only one side. Finally, a surface contains *observation points*, which provide an open facility to the perceiving agent to face the source of illumination.

On the other hand, like space, time is an imperceptible matter too. Practically, instead of *time*, we perceive the spatial or temporal shift of the objects. From the perspective of time, the object may be detected by our visual system either as persistent or changeable. The terms persistence and change represent the *state* of the object that is relative and reciprocal, in nature. Gibson in his work uses the term ‘object’ in a different sense, unlike philosophy. For him, the term does not represent something beyond description as well as perception. But it represents a *persisting substance*. For him, an *object* must have substantial characteristics like size, form, solidity, colour, texture, etc. that make it perceptible. Broadly speaking, *object* refers to the substantial aspect of the environment, which is heterogeneous in nature. Rock, soil, sand, mud, etc. all those things that occupy some area of surface, that is opaque, through which illumination cannot transmit, are categorised as objects. Every object is unique in the respect of others. According to a broad categorisation, *attached* and *detached* are two categories of the object. Detached object “refers to a layout of the surface completely surrounded by the medium” (Gibson, 1979/1986: 34). It has locomotion, it moves without breaking the continuity of any surface. In short,

detached objects are portable, *affords* carry-ability. All the objects that a human being can lift up from the ground by her own hand or by any instrumental help, come under the category of detached object. On the other hand, an attached object cannot be moved unless one cut, break, or uproot it. The objects of this kind remain constantly connected with the surface of the ground or some other substance. Therefore, it refers to a layout of the surface. Attached objects lack locomotion and provide temporary or persisting support to animals including human beings. Trees, mountains, houses are a few examples of this kind of objects. Before proceeding further, at this point, it is necessary to mention what Gibson considers by the term ‘substance’. According to him, *substances* “are more or less resistant to deformation, more or less impenetrable by solid bodies, and more or less permanent in shape. They are usually opaque to light” (1979/1986: 19)¹.

Following the link of the substantial aspect of the environment, it is essential to discuss the insubstantial aspect of the environment. This aspect refers to the medium of the environment. Medium is the homogeneous element of the environment that secures the availability of the information through the entire medium, and the smooth, resistance-free movements of the solid bodies through it. Air is the medium of the terrestrial environment (and water is the medium of the aquatic environment). Air is *insubstantial* in nature that allows the locomotion of the human body through it, without resistance. For the insubstantial nature of the medium light easily can transmit and reverberate through it. The homogeneity of the medium helps the light to reverberate smoothly and to be transformed into *illumination*. This illumination, in turn, fills the medium and reaches a *steady-state* i.e. called *ambient light*. Like illumination, the medium contains vibrations and odour, too that makes us hear the sound and smell the odour. Like light,

¹ Substances are opaque to odour and sound, too. Apart from that substantiality is such a feature that obstruct the locomotion of animals; it does not provide pass-through-ability.

vibrations of the sound waves and odour of any object get transmitted and spread through the medium, and reach to our perceptual systems. In other words, we can say, the whole medium contains information about the objects that reflect light, vibrate, and contain odour. The medium in the environment contains numerous observation points. An *observation point* refers to the spot on the terrestrial surface of the earth, standing where an organism observes her surroundings. Each point provides at least some information to the observer. It is to note that no two points provide the same information. Locomotion or interaction takes the observer to explore more information regarding the object of perception.

Moreover, the medium helps us to breathe by containing oxygen. Gibson says the characteristics of the medium as a part of the environment remain unchangeable or *invariant* despite the evolution of human life. These *invariants* have been called by Gibson *affordances* that are offered to human beings by an environment to live their life.

1.3: Information in Gibsonian System

Information is the most essential element for the processing of direct visual perception. Picking of the proper information makes possible the perceptual process to occur in a non-erroneous manner that in turn makes us achieve our aimed object or goal through action. The environment is the locus of information or more precisely, the *illumination* that fills the entire medium, as well as the environment, is the locus of information. Categorically illumination is deserved to be called as *light* but it is not to be understood the same as the radiant light. Gibson differentiates between the two by saying that radiant light is *physical optics* and illumination is *ecological optics*, which is also known as the *ambient light*. In a very general sense, the term ‘information’ refers to some data contained by any sign, symbol, or invisible or virtual frequency. In this

context, however, the term does not mean so; it refers to stimulus information, which is carried by *light*. Therefore, before understanding the information in details, we need to have some ideas about the light.

1.3.1: Light, the Locus of Information

The term ‘light’ is interpreted in different fields with different significance that refers to the various roles of it. In the theory, Gibson has treated light in three ways as *physical energy*, as a *stimulus for vision*, and as *information for perception*. Physical energy consists of the radiant light that comes either from natural sources like the sun or from created sources like electric lamps, fire lamps, etc. In the daytime (for example,) the sunlight, on one hand, reaches the earth directly in parallel rays, particularly from left to right². On the other hand, some parts of the light waves from the same source simultaneously transmit through the quasi-transparent atmosphere or medium to get scattered being resisted by the micro or nanoparticles in that medium. The part of the light wave that comes in a parallel manner, after touching the earth, gets scattered. The rays touch the *texture* of earth that we can understand as the uppermost layer of the surface of the ground, which is neither plane nor transparent. This act of scattering of the radiant light is called “scatter reflection” (Gibson, 1979/1986:50). The reflections of the sunlight go to the sky and again reflect back. Each of this reflection further disperses incident rays³. This act of reverberation keeps going on until the energy is completely absorbed by the objects, cliffs, etc. different enclosed spaces in the environment. After the complete absorption of the energy, no movement of the radiant light remains and the illumination reaches a steady state. It means illumination is the outcome of the reverberation of the radiant light that fills the medium as well

² In the example I only talked about the duration of before noon.

³ In Physics the ray of light that hits a surface is called Incident Ray. And the angle between this ray and perpendicular to the surface is the angle of incidence.

as the environment. At this point, one may ask whether ecological optics i.e. illumination and the ambient light refers to the same thing, though they are synonymous in this context. The answer is no. There is a difference. Ambient light is a more subtle matter than illumination. In Gibsonian terms, ambient light could be understood as an “omnidirectional flux of light that could not exist in empty space but only in an environment of reflecting surfaces” (1979/1986:51). If we think of numerous observation points in the medium then ambient light “would come to every point; it would surround every point; it would environing at every point” (Gibson, 1979/1986:51). Ambient light is much more delicate to understand in comparison with radiant light, though we have seen that ambient light relationally depends on radiant light. Radiant light causes illumination and illumination, in turn, causes ambient light. Here we can mention some more differences between the two. Radiant light diverges from an energy source; in fact, it is the propagation of energy. But ambient light is not so. It stays as stable until the duration of illumination. It converges to every point of observation; it contains information for perception. Radiant light consists of an infinitely dense set of rays. It has no particular structure. On the other hand, ambient light is structured; it can be conceived as a set of solid angles with equal and common apex.

At this point, we need to know about the nature of the structure of ambient light, which is very important for the (optical) information. The ambient light has to have a heterogeneous structure; otherwise, the process of perception will fail. The ambient light can be described as the merge of radiant lights or scattered reflections, from different angles and of different intensities. At an observation point, the radiant lights or scattered reflections, come from the left, right, top, and ground and are merged together. It is to note here that the left, right, etc. perspectives are decided in respect of the observer that occupies the point. The lights come from different sides of the

person, apparently seems to her alike. However, instead of the likeness or resemblance, there are differences among the lights because those are exclusive to each other in terms of intensity, etc. The differences are much more noticeable during movement or locomotion. For the differences or heterogeneity, the visual system can *pick up* the information to perceive the object as it is situated in the environment along with the surrounding environment. Sometimes ambient light possesses a homogeneous structure and sometimes appears as unstructured. And as consequences in those situations, perception fails. The fact is that the homogeneous structure of ambient light does not carry any information, therefore, from that kind of light visual system fails to pick up information and for that no processing occurs. For example, we can talk about dense fog. In winter when dense fog fills the air completely, then the atmosphere or medium remains no more transparent, it becomes translucent. For that, the radiant light cannot transmit the medium. It cannot reverberate between surfaces, but the reverberation gets limited between the droplets and other particles in the air. The reflection becomes micro-reflection that yields a sort of *micro illumination*, which remains beyond our perception. At any observation point in the foggy environment “there would be radiant light but without a difference in different directions, without transmission or gradation of intensity, there would be no structure and no array” (Gibson, 1986:52). Again, in the case of unstructured ambient light, we cannot perceive anything. For, in normal cases, the ambient light refers to or specifies the environment, but in this case, no environment is specified as well as no information regarding the environment is available. Unstructured ambient light is the same as ambient darkness.

Actually, in the fog-filled medium the receptor of the retina of an observer, standing at a point, gets stimulated and consequently, the impulses reach the fibres of the optic nerve. But Since, the light entering the pupil of the eye is not different in different directions, it remains out of focus,

and as a result, no image can form on the retina. The observer cannot see anything because the light on the retina is just as homogeneous as ambient light outside the eye. For the reason, the possessor of the eye gets puzzled, cannot determine anything. The eye keeps on moving aimlessly, but cannot perceive anything, for it finds no object there at that moment. In the situation, if the observer turns her eye, she would experience the same blankness just as before. If she moves the eye forward in space, nothing in the field of view would change. In the situation, she feels no difference in her perceptual experience. But right there if the observer closes her eye she would feel the difference between brightness and darkness. This is the state when the observer can distinguish between the state of the presence of stimulation of photo-receptor and the state of the absence of the stimulation. Now, in the fog-filled environment, if the perceiver keeps continuing to try to perceive through it for a long period, her eye would gradually start to behave like a blind's eye does; it would feel no difference whether the light i.e. stimulus of photo-receptor, enters the pupil or not. So here, one more thing is to notice that stimulus and stimulus information are not the same things. Stimulus i.e. stimulus energy remains contained in the radiant light. It only fires or stimulates the receptor cells in the eye, which work as transducers and convert energy from one form to another. The energy is absorbed by the receptors. On the other hand, the stimulus information is optical information that is carried by the heterogeneous structure and *array* of the ambient light or *optic*. It is not the information to be *conveyed* by a medium but is to be *perceived* by an observer as firsthand experience. The information consists of the *ambient optic array* of the environment, the world independent of the perceiver. We need to explore it through interaction with the world. Actually, “[t]he world is *specified* in the structure of light that reaches us, but it is entirely up to us to perceive it. The secrets of nature are not to be understood by the breaking of its code” (Gibson, 1979/1986: 63).

1.4: Ambient Optic Array

Ambient optic, at every observation point, has an array. *Array* means an arrangement or structure. The ambient optic array is nothing more than the ecological optic. Ecological optic fills an entire medium, but it is ambient only at a point of observation. Ambient means to surround a position in the environment that could be occupied by an observer. It is to note that the observation point is not an abstract point in the void rather it is real position in the *ecological space*, from where the act of observation can occur. The ambient array, at any observation point, contains information about the body or physical structure of the observer. The observation point is not stationary⁴. It normally moves along the path of locomotion. Every array takes on its own *forms* at different observation points, and it keeps changing as locomotion proceeds. For that reason the solid angles that are included in the array change in forms. It means the solid angle which is large may appear as larger, and the small one may get reduced. On the other hand, in some cases, due to locomotion as the surface goes out of sight the solid angles get wiped out. “The optic array changes, of course, as the point of observation moves” (Gibson, 1986:73). This change, however, is not complete. For, generally, every array bears numerous features among which some are changeable and some remain unchangeable. Changeable features go outside of vision as the observer proceeds. But the unchangeable features make us aware of the rigid layouts in the environment that interrupt our locomotion or sometimes obstruct it. The changing

⁴ The act of perception always implies movements or locomotion. In this respect locomotion means moving from one observation point to another. There is no motionless, static observation point. It is impossible for the perceptual process to be carried on from a single, motionless, static place, for it provides almost no information that may be picked up. Therefore, the cases of perception from a stationary observation point are known as the cases of null perception.

structure of the array is called *perspective* structure and the unchanging structure is called the *invariant* structure.

1.4.1: Structure of the Ambient Light

Ambient optic contains structure or format every point of observation. Normally the term ‘structure’ or ‘form’ make us imagine a formation that is closed by an outline or boundary (“*closed contour forms*”). But the outline or *contour* of the structure or form in ambient optical array at an observation point is not closed in actual sense (even not in the panoramic vision). Gibson says the form in the array is not able to correspond to each object in the space because some objects are hidden behind others. The fact is, firstly, the environment is not just an individual, distinct matter; all of its containing objects like places, surfaces, layouts, motions, events, animals, people, artefacts, etc., are the environment. These things correspondingly structure the light at a point of observation. Secondly, the environment does not consist of objects; rather objects are on the earth like mountains or in the sky like clouds. Each and every object are not detached and segregated; some objects are nested within one another like mountains, rooms in the house, seeds in the fruit, etc. On the other hand, some are attached, some are moving, or animated, etc. Therefore, it is not possible for the *form* in the array to corresponding with all the objects. The components of the optic array are not the same as the components of the objects on the earth. An array contains visual angles from mountains, etc. as its components, which is known in the terms of geometry as solid angles and get measured in degrees, minutes, and seconds. These visual angles in the array get changed in size as the point of observation moves. There is no gap in the structure of an optic array. Every component in it consists of smaller components within the boundary of any form. It is completely filled by the segregated or nested visual angles instead of abstract points or spots.

Visual angles of Gibson are the same as the solid angles of geometry. In the ancient theory of geometry or physics, the structure of ambient optic array has been described as a set of solid angles corresponding to objects. Gibson is not completely agreed with this stand of ancient geometry. He thinks that normal human beings do not only perceive the *free-standing* i.e. detached objects before their eyes as the only object of perception. Practically, the entire illuminated environment is the matter of our visual perception that includes both attached and detached objects, empty fields and objects cluttered rooms, a grain of sand and mountains, etc. Gibson says the optic array is a *nested complex* of visual angles or solid angles instead of a set of them. Actually in the structure of the array, as it is mentioned earlier, the respectively small angles are nested inside the relatively large angles, and so on. “The large solid angles in the array come from the *faces* of this layout, from the facades of detached objects, and from the interspaces or holes that we call background or sky. ... The small solid angles in the array come from what might be called the *facets* of the layout as distinguished from the faces, the textures of the surfaces as distinguished from their forms” (Gibson, 1986: 70).

1.4.2: Perspective Structure and Invariant Structure

In this context the term *structure* is vague. This matter can be described this way: the structure at every observation point has two layers one may be called essential structure and others may be called superficial structure. Supposedly the essential structure is nested underneath the superficial structure. The essential structure mainly contains those features of the optic array, which remain unchanged despite the *change* of point of observation due to locomotion. Here we can ask what kind of *change* Gibson has talked about. There are generally two kinds of *change*. In the first kind of change, ‘change’ means becoming different. In this kind of change, a thing becomes different from what it was at its earlier stage(s). On the other hand, in the second kind,

‘change’ means ‘conversion’. In this kind of change, a thing gets converted into something else. In the context of the ecological theory of perception Gibson talks about the first kind of change. He says it is impossible even to imagine that a rectangular object in t_1 and p_1 (where ‘ t ’ is time and ‘ p ’ place) gets converted into a quadrangular or any other object. Therefore, here change means appearing with a difference. Moreover, in the context, Gibson mentions that despite the changes a structure of ambient optic sometimes contains more than one invariant feature together. The periods of the persistence of all invariant features are not equal. Some persist for, comparatively, short periods and some go a long way. Among these invariants, there is a third kind of invariants, which persist only inside a boundary, like in the case of a room. On the other hand, Gibson calls the variant features in the environment as *perspectives* of the structure of ambient optic, which are not homogeneous or repetitive. The perspectives of every observation point are unique. There is no place for recurrence, replication, or repetition in the environment. In this part, our subjects of concern are the concepts of variance and invariance as they are reciprocal to one another. A stationary observation point is nothing but “a pause in locomotion, as a temporarily fixed position relative to the environment” (Gibson, 1986: 75). The structure in ambient optic at a stationary observation point contains *frozen* perspective(s) that indeed specifies the fixed position, and the flowing perspective refers to unfixed position to an observer. Therefore, it is clear that optical information brings information regarding the distinction between locomotion (motion) and non-locomotion (rest) to an observer, which is quite important for her perception.

The structure of the ambient array contains information about the observer as well as the environment. The flowing and frozen perspective structures contain information about the observer. And on the other hand, the invariant i.e. essential features of the structure contain the

information about the environment. The perspective structure and the invariant structure are concurrent. It means, they exist at the same time and they specify two different things through common locomotion. This fact is not illogical and impractical at all. One thing is to note here that the information about one observation point implies information about another observation point and so on. It helps an observer to continue the locomotion or movement.

1.4.3: Projected, Unprojected, Partially Covered Edges

The process of perception, no doubt, may be described as a riddle. During perception when we *see* the environment then the entire layout of the environment is projected to us. But if we analyse this experience we find that the entire layout does not get revealed to us, some parts of it remain unprojected, concealed. This environment is furnished with innumerable objects that are scattered in it, maybe in a disciplined way or may not be. Hardly can we see the empty-environment in a normal situation. Each and every object is not perceivable from every point of observation, sometimes they are covered or sometimes they cover other objects partially or wholly. It means, the environment contains some hidden and some unhidden, some projected and some unprojected objects. But the fact is we can perceive the hidden, unprojected objects in the same way we perceive unhidden, projected objects. Following the path of locomotion and the shifts of observation points the hidden objects appear as unhidden, and some previously projected objects get hidden. More vividly speaking, when we move to reach a certain destination, we perceive some objects as hidden, some as unhidden, or some as partially hidden. Again, when we return to the starting point, following the same route, the objects that appeared as hidden previously, now get revealed, and those that were unhidden get concealed. And those that appeared as partially hidden may appear as hidden or unhidden, or again as partially hidden, but this time, not the same portions but other sides of the objects get covered or *occluded*. In this

way, we can perceive the covered objects too. In this regard, there is a very general thought that the rays of light coming toward covered object get cut off by the covering object. This is not the truth. The fact is the covering object cut off solid angles instead of rays of light. It covers one or more solid angles temporarily only from any particular observation point. To express this matter of covering or cutting off solid angles Gibson prefers to use the term *occlusion*. According to him “[a]n occluded surface is one that is out of sight or hidden from view” (1986: 78). There are two reasons for the fact of occlusion. First is, the surfaces are not transparent like the medium, they are opaque, and the second reason is, the earth’s environment is cluttered with the objects. The opaque surfaces obstruct the vision, not light. The objects that are cluttered on earth in order to furnish it and to afford our behaviour provide some features to the environment such as enclosures (gates, doors, etc.), convexities (hills, etc.), concavities (holes, caves, etc.), and openings (windows, ventilators, etc.) through attached or detached objects. These features of surface layout occlude some other surfaces. The occluding surfaces, which are projected at a point of observation may be diminished, faded away, or wiped out at some other point of observation due to locomotion of the observer. So the relation between occluding and occluded surfaces are temporary and variable. It depends on the laws of both geometry and optics.

1.4.4: How the Array of Ambient Light Get Structured

Primarily we knew that light is ambient at a point of observation if it is surrounded by the environment. It means the structure of ambient light cannot be built by the empty medium of air or by fog-filled medium (homogeneous). The structure depends upon the condition of the heterogeneity of the environment. Essentially it gets formed by the light-emitting surfaces and light-reflecting surfaces in the environment. The ambient light contains information in it because it is structured by the substantial environment. The layout of the substantial environment

involves the puzzle of the pattern of light and shades. The surfaces on the layout are indicative of the substantial objects of various kinds, colours, shapes, and sizes. Both the lighted or shaded, occluding or occluded surfaces have their own contributions in the invariant structure of the ambient light. We perceive our surrounding environment not as a mosaic of black and white but as multicoloured. The objects in the environment are made by different combinations of physical and chemical components that determine the nature and quality of the objects like their colour, etc. Every surface in the environment reflects radiant energy that quite effectively contributes to the puzzle of the pattern of light and shade and helps the environment to appear as colourful before us. The fact is different surfaces have different reflectances⁵. So when radiant light containing different wave-length falls on an object, only light of a particular wave-length reflects from its surface, generating a particular colour for it. Since our visual system possesses the ability to perceive different shades of colours, hence we naturally can perceive the multicolored environment containing colourful objects and events. In fact, sometimes instead of shape, size, or close observation only perception of the colour of an object from a distance helps us to recognise it, to realise its state, taste, etc., and behave accordingly. For example, by perceiving a particular shade of yellow colour we recognise a certain fruit like mango, and without touching it we can identify the mango as ripe and tasty. And this realisation makes us to rush for it or to repulse it. Regarding the invariant aspect of the structure of ambient light, the layout of the terrestrial environment and the reflectances of the surfaces are considered among the main invariant features. The layout comes under this category because most of the surfaces on the terrestrial environment are so solid and rigid that they resist deformation. On the other hand, reflectances tend to be invariant for most of the substances are chemically inert, which means that their

⁵ Reflectance is the ratio of intensity of reflected ray and incident ray.

composition does not react with other elements or at their interfaces⁶, and their surfaces also retain the same composition and do not get change being influenced by any other object or event. At the level of *texture* (micro appearance of layout) and *conglomeration* (subtle state of the composition of different surfaces), the layout and reflectances get merged.

On the other hand, besides the invariant, there is one more structural aspect of ambient light, which is variant in nature. Moving point of observation and the moving sources of radiant light are two regular reasons behind the variance. How the movements through observation points successively bring changes in the structure of ambient light has been discussed in the earlier portion of this section. So, here we will concentrate on the second reason. Sun and its locomotion during the period of dawn to dusk are the original cause for illumination or ecological optics. As the source of light moves, the direction of the falling of light on the surfaces changes, and following that, the shadows move. In the case, the layout and reflectance of the surfaces remain invariant but the pattern of light and shade varies.

The gradual shifts of the source of radiant light bring obvious changes in the illumination or we can say in the degree of density of the illumination or ecological optics. Following these changes the pattern of light and shade also get varied, though all the changes occur in a slow and consecutive manner. Following the link of the change the variable constituents of the structure of ambient light, at an observation point, keep changing in order to maintain the continuity of information. In our everyday experience, we see the afternoon as a highly illuminated period in respect of the other periods of dawn, dusk, or twilight. These changes affect the perceptual process as well as the experience.

⁶ 'Interface' is a technical term of chemistry that refers to a thin layer or boundary between different substances or two phases of a single substance. Here *substance* is the substance of physics.

1.5: Affordances: Perception of *-able-ness*

According to Gibson's description we live in an environment that is a combination of surfaces, substances and medium. In fact, the empty or object cluttered earth cannot be imagined outside the environment. The environment provides or affords to all of its inhabitant shelter, water, fire, objects, etc. Here the question is how one can know about affordances? Can we say that the ambient array contains information for the perception of affordances as it does for the perception of surfaces, etc.? From the perspective of ecology, every environment has its own value and meaning, which, according to Gibson, are a matter of perception. For these are not like the values of ethics, these are absolutely objective and external to the observer. Therefore, again, our curiosity is how the affordances get perceived? Are they perceived simultaneously with objects? Before proceeding to find out the answers to these questions, it is necessary to mention that the term *affordance* has no etymological reference, it has been implied by Gibson himself from the English phrase *to afford*. The term *affordance* refers to the faculty of *afford-ability* of something. It seems that by the term he means to refer to the environment in a particular and unique manner with respect to the observer. In his words "[t]he *affordances* of the environment are what it offers the animal, what it *provides* or *furnishes*, either for good or ill" (1979/1986:127). Here let us see how the environment that is a conglomeration of surfaces, substances, etc. provides *affordances* to the inhabitants who observed it every day as well as live in it.

The surfaces called ground or floor provides bipeds (or quadrupeds) upright postures because the surfaces are horizontal, flat, extended, and of course rigid in nature. These four features are exclusively physical and external properties. The surfaces with these four properties are *able* to afford support to human being and other organisms that it can walk or run on. But it is to be

noted that, among the four properties extension and rigidity are such properties that are relative to the animal's size and weight in order to provide support. For the reason, a walk-able surface for human beings and a walk-able surface for insects are not (always) same. This means that an insect can easily walk or crawl on the surface that provides a human being with walk-ability but it might not always be the case. For example, an insect can walk on a swamp, blade of grass, thin wire or string. But none of these is able to provide support to a normal adult human being. According to Gibson affordances are unique for organisms. Affordances are not something abstract; people actually can see those directly as features of objects.

Affordance cannot be measured by any standard of physics. Terrestrial surfaces not only provide walk-on-ability or run-on-ability, but they also afford climb-on-ability like walls, fall-off-ability like cliffs, get-underneath-ability like caves, and many more. "Different layouts afford different behaviors for different animals, and different mechanical encounters" (1986: 130). Each and every object, (even the tiny one,) every part of the layout affords at least something at the observation point, occupied by an observer. Practically these affordances are mutually exclusive, though the observer receives them as united and related. The act of the receiving or picking up of affordances completely depends upon the observer's physical structure, bodily postures, and her behaviour. Secondly, the postures and behaviour of the observer that make her receive affordances, are relative to its biological orientation. For instance, a chair affords to a human being sit-in-ability and back-rest-ability. But it affords to a cat climb-on-ability, sleep-on-ability, etc. On the other hand, the postures and behaviour of the observer are determined according to her sociocultural, racial, or genetic influences. For example, we may mention an anecdote. The British people use the chair as a sit-able object because they consider it appropriate for sitting or lining posture. They learn the *use* of chair through cultural transmission down the generation.

But when in Japan, the chair was introduced for the first time the Japanese were absolutely confused about its use. For (until that time) in their culture there was no use of chair; they used to sit in the floor with the folded leg.

This was an example of how things are in the case of a normal adult human being. But if the observer is a child or a dwarf then the same chair may not afford sit-in-ability to her. For its affordance is not appropriate to their size. But in any case, if they are helped by some normal human being to sit in the chair or use any stool or similar object to reach the height of that chair then like other normal people they also become able to receive the affordance and behave accordingly. Not only artefacts like chairs, couches, or stools, but some knee-length convex parts of the layout may afford sit-in-ability to human beings. When an observer receives the affordances from any certain surfaces then the texture, colour, etc. of that surface appear to her as quite irrelevant. Here Gibson's point is every normal observer can recognise and discriminate the afford-able property/-ies of any object in the environment among its other properties. And they can do it just by looking at the object, even from a distance. Therefore, we may say that affordances have their own meanings, which are perceivable.

All organisms, especially human beings, have a quality to manipulate things. As the part of the environment according to situations and needs, we can spontaneously manipulate our perception that in turn manipulates our action. Different types of affordances from different surfaces and substances supply food for the process of manipulation. Here the term *substance* refers to all kinds of inert objects and living objects, other than the observer. Living objects afford not just different types of ability but it provides various relations to the observer like nurturing, playing, cooperating, fighting, preying, and many more, through the interaction between the observer and

object of perception. In the case of human beings, the intensity and mode of these interactions as affordances consist of ethical, aesthetic values and social significance.

Earth is the universal habitat of all species. The ecological environment on earth offers natural ways of living for organisms. Every species has a unique style of living. They try hard to arrange their *own ways of living* i.e. niche or maybe called home. Gibson interprets the *niche* as *a set of affordances* that are directly afforded by the environment. In the case of terrestrial environment, every organism has its own set of affordances or niche. The niche and the organism are complementary to each other. One implies the existence of other though it becomes possible due to the contribution of a giant set of unlimited possibilities known as the environment; it exists prior to everything. Generally, the term *niche* stands for a place where any organism stays, rests, and sleeps. From the perspective of ecology ‘niche’ refers to a well-formed setting of natural features.

Affordances contain physical value regarding the object of perception, and from that perspective, they are accepted by the observer as real or physical matters. Besides this, affordances carry some phenomenal values, too, which provide ground for the affordances to be accepted as subjective and mental matters. Affordances are such features of the environment that are not enough to understand as categorised in a particular class of subjective-objective dichotomy. Every affordance appeals to the environment and observer in both manners. There is a natural tendency in all organisms that they struggle to cope up with the changes in the environment in order to survive. Some of them successfully get adapted to the change of the environment, and some of them fail and slowly get wiped out. During the period of struggling organisms manipulate their perception and action and discover such new affordances, besides existing numbers, which provide them the stamina to survive, the ways to live. Besides these natural

affordances, human beings have invented much more artificial/ created affordances like an electric lamp, medicines, etc. in order to bring more ease and comfort to their lives. From the beginning of civilisation, they are struggling to modify, to *reshape* the environment so that it can provide some more affordances. And the process of modification is still going on. The struggle is affecting the habits and the eco-system of other creatures, which is not in any way desirable.

Now the question is what makes a human being to manipulate the systems of the environment, to *reshape* the substances? We may form an answer to the question this way: among all the animal species, the faculty of intelligence makes the human species superior and mighty. Maybe for that reason human being is not satisfied with the typical and repetitive affordances that only provide food, shelter, and the ways to fulfill very basic and essential requirements in order to survive on the earth. Intelligent human beings at the very earlier stages of evolution consciously or unconsciously realised the abundant value of the environment and its significance in their lives. To secure the sources of food, to make life comfortable human beings started to *manufacture* various things by using natural ingredients and environment. Human beings created an artificial world of material products on the earth despite the natural environment. They have done it to get more affordances, more options for a smooth living of their own self and for their future generation. One thing should be noted here that the artificial world is not distinct from the natural world; artefacts or material products are actually something made by natural stuff. In fact, these divisions of the natural world, artificial world, etc. are simply the puzzles created by language, practically there is only one world i.e. earth, which is the habitat of all animals including the intelligent human beings.

1.5.1: Environment: The Source and Resource of Affordances

How the environment affords? What does it indeed do? As we mentioned earlier that the environment is not any separate thing apart from air, substances, layout, surfaces, etc. Therefore, the expression '*environment's affordances*' refers to all the values and meanings, which come from each and every constituent of the environment and which afford to live for the organism. Air, as the medium of terrestrial environment, affords unimpeded movement and locomotion relative to the ground. On the other hand, being a natural, essential element of the environment, it affords breathing or respiration to the entire world of living beings (including plant and trees). We can see, hear, or smell *through* the air, and can find our surrounding environment as illuminated. In everyday life, we generally deal with two types of substances – liquid and solid. Water is the most basic and fundamental liquid substance that provides different affordances like drink-ability, pour-ability, wash-ability, solubility, etc., for terrestrial organisms but the water surfaces do not provide standing or support for most of the terrestrial organisms. They appear as such a type of obstacle in the path of locomotion that may be overcome by swimming or ferry across. On the other hand, solid substances afford various surfaces to the environment and its inhabitants. The values and meanings of the affordances come from these substances depending on the organisms in order to be opted, though not for existence. For that, some organisms found some solid substances like few types of fruits as nutritious when others found them as toxic. Again some solid substances afford manufacture-ability, especially to human beings. For example, we can talk about soil that is a natural solid substance, which is used by a human being to manufacture models, bricks, utensils, etc. Besides these flexible types of solid substances, there are some rigid types of substances available in the environment that affords obstacle and

that is quite rigid to be deformed or re-shaped. These latter type of substances make us realise the invariant aspect of the environment.

1.5.2: Layout and Surfaces: The Ground of Basic Affordances

The most layer or surface of the earth, which is known as a ground, is the most prominent example of solid substance. As we know that ground provides support to us, for its horizontal, flat, extended, and rigid. These four characteristics make the ground *able* to provide support. These four together afford equilibrium that an organism can maintain her body postures relative to gravity. In the respect of these characteristics, we acquire the sense of horizon that in turn affords us the sense of distance. Normally, standing on the ground we perceive the horizon as such a point where the ground supposedly merges with the sky. But practically it is not so, and adult human beings are aware of it. The sky and the ground never get merged; it is just the case that from a distant observation point people perceive this way. At the point of horizon instead of the sky and the ground, our range of vision gets merged. In this context, Gibson says that despite the knowledge or awareness about the shape of the (planet) earth all ‘human animals’ (1979/1986: 130) use their own scale and perceive the world as flat instead of round. For our experience our perception makes us *see* that way. Depending on that scale we always *see*, *visualise*, and *feel* the horizon as flat. The objects that are cluttered on the *flat* earth are perceived or experienced in relation to the horizontal plane. Here it may be mentioned that ground is the most extended and prominent example of the horizontal surface on earth. And in the case of the perception of other horizontal surfaces the same mechanism works in us. Besides horizontal surfaces the environment consists of one more extreme type of surface that is vertical surfaces. Like horizontal surfaces, vertical surfaces also consist of four essential features like being vertical, flat, extended, and of course, being rigid. Mountains are examples of natural vertical

surfaces. Boundary walls of highly secured buildings or skyscrapers are artificial examples of this kind of surface. Vertical surfaces provide climb-on-ability, crawl-on-ability (for few types of quadrupeds and for insects). In our experience, we face this type of surfaces as barriers or obstacles in our path of locomotion as relative to our size and shape. There is a common tendency in the nature of all organisms, including us that when we encounter any obstacle, either we try to overcome it or change the path to continue our locomotion. Generally, organisms, other than human beings, use only their body or some natural means to cross barriers. But for human beings, natural help or methods to cross barriers are not always enough. They use artificial methods and means to do the job. For example, human beings manufacture ladder or staircases, elevators, etc. to ascend the upper stories of skyscrapers; hair-pin bends, spiral bends, etc. to reach the high altitude mountains; even they manufacture various types of instruments, devices, and other necessary products to climb-on the vertical walls of inaccessible mountains, etc. Vertical surfaces provide fall-off-ability, which is not desirable of any species, for this affordance may afford wound, injury, or death in extreme cases. The parts of horizontal surfaces like the ground, being separated and surrounded by vertical surfaces like walls, build houses or rooms that are the *home* to human beings. We usually interpret vertical surfaces as obstacles or barriers that stop us to proceed. But these matters guide our perception and direct us to find out openings that we can keep continue our locomotion through it. Obstacles like inaccessible walls, cliffs, caves, etc. (even water surfaces like streams, etc.) afford us to steer ourselves into openings and to keep away from injuries.

1.5.3: Affordances as Use-ability

Here we are to discuss another important substantial ingredient of the environment called objects. The affordances in the environment that come from objects are “extremely various”

(Gibson, 1979/1986:133). But they afford behaviour or actions according to the size, shape, and weight of animals and persons. Among the innumerable affordances, maximum numbers of affordances are recognised and received by those organisms that have hands (not just front arms). And of course, human beings occupy the top position of the list of this type of organisms. Human beings in one hand are capable to recognise or discover maximum numbers of affordances and to invent many more affordances by manufacturing artificial objects, which include both of the types of detached and attached objects. The affordances come from different kinds of detached objects that determine the observer's behaviour, according to the situations. An object may provide different affordances to the same or different observers. For example, a club may be used as a weapon to hit someone or in self-defense, if the user (observer) is in danger or is chased by someone. It may be used as walking-support, if the user is an old person or unable to walk steadily. Again, it may be used as one of the ingredients to fence the garden, and so on. On the other hand, more than one object may provide the same affordances at the different moments to the same or to different people. As for an instance we can mention, there is a type of object that is used to put some weight on papers to resist it to get disordered or fly-away, named 'paperweight'. But we often use different objects like a book, pen stand, pencil box, small container, even our mobile phone for the same purpose instead of *actual* paper-weight. Depending on the size, shape, and weight detached objects provide lift-on-ability, throw-away-ability, grasp-ability, and many more. Affordances consist in the environment independent of every condition but which affordances will *appeal* to which observer that is specified *in* the optic array.

Every single object in the environment has a name though the name varies according to the variations of languages, cultures, and localities. In a particular locality, objects are recognised or

known by their name and category. For example, in the domain of English language speakers nail, hammer, wrench, etc. are categorised as tools; chairs, tables, almirah, etc. are classified as furniture; pots, pans, spoons, dishes, are known as utensils, and so on. But these are known as different names at different parts of the world though they solve the same purposes. Again every object has its own properties like colour, texture, composition, size, shape, mass, rigidity, elasticity, mobility, etc. So, here the question is, 'what gets captured by our visual system when we perceive? Are the properties of the object at all perceived?' Some orthodox psychologists say that objects are *composed form* of their qualities. Therefore, our perception of any object occurs as we discriminate its properties. Gibson does not agree with the orthodox view. He suggests that by looking at the object we perceive its affordances, not its properties. Indeed, every normal adult is aware of the fact that every object is a combined form of some qualities. But when we look at the objects, by nature we notice how the object can fulfil our purpose, what the object affords, and whether those affordances are attainable by us. The combination of qualities is not a matter to be noticed at the primary stage. It is to be noted that the fact of perceiving affordances does not refer to classifying objects. It means, an object despite belonging to a particular class may afford various things following the situation, position, requirement of the observer. Or it is better to say, an observer according to her position, etc. picks up necessary affordances from the environment. For instance, a piece of stone has the potential to be used as a weapon, paper-weight, hammer, or may be used in building a wall. It means a single object may afford so many affordances but all of them bear a consistency.⁷ All affordances are related to the *heavy-weight-*

⁷ Someone can use the stone piece even as a showpiece. But here my question to Gibson is how the affordance of *being used as a showpiece* may be consistent with the *heavy weight providing ability* of that stone piece? For, normally when an object, despite having various values and utilities, is perceived by someone merely as a showpiece, in order to decorate a room, hall, etc., it affords only some aesthetic features to that person. Similarly, when a stone (i.e. a piece of rock, not precious jewel) is perceived by someone as a showpiece, the perceiver picks up only its artistic or aesthetic feature(s) instead of that *heavy weight providing ability* as its affordance.

providing-ability of that stone. Here it is to explain that by the term ‘consistency’ Gibson does not mean that all of the affordances of a certain object are strung together. He even does not say that every purpose that is solved by that object, are of similar nature. Gibson’s point is that all the affordances are mutually exclusive, but each of them individually contains relevance, a link with the main object. Following the aforementioned examples, we can say, a stone provides numerous affordances of various types but it is not *able* to provide such an affordance that is absent in its nature; it can never provide flying-ability, floating-ability, or volatility. For none of these is available in stone’s nature. And one more noticeable thing is, when one uses the stone as in a particular form to solve a particular purpose, we recognise it with a new name, a new category. When we use the stone piece to nail something, we *perceive* it like a hammer and classify it as a tool, etc. Therefore, it is clear at this point that our visual system picks up affordances (as information) at first, by looking at the object cluttered environment.

In the case of child-perception a young child, first of all, perceives the affordances i.e. the meaning of the object and behaves accordingly. A child at the very beginning does not learn to discriminate and combine qualities in order to specify a certain object, but quite naturally learns to recognise affordances. Irrespective of age there is a natural tendency in human beings, in

We may explain the issue this way: let us, again, take the example of the stone, which apart from already mentioned things may provide many more other affordances. The same stone may be used as a showpiece, a relic, matter to worship, or as a proof or data of some cosmological fact. We saw that *heavy weight providing ability* is such a feature that is present in all of the aforementioned examples of affordances. But this feature is irrelevant for the examples of the affordances like showpiece, etc. They are much more related to the two essential characteristics of stone in general called rigidity and solidity (the cases of soft stones like sand-stones are exceptions). Perhaps these two characteristics make a perceiver interested or attracted to collect stone pieces as show pieces, relic, or data. Here we can talk about one more *consistent* feature among these four affordances that every appearance of the stone individually, in their own structure carries some information that is linked to the main object (stone) but not with the other affordances. For example, when a stone is perceived as a relic it contains some historical information, when it is perceived as (locus of) ‘God’ or any religious symbol then it represents a picture of any tribe or clan’s religious culture. Again, when the stone is recognised as a piece of meteor or comet then it is perceived as a collection of information for cosmological study and research.

general, to perceive the affordances or meaning before substances and surfaces, even before colour, shape, and size. Hence, once again, here the question may arise, what is affordance? Affordance is that invariant feature, which, on one hand, is noticed as separate from qualities and on the other, involves all the qualities. In Gibson's words "[a]n affordance is an invariant combination of variables, and one might guess that it is easier to perceive such an invariant unit than it is to perceive all the variables separately. It is never necessary to distinguish *all* the features of an object and, in fact, it would be impossible to do so. Perception is economical" (1979/1986: 134-135).

1.5.4: Affordances as Interaction

The environment consists of different types of affordances, but among all types, the most intricate and the richest affordances are provided to the environment by living beings. An organism may receive affordances from the other members of its own species or from the members of other species. When an observer looks at other organism then at the primary stage of perception she perceives the organism just as an (detached) object. Organisms are naturally categorised as detached objects. All living objects have a fundamental biological structure that classifies them as different species. But their colours, sizes, physical shapes, etc. are not common; it differs from individual to individual. For these properties are determined according to the conditions like gene, geographical atmosphere, climate, lifestyle, etc. And depending on these conditions their behaviour, culture, taste, etc. get determined. Living beings are by nature spontaneous and flexible. They can initiate their own movements by their own self. They easily can move or shift from one place to another. They can change their body postures. Even they can ingest and produce or release certain substances according to their needs. Living objects get related to the observer through their affordances in a *reciprocal* manner. They *interact* with the

observer, other living beings, and the environment in the same way. Means, if they are touched, touch back, if they are struck, strike back. The fact is “[b]ehavior affords behavior” (Gibson, 1979/1986:135). In the environment different kinds of behaviours are available like friendly, nurturing, economic, political, etc. each type of behaviour depends on the perception of the frequency and intensity of the same type of behaviour, coming from the opposite side of the *beholder* (Gibson, 1979/1986). This fact confirms that behaviour i.e. affordances are not just reciprocal but mutual to each other. At this point, we can see that perception of the affordances that come from living objects are much more complicated in comparison with the perception of the affordances that come from inert objects and their surfaces. One more important point is that for the perception of inert objects the observer needs to have an *ambulatory vision* associated with *ambient vision* in order to pick up information, but living being as objects of perception emit information by themselves in the forms of touch, sound or word, odour, taste, and of course as ambient light, for they are tangible, audible, odorant, testable, or visible. During the perception of living objects the observer⁸ consciously draws a line of discrimination between the observer and the observing object as *ego* and *other* respectively. And simultaneously the *ego* identifies the *other* as an ecological object with skin (that affords tangibility) and expresses the other as *she* or *he* instead of *it*. She treats the other merely as an object of perception that “...has a surface that reflects light, and the information to specify what he or she is, invites, promises, threatens, or does can be found in the light” (Gibson, 1979/1986:136).

⁸ Here the word ‘observer’ refers to the ‘agent’ instead of mere ‘person’, who has the sense of agency along with the awareness of the distinction between *ego* (*self*) and *other*. This matter will be developed later.

1.5.5: The Evaluation of Affordance

At this point of discussion if we take a look at the background of the unique concept of affordances that will clear our vision about it. It is a general psychological claim that in every organism, especially in human beings, there is a tendency to look for the value and meaning of the object that is related with their life or surrounds them. And people accept only those objects, the values of which are clear to them. According to the opinion of the Gestalt psychologists, the meaning and values are perceivable just immediately as colour of objects. For them, objects possess their values on their faces i.e. external appearance, and for that, just by looking at the people can decide or understand that ‘it is good to eat’ or ‘it is so strong to hit the nail’, etc. For every material object, including living or animate objects, own a *physiognomic* quality in their physical appearance or face that make them be read or used by the observer. In support of their account, Gestalt psychologists say that these values of objects are essential features for the faculty of experience. Moreover, they consider that objects in the environment appeal or invite observers to choose and use in a particular manner – this thing or meaning cannot be a matter to be stored as memory images or as ‘an unconscious set of response tendencies’ (1979/1986: 138). Objects appeal to observers at every fresh and present moment of perception. Gestalt psychologists consider that the value may be changed according to the change of need or taste of the observer. Gibson opposes this position of gestalt psychologists and suggests that the value or meaning of the objects i.e. affordances are not subject to change following the observer’s need and taste. The concept of affordance has been derived from the concept of the psychology called *valence*, which is a basic invariant feature of the human mind or understanding that deals with emotion. *Valence* actually refers to the ability of the human mind to be engaged in the process of valuation that means judging something whether it is useful or harmful. And for that affordances

are referred to as the invariant features of the objects in the environment. These features are not changeable with the need of the observer. According to Gibson, we can say, it is true that affordances contain the value and meaning of any physical object. But here ‘value and meaning’ do not represent those qualities of the objects, which are not able to be perceived by visual systems like the taste, love, etc., which are internal. Through the process of perceiving affordances, we only can perceive is it beneficial or injurious to someone. The ambient light for perceiving affordances only contains *objective* features like colour, texture, form, etc. of any object or surface.

1.6: Conclusion

Gibson in the theory of direct visual perception describes the perceptual process as something that necessarily involves the action called locomotion, though, in Gibsonian view, the process of perception is itself an action. By mentioning locomotion Gibson has talked about voluntary action. Very simply speaking, voluntary action is such an action that is produced and directed by an organism’s volition. And volition is produced by intention. It is to be noted that intention and volition are both internal faculties. Through the detailed discussion, we saw that Gibson no way entertains the involvement of sense data, mental representation, etc. as a medium of the perceptual process that occurs by the pure contact between the observer and surrounding environment that is an accumulated representation of objects, etc. According to Gibson, *living* organisms, at the state of wakening, are always conscious. Only at the states of sleeping or senselessness, they are literally unconscious. Apart from that, at the moments of the awakened state, when people are called ‘unconscious’ by others, they are actually deeply involved in any serious activities like reading, writing paper, composing music, etc. At these so-called *unconscious* moments if some stimuli get imposed on a person then she will react accordingly

through some actions. These sudden impulsive actions are categorised as reflexive actions that are caused by a pattern of sensory input. No internal mechanism like will or intention works behind the reflex actions. It is a spontaneous expression of organisms. But immediately after those few moments the person becomes conscious and starts to follow her volition. Therefore, since perception cannot occur in the state of sleeping, etc., it is a conscious voluntary action. Organisms pick up information in order to perceive the matter of their interest. Perception, for Gibson, is not a passive action, but it is an action that essentially occurs to reach a goal or purpose. Perception involves goal-directed movements or locomotion instead of mere stroll or perambulation. The goal or, we can say, the meaning of perception is to know the world or environment and its habitant objects and species through interaction with them. Interaction is the means of finding a relation between affordances and observers. This relation and the awareness about this relationship are important to living our life. It makes us learn, find out, and identify the properties that are *able* to solve our various purposes, like satisfying hunger, etc. depending on our needs and circumstances. In goal-directed actions, the perceptual functions are necessary to guide our movements. For example, in the given case different actions are required to use a fork, knife, or spoon to satisfy the goal. Therefore, after Gibson, we can conclude by saying that perception is an achievement.

Analysis of the Process of Direct Visual Perception under the Framework of Nyāya Theory of Perception

Perception, being the most basic awareness, provides ground for every type of cognition and actions. But there is a debate regarding the nature of perceptual awareness. Some theories claim that perception is sensory awareness, which is caused by sensory or nervous activities directed towards the brain. On the other hand, some other theories describe perception as a direct process, through which a perceiver's sense organ directly is related to the object of perception and, as a result, perceptual awareness occurs. The former type of theories represents the indirect model of perception. On the other hand, the latter type of theories argues for the direct model of perception. The Nyāya theory of perception also represents a kind of direct theory of perception. The main aim of this chapter is to describe the Nyāya theory of perception in such a manner that will support the claim that the Nyāya theory contains a kind of direct approach. According to this approach, perception is a process that starts with the direct and immediate relation between human beings and the objects of perception, which are scattered in the very environment the perceiver inhabits. This view argues that the perceptual process is reciprocal and dynamic – a process in which the perceiver and her surrounding environment equally take part. It is to add that, according to the direct approach, there are some factors, which significantly matter for an individual for acquiring perceptual experience or cognition and applying those, further in some real situation. Among many of the factors, an object's shape, size, height, etc., and a perceiver's

bodily movements, locomotion, physical structure, mental state, etc., are mentionable as an example.

Perception is not a simple process that occurs by just a relation between the sense organ and its respective object; it is much more complicated than that. Perception is a quite intense and complex process. It involves not just sense organs that are parts of a perceiver's body, but the whole body gets involved in the perceptual process. The role of the body is essential and significant in the process of perception. Our cognition, experience, emotion, and awareness, are embodied. In all the events happening around us, we participate as embodied being. Our biological structure and physical or *functional* structure make each of us separate from others and we recognise others and ourselves as individual personalities, who have a subjective identity or appearance beside the objective, physical, or external appearance. This *subjective identity* is constituted by our subjective experience that is in turn dependent on perception. The direct model of perception argues that for the generation of perceptual cognition about any living object, non-living object, or event perceiver's locomotion or bodily movement is necessary. In fact, just to be sure about the real existence of the object, etc., the perceiver has to move toward it to see or feel it by taking a tour around it or by moving the head or any other body part to check it from all the possible sides and aspects. Events like locomotion and bodily movements are examples of voluntary action that is directed by the faculty called 'intentionality'. Intentionality is a characteristic feature of our internal state. As a conscious beings, we have awareness about our surrounding environment, objects, and events, along with the existence of our selves as well as others. Even we are conscious of abstract objects like numbers, words, etc. In fact, all these matters always affect us depending on our instantaneous situation, place, our mental states or moods, etc. Those affect our life, activities, and decisions by affecting our intention, action, and

perception. This fact provides us with options to select, reject or to be indifferent about the object or event of perception.

Arguably, the notion of embodiment and the notion of perception are related to each other, the meaning of ‘embodiment’ is incomplete or partial without the involvement of the meaning of ‘perception’ and vice versa. Being embodied means having a body, which means having a physiological structure and physical locus for the conscious self of the human being who recognises her own self as embodied—as ‘I’¹. This ‘I’ is more than just an ego — it may be identified as self-understanding. Our material body connects the ‘I’ with this material world. Although, ‘embodiment’ is a core concept of existential phenomenology, contemporary cognitive psychology, and gender and other marginality studies; the subject-matter of this concept may be found latently available in some of the theories of Indian philosophy. One of the main objectives of this chapter is to have a picture of the concept of embodiment in terms of the Nyāya theory of visual perception. Here we will also try to explore the way, following which the Nyāya realism deals with the connection or bond between an embodied human being’s perception and action.

2.1: Defining and Describing Perception in Nyāya Terms

Following the Nyāya description, we can conceptually interpret ‘embodied being’ as *jīva*. The *jīva* or sentient being is a conscious being, who is able to cognise the world. It has a particular biological form called *śarīra* i.e. body. The body of a particular sentient being is attached to a particular self that makes her aware of her relationship with the world. In this dissertation by the phrase ‘embodied being’ I will mean sentient being only. Besides, it is essential to mention that Gautama, by the word ‘*pratyakṣa*’ i.e. perception, refers to the means of perception (*pramāṇa*),

¹ It is important to mention that the term ‘self’, which has been used here as the reference of embodied ‘I’, does not refer to the notion of ‘the self’, following the Nyāya theory. There is no intention to enter into the discussion of the issue because it is not the concern of the chapter as well as the thesis.

true cognition (*pramā*) that is directly acquired, and the object of perception (*viṣaya*) (*Nyāyadarśana*, vol.1: 87).² In the *Nyāya-Sūtra* Gautama defines perception as “*indriyārtha-sannikarṣa-utpannam jñānam-avyapadeśyam-avyabhicāri vyavasāyātmakam pratyakṣam*” (1/1/4). That means perception is the knowledge resulting from the relation (*sannikarṣa*) between sense organ (*indriya*) and object (*artha*), which is not due to words, invariable, and indubitable, in nature. Naiyāyikas say that the process of perception involves two stages – *nirvikalpaka*, i.e. indeterminate, and *savikalpaka*, i.e. determinate. It is to mention here that Gautama refers to the connection or relation of conjunction (*samvaddhatā*) between the sense organ and an object by the term ‘*sannikarṣa*’ instead of the term ‘*saṃyoga*’. Why does he do so? The answer is, we do not only perceive the objects by our sense organs but we also perceive the colour, etc. quality, colour-ness, etc. the common-ness (*jāti*) of the quality of the object with the same sense organs. Vaiśeṣika philosopher Kaṇāda argues that since conjunction i.e. *saṃyoga* is a kind of quality. It only can be connected with substance (*dravya*) for it resides in the substance only, with the relation of inherence (*samavāya*). But no quality can be connected with another quality like colour, etc. Being a kind of quality *saṃyoga* cannot be connected with the quality-ness like colour-ness as well. For a quality contains no quality. A quality alone, without being placed (*āśrita*) in an object, cannot produce another quality. The substance is the one and only place (*āśraya*) of quality. No quality ever gets related to something by the relation of connection (*saṃyoga*). Therefore, considering these aforementioned arguments of Kaṇāda, Gautama defines all types of relations by the term ‘*sannikarṣa*’. Again coming back to the context it is to say that in the initial stage i.e. indeterminate, the perceptual cognition occurs as bare, unqualified awareness. More succinctly, indeterminate cognition does not contain any quality of the object of

² Here by ‘perception’, I intend to mean mainly perceptual process. But at some places, following the contextual relevance, the term will mean perceptual cognition too.

perception like form, etc. It is a kind of non-relational cognition, in which the contents do not appear in ‘*x is F*’ form, but as isolated items only. Let us take the case of ‘*ghaṭavat bhūtaḥ*’, which means the floor is qualified by the jar. In this case, there are three factors (independent of the perceiver) on the objective side of the cognition — the floor, the jar, and the connection (*saṃjoga*) between them. These three matters have their own essences like the floor-ness (*bhūtatva*), the jar-ness (*ghaṭatva*), and the connection-ness (*saṃyogatva*), respectively. But when this floor and jar, as connected to each other, become someone’s object of perception, the floor, the jar, and the connection between them appear in her cognition as the qualificandum (*viśeṣya*), the qualifier (*viśeṣaṇa*), and the relation (*samsarga*), respectively³. At the primary (i.e. indeterminate) stage of perception the floor, etc. do not get registered by the perceiver as qualificandum, qualifier, and relation, that is to say, they do not appear in the cognition as being qualified (*viśiṣṭa*) by the qualificandum-ness, qualifier-ness, and relation-ness. But that does not mean that in the primary stage of perception, these factors, floor, etc., do not exist at all. They exist but do not appear as clear, distinct, and qualified objects of perceptual cognition. As a result of that the cognition in this primary stage remains indeterminate; *viśeṣaṇa-viśeṣya-bhāva rahita*. On the other hand, the nature of determinate cognition is totally different. It is a relational type of cognition that represents its content as qualified. In the determinate stage, an individual cognises the floor as qualified by a jar. Along with that she also cognises the relation between that floor and the jar on it. Even, in this stage, she knows the floor as containing floor-ness, the jar as containing jar-ness, and the relation between them containing relation-ness. The role and

³ In case of perception it is not pre-decided whether an object would present in cognition as qualificandum or qualifier; there is no fixed rule for it. It depends on how someone perceives and expresses an instance. If the instance of ‘the jar is on the floor’ is expressed as ‘*ghaṭavat bhūtaḥ*’ then the floor is qualificandum and the jar is qualifier. But if it is expressed as ‘*bhūtale ghaṭa asti*’ then the jar is qualificandum and the floor is qualifier.

function of indeterminate and determinate cognition in the whole process of perception can be elaborated as follows:

2.1.1: Indeterminate and Determinate—Chronological Order of Perceptual Cognition

According to the Nyāya theory, indeterminate and determinate are two stages through which the perceptual cognition is produced. In this part, we are going to talk about the chronological sequence of indeterminate and determinate perception or perceptual cognition. Technically these two stages should be considered as psychological stages. By ‘psychological’ one should not take the stages as imaginary or outcome of mental construction. The perceptual cognition practically occurs in two sequential manners. Between the two, we are capable of registering only the advanced one i.e. the determinate perception. Despite the difference(s) between both of the stages, they share a common content of cognition. For example, in the case of perceiving a jar, the perceiver, at the indeterminate state, cognises the jar as barely *something* but at the immediate next stage of that, she perceives that same jar, as a determinate object called ‘jar’. In the determinate state, i.e. the advanced state of perception, the person perceives the jar as a definite object having a certain name, colour, purpose, etc. Indeterminate cognition of an object becomes explicit and established through determinate perception. Indeterminate cognition is succeeded by determinate cognition, and this order is constant.

Indeterminate cognition prepares the ground for determinate cognition. The duration of this stage is so short to register by the perceiver. Besides the theory, no one can know or experience the state as occurring or occurred. According to the Nyāya account, *jñāna* exists for three moments -- the moments of occurrence or appearance (*utpatti*), stability (*sthiti*), and perishment (*dvamsa*) respectively. As a kind of cognition indeterminate cognition also stays for the three moments.

Following the context (of cognition) it is to note that the fact of tri-momentary duration for both of the indeterminate and that of determinate do not oppose or contradict the nature of indivisibility (*akhandatā*) of cognition. Indeterminate, etc. all these divisions are psychological, logical, and temporal, which bear mere physical differences (*vyavahārika bheda*). The cognition that is *placed* in the self is integrated and continuous. The indeterminate state and the determinate state indeed share the same content but nature wise there are a few differences between the two states. In the primary state, the content is latent and in the secondary state the content is manifested. The content of the determinate cognition is not unmanifested (*anudbhūta*) like the content of indeterminate cognition, rather it is manifest (*udbhūta*) and qualified. In the case of the jar-perception, in the determinate stage, the content of cognition is recognised as ‘the jar’ along with its form (*kambu-grībādimāna*), colour, etc. other details. In this stage, the content appears as manifested in the cognition as well as in the perceiving agent.

The second difference is quite intense and subtle. There is a difference between the status of contents. The content of indeterminate cognition appears to the cognizing agent as unqualified and unrecognised. On the other hand, the content of the determinate cognition is always qualified. The indeterminate stage of perception is the most initial stage of the process of perception and determinate cognition succeeds indeterminate cognition. In both the stages, the content of cognition appears with all of its specifications like its features, and the relation of those features with the content. But in the indeterminate stage none of the object, its qualities, or the relation, are manifested. Whereas, in the determinate stage, the object is known as qualified by its qualities as well as the relation. According to the Nyāya theory, cognition must have some object. Cognition is always related to its object by a specific relation. This relation is called

‘objecthood’ (*viṣayatā*)⁴. “Thus a cognition of a particular jar has the jar as its object. The objecthood of that cognition resides in the jar...” (S.Bhattacharyya, 1990: 6). The object of cognition is technically ascribed as qualificandum (*viśeṣya*) and qualities like its form, genus, etc. are ascribed as qualifiers (*viśeṣaṇa*). Qualificandum has its qualifiers by the relation of inherence (*samavāya*). Again, qualificandum, etc. separately have their own objecthood called *qualificandum-ness*, *qualifier-ness*, and *relation-ness* respectively⁵. In the indeterminate stage, the objecthood remains unregistered by the perceiver. Even the qualificandum, qualifier, and the relation do not get recognised as *qualificandum*, *qualifier*, and *relation* respectively. In this stage, the perceiver has just a bare awareness of the object, though she is not conscious of this awareness. But the determinate stage is not like that. In this stage the object appears and gets cognised with its objecthood, that is to say, the qualificandum is known as qualificandum that owns the essence of qualificandum-ness, the qualifier is known as a qualifier that owns qualifier-ness, and in the same manner, the relation known as a relation that owns relation-ness. The object is known by the perceiver as qualified by its qualities; the connection among the qualificandum etc. gets revealed through cognition. In this stage, perceiver knows the object like a *jar* that has *jar-ness*. It needs to be mentioned here that the objecthood has no division as such, but from the perspective of the *mode of presence* or *appearance*, objecthood may be divided into

⁴ According to Navya Naiyāyika Gadādhara, *objecthood* is the relation between the object of cognition and the cognition itself. Objecthood is nothing more than the term ‘objecthood’; it has no separate or independent entity. Following the variation of objects objecthood varies. It is unique to its own object. It means, in the case of conjunctive cognition of jar and cloth, jar-ness and clothness should not be treated as they are flexible, being the part of one common cognition. Jar-ness always resides in jar, never in the cloth and similarly, clothness always resides in the cloth, never in the jar.

⁵ Qualificandum-ness, qualifier-ness, and relation-ness these three are not to be considered as three types of one general matter called *objecthood*. Objecthood is nothing more than the term ‘objecthood’. Objecthood contains no division; it is unique to its own object. Now if it is considered that the three afore mentioned objecthood are three types of one particular objecthood like jar-ness, then we have to accept that those three also reside in the place (*ādhāra*) of jar-ness that is jar. But it is not the fact. Qualificandum-ness resides in its object called qualificandum, qualifier-ness resides in its object called qualifier, and similarly, relation-ness resides in its own object relation.

three forms like transcendental (*turīya*), latent (*anudbhūta*), and manifested (*udbhūta*). The indeterminate cognition contains the first form of objecthood i.e. the transcendental objecthood (*turīya viṣayatā*). This kind of objecthood is not a matter of ordinary perception for ordinary people, except *yogī* or sages. Ordinary people only can infer its existence. It exclusively remains limited in the sphere of indeterminate cognition⁶; it ceased to exist with the cessation of indeterminate cognition. Though the content of indeterminate cognition is converted in determinate cognition (whether it occurs immediately after that very indeterminate cognition or later), but the objecthood of indeterminate cognition is not transferable. It is to note here that a few lines before I said that there was no objecthood in indeterminate cognition, and now I am saying that it contains an objecthood. The fact is that none of these claims is wrong. At the previous place by the term ‘objecthood’ I meant the *manifested* objecthood, which is truly not the content of indeterminate cognition. But later by ‘objecthood’, I referred to the *transcendental* objecthood.

On the other hand, in the determinate stage of cognition, the content has two phases, one is primary and another is secondary. In the primary phase, the mode of objecthood is (or may be) unuttered or silent (*anullikhyamāna*) and in the second phase the mode of content is uttered or spoken (*ullikhyamāna*)⁷. These two modes are available in the determinate stage only. Let me say a few words to explain the issue of the two phases of the determinate perception. In the primary phase of the determinate cognition only a few features appears before the perceiver as manifested, although most of the features including the objecthood remains silent. For instance,

⁶ Apart from indeterminate cognition the transcendent objecthood is contained in the cognition/perception of sages (*yogī jñāna/pratyakṣa*). They can perceive it directly.

⁷ ‘This is a jar’ and ‘this is a jar that is qualified by jariness’ these are two different forms of one same cognition that the object of cognition jar has its essential quality jariness. But in the first form *jariness* is silent (*anullikhyamāna*) while in the second form jariness is clearly spoken (*ullikhyamāna*).

in the case of the determinate perception of a jar, primarily the perceiver knows the jar as ‘this is the jar’ (*ayam ghatah*). In the stage, she does know the jar neither as ‘this jar is qualified by the jariness’ (*ghatatvavāna ghatam aham*) nor as ‘this is that’ (*ayam-ta*). The essence of the jar i.e. the jariness (*ghatatva*) remains silent in this stage. However, in the second stage of the determinate perception all features of the object of perception appears before the perceiver as manifested. In this advanced stage, she knows or identifies all the (qualifying) features of the object of perception as well as the relation of them with the object, quite clearly. This second phase of the determinate perception also includes the stage of metacognition i.e. *anuvyavasāya*, in which along with the object, the jar for example, she recognises her knowledge or consciousness of the jar (*ghatam aham jānāmi* or *ghatvavāna ghatam aham janami*) too.

Apart from these two differences, there is another important difference between these two stages. There is a difference between indeterminate and determinate stages from the perspective of the way to access them. Although both are psychological stages, the determinate stage is psychologically accessible but the indeterminate stage is only accessible logically.⁸ Despite being non-relational, the indeterminate cognition provides a logical base for relational determinate cognition.

2.2: The Nature of the Perceptual Process—the Causation

From the definition of perception, we may have ideas about the nature of perceptual cognition as well as its instrumental cause (*karaṇa*). For, the first part of the definition, i.e. ‘*indriyārtha-*

⁸ By ‘psychologically accessible’ I meant determinate stage can be accessed or experienced through metacognition (*anuvyavasāya*). Metacognition may be categorised as a type of core psychological method introspection. By the method of metacognition a person cognises the determinate cognition ‘this is a jar’ (*ayam ghatam*) as ‘I perceive the jar’ (*aham ghatam paśyami*). On the other hand, by ‘logically accessible’ I intend to say that the indeterminate stage as well as the indeterminate cognition of jar can be accessed only through inference.

sannikarṣa-utpannam...’, expresses the process or method of the causation of perceptual cognition and the latter portion, i.e. ‘...*jñānam avyapadeśyam-avyabhicāri vyavasāyātmakam pratyakṣam*’, explains the nature of that cognition. The first part highlights the process of causation of the perceptual cognition (*pratyakṣa pramā*), which is the relation between sense organ and object. Therefore, in a literal sense, the relation is the special cause (*asādhāraṇa kāraṇa*) of the perceptual cognition that occurs immediately after the contact between two relata. The older sect of the Nyāya School technically describes the immediately precedent cause (*avyavahita purvavartī kāraṇa*) as *karāṇa* (*phalāyoga-vyavacchinnaṁ kāraṇam karaṇam*). For them, it is the instrumental cause (*karāṇa*) of the effect. Following this rule, the Naiyāyikas of the older sect consider the relation between sense organ and object as the instrumental cause of the effect called true perceptual cognition. There is a rule that the special cause is the instrumental cause for an effect.⁹ If following the Naiyāyikas of the older sect it is accepted that the immediately preceding cause is the instrumental cause then in the cases of determinate perception and the perception of the desirability, etc. of the object, the relation between sense organ and object would not be called instrumental cause anymore. And for that, the main definition would be violated. The relation between sense organ and object plays the role of the immediately precedent cause only in the case of production of indeterminate perception (cognition). It does not even directly produce determinate perception. Determinate perception is the immediate effect of indeterminate cognition (*ālocana*). Again, the cases of perception due to the knowledge of desire, etc. do not get produced directly by the relation between sense organ and object. It is the immediate result of determinate cognition of the object (that previously was produced by the relation between sense organ and object being mediated by indeterminate

⁹ “*Asādhāraṇam kāraṇam karaṇam.*” – *Tarkasaṁgraha*, *kārika*- 30

cognition). Therefore, in these cases, following the definition of instrumental cause provided by the Naiyāyikas of the older sect, indeterminate cognition (in the case of determinate perception) and determinate cognition (in the case of the perception of the desirability, etc. of the object) deserve to be called instrumental causes, which is the clear violation of the key definition (*sūtra*) of perception.

The solution to this problem is given by the neo-Naiyāyikas. They have modified the rule that *the special cause is the instrumental cause for an effect* just by providing a different interpretation of the phrase ‘special cause’. They said that the cause(s), which is qualified by intermediate cause, is called instrumental cause.¹⁰ For them, ‘special-ness’ (*asādhāraṇatva*) means ‘having the quality of mediated-ness’ (*vyāpāravatva*). Neo-Naiyāyikas interpret the immediately preceding cause of an effect as an intermediate cause that is technically known as *vyāpāra*. According to the Nyāya theory, an effect may have one or many special causes (*Tarkasaṃgraha*: 291). All special causes are not immediately succeeded by the effect; apart from the extreme last one, there are temporal gaps among the special causes and the effect. In fact, among all of the special causes if one or two causes get destroyed at the moment of occurrence of the effect then also they are called *special causes* for the reason of intermediate cause. For example, let us take the example of the production of a jar. The entire case of the production of a jar involves some special causes apart from the connection between the two convex parts (*kapala-dvaya saṃyoga*) of the jar. The connection between two convex parts of the jar is the extreme last one among all the special causes for the causation of the jar. It means it is the intermediate cause of the causation of the jar. Apart from this one, the potter who makes the jar, her skill of pottery, the lump of clay by which the jar is made, water that has been used to

¹⁰ “*Vyāpāravat kāraṇaṃ karaṇam*” – *Tarkasaṃgraha*.

soften the lump of clay, the wheel on which the lump of clay is converted into the jar, the bar that has been used to rotate the wheel, etc. all are the special causes to the production of the jar. However, at the moment of the connection between the two convex part of the jar or the production of the jar, some of the previous special causes like the lump of the clay, the water, or the bar may not remain there. Despite the absence or the gap, all those causes are still considered as the special causes of the jar. The intermediate cause maintains the link between the special causes and the effect i.e. the jar. Now, the question is what is the intermediate cause? Neo Naiyāyikas define the intermediate cause as such a matter (Y), which is produced by a cause (X) at first and then it causes such an effect (Z), which is, indeed, the result of that very particular cause (X).¹¹ Naiyāyikas confirm that in the process, cause X and cause Y have to be co-located (*sāmānyādhikaraṇa*).

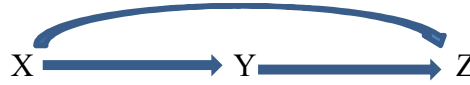


Figure: 1
Diagram of the role and position of intermediate cause i.e. *vyāpāra*

Let us take the case of the production of a piece of cloth. As we know that cloth is produced by the mutual function of yarn, shuttle, loom, weaver, etc. But if we analyse the process of production we would see that the cloth (as a real object), is produced immediately after the concatenation of its threads (*tantu saṃyoga*), though the fact of the concatenation of threads happens due to the mutual function of yarn, shuttle, etc. Therefore, logically speaking, the yarn, etc. (X) are called the cause of the cloth (Z) as being mediated by the fact of the concatenation of threads (Y). Now according to neo Naiyāyikas, this fact of the concatenation of threads is the

¹¹ “*Tat-janytve-sa-iti-tat-janya-janakatvam*”—*Tarkasaṃgraha*.

intermediate cause (*vyāpāra*). For it is the end or immediately preceding cause of the effect. And in this respect, the other causes in the chain, apart from the end one, are instrumental causes. These causes are known as instrumental for they are not directly present just before the production of effect; the production of effect does not depend directly on these causes. In fact, these are connected with the effect being mediated by the intermediate cause. Therefore, these are known as instrumental causes.

Applying the explanation on the case of perception we can say, the relation between sense organ and object is the cause of the perception in general. But this is not the instrumental cause of all sorts of perception, according to the ancient Naiyāyikas' interpretation; for this is not the immediately preceding cause for all kinds of perception. It works as the instrumental cause only for the causation of indeterminate cognition because it is immediately succeeded by determinate perception. Determinate perception is the direct effect of indeterminate cognition. Again, the relation does not directly cause the perception of the knowledge of desirability, etc., too. This type of perception is produced by the determinate cognition of the object. However, the relation between sense organ and object causes this determinate cognition, this relation plays no role to decide whether in a certain situation the object will be accepted, rejected, or be treated as the matter of indifference. It depends upon the determinate perception that is the immediately preceding cause of the effect. Therefore, we can see that in the cases of determinate perception and perception of the knowledge of desirability, etc., indeterminate cognition and determinate cognition, respectively, play the role of instrumental cause. For, they possess the intermediateness. Along with that the *relation* between sense organ and object, being mediated by indeterminate cognition and determinate cognition, respectively, is treated as the instrumental cause of determinate perception and perception of the knowledge of desirability, etc. We may try

to describe this argument following the aforementioned diagram. The case of normal determinate perception contains three steps. step1: the relation between sense organ and object (X), step2: indeterminate perception (Y), and step3: determinate perception (Z).

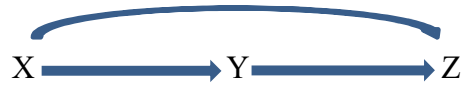


Figure: 2
Diagram of the causation of determinate perception

Moreover, in the case of the perception due to the knowledge of desirability also, (it can be shown that) the relation between sense organ and object plays the role of instrumental cause. Although one may argue that at the moment of causation of desire, etc. the relation between sense organ and object does not remain there anymore, it passes away. For, the moment of occurrence of determinate perception is the third moment i.e. the moment of perishment (see p.6) for the relation of sense organ and object. And the moments of the occurrence of desire, etc. as well as the perception (action) due to the knowledge of desirability, etc. are the fourth fifth, etc. moments for the relation. Therefore, naturally, at those fourth, fifth, etc. moments, the relation passes away. Therefore, in the case of the perception due to the knowledge of desirability, etc. the relation between sense organ and object cannot be the instrumental cause to the perception. However, it is not like that. There is a scope to show that the relation between sense organ and object can be considered as the instrumental cause of the perception due to the knowledge of desirability, etc. Every determinate perception causes some action or application (*vyavahāra*). From the perspective of the application, apparently, it seems that the action occurs at the immediate next moment of the determinate perception, which is the fourth moment for the relation. However, the action occurs almost together with the determinate perception because

these two are intrinsically connected with each other. The fact is there are some factors like desire, knowledge of attainability, etc., which occur in-between the states of determinate perception and the state of action. Through the factors, the determinate perception moves forward to produce effect i.e. action. These factors occur *in* the perceiving agent¹², almost simultaneously with the determinate perception. As a result of that, the perceiver's action and behaviour towards the object of perception are determined according to her present state of mind¹³. From this perspective, for the sake of explanation, the person having determinate perception can be considered (in a broad sense) as the owner (*ādhāra*) (Ganeri, 2012: 232) of all the stages from the desire to effort, the stages belong to her. Simultaneously, the state of determinate perception also can be considered as a set, in which desire, etc. all are included. The fact is, the states occur immediately one after one in a quite subtle level and such a fast manner that the awareness of the perceiver cannot reach the level subtlety as well as the speed. Therefore, from that aspect, the relation between sense organ and object should be considered as the instrumental cause of all of these stages, too.

At the end of this explanation, it is clear that only following the Neo-Naiyāyikas interpretation of the nature of instrumental cause the relation between sense organ and object can be accepted as the instrumental cause of perception in general. At this point, it is to note that despite the differences regarding the definition of instrumental cause, the entire Nyāya school accept that *karaṇa* or instrumental cause of the true cognition is called *pramāṇa* or the means (*pramā karaṇam pramāṇam*). Therefore, following the fact, it derives that the relation between sense organ and its respective object is the instrumental cause or *pramāṇa* i.e. the means of perception.

¹² Here I am mentioning the phrase '*in* the perceiving agent' separately because indeterminate perception or determinate perception involve individual's awareness but not her subjective states like her mood, desire, need, experience, etc., whereas desire, etc. states occur according to the present mode of the individual's internal states.

¹³ I will discuss the process in more detail in the sub-section 3.2.2. (p.66).

At this point, discontinuing the flow of discussion it is to declare that in this research work without violating the notions, explanations, and interpretations that are related to the Nyāya theory of perception, the instrumental cause or the means of perception can be considered as the initiating step of the perceptual process. The term ‘process’ in this context refers to the entire circle of perception that includes all those pre-perception activities that are responsible for the causation of perception. The circle also includes post-perception activities that happen for applying the perceptual cognition, experiences for dealing with the external world. Moreover, the perceptual process includes some more important issues like when and how the relation between sense organ occurs, how it works, how far its effect is spread, how long the effect remains, etc. These matters are intrinsically related to the mechanism of the occurrence of perception. In a sense, it can be said, these matters shape perception and add some meaning to it.

According to Nyāya, there are two categories of sense-object-contact — ordinary (*laukika*) and extraordinary (*alaukika*). There are six types of ordinary relations operating in an ordinary perception – *samyoga*, *samyukta samavāya*, *samyukta samaveta samavāya*, *samavāya*, *samaveta samavāya*, and *viśeṣaṇa-viśeṣya-bhāva*. Among these six types, the fourth and the fifth are exclusively engaged with auditory perception. Apart from that, the remaining four relations do also contribute to the perceptual processes. Again, among these four the first three are necessary for the perception of those objects which are present (*bhāva padārtha*) before the perceiver. On the other hand, the fourth (i.e. sixth one in the main sequence) type of relation i.e. *viśeṣaṇa-viśeṣya-bhāva* is required for the perception of absence (*abhāva*)¹⁴. The first kind of relation i.e.

¹⁴ *Viśeṣaṇaviśeṣyabhāva sannikarṣa* is such a type of relation by which, visual sense organ directly perceives the absence (*abhāva*). This relation, actually, is a combination of two more individual relations, named *samyukta viśeṣaṇtā* and *samyukta viśeṣvatā*. In fact, between these two, which one will cause the perception of absence that depends on the perception of locus of the absence. According to the Nyāya consideration, before the perception of absence the locus of that absence get perceived by *samyoga sannikarṣa*. Now, if the object of perception is ‘*ghatābhāvavat bhūtaḥ*’ means the floor is determinate by the absence of pot, then the visual sense organ gets

saṃyoga makes us perceive the whole object e.g. jar. Our visual sense organ directly gets related to the object and we perceive it as ‘jar’. By the second kind of relation i.e. *saṃyukta samavāya* we perceive the colour, shape, size, etc. (*rūpa*) of the object. We perceive the jar as ‘red jar’. By the third type of relation i.e. *saṃyukta samaveta samavāya*, we can perceive colour-ness (*rūpatva*) that is the essential quality of the colour. In this case, we can perceive the red-ness that is the essential quality of the red colour¹⁵.

2.2.1: The Causal Process of Extra-Ordinary Perception

In the case of extraordinary relation cognition functions as the relation. But this *relation* does not function in the same way, in which ordinary relations do. This special kind of relation cannot be grasped by any of the sense organs. For that reason, maybe, it is called as extraordinary. Extraordinary perceptual relation has three types – *sāmānyalakṣaṇa*, *jñānalakṣaṇa*, and *yogaja*. *Yogaja* relation is exclusively the matter of the perceptual process of the sages. Perception of sages is not the concern of this thesis, therefore, keeping the issue aside, the discussion will proceed to explore the context of the extraordinary perception of ordinary people, following the remaining two types of extraordinary perception. Through the *sāmānyalakṣaṇa* relation ordinary

connected with the absence by *saṃyukta viśeṣantā*. On the other hand, if the object of perception is ‘*bhūtaḥ ghaṭābhāvaḥ*’ means the pot is absent on the floor then the visual sense organ gets connected with the absence by *saṃyukta viśeṣvatā*. – *Bhāratīya Darśanakośa* (vol. 1).

¹⁵ In the general cases of perceptual processes, irrespective of visual, etc., the relation of *saṃyukta samavāya* is required for the perception of qualities or *guṇa* of the object of perception and the relation of *saṃyukta samaveta samavāya* is required for the perception of the essential quality i.e. *guṇatva* of those qualities. Each of the qualities is imperceptible for each of the external sense organs. Every sense organ has its own quality to perceive like visual sense organ perceives colour (*rūpa*), olfactory sense organ perceives fragrance (*gandha/ghrāṇa*), etc. And for that every particular sense organ is able to perceive only those objects that share the common quality with that particular sense organ. For example, our gustatory sense organ is made by the atoms of water (*apa*) and for that it is able to perceive only those objects which contain taste or *rasa* i.e. the unique quality of water. Therefore, during gustatory perception by the relation of *saṃyukta samavāya* we can perceive an apple as *sweet*. And by the relation of *saṃyukta samaveta samavāya* we can perceive the *sweetness* of the same apple. ‘Sweetness’ is the essential quality of the quality sweet. In the main context we only have mentioned the quality of *colour* and its essential quality *colourness* because we are only dealing with visual perception.

people perceive such a quality of an object that is commonly available in other objects of the similar or same class.

The term *sāmānyalakṣaṇa* is a combination of two meaningful terms, *sāmānya* and *lakṣaṇa*. ‘*Lakṣaṇa*’ means cognition i.e. *jñāna*¹⁶. It means that the cognition of common-ness (*sāmānya*) plays the role of relation. All followers of this interpretation do not hold the same explanation for it. A group of Naiyāyikas advocate that the cognition that works as relation contains the common-ness as its qualifier (*viśeṣaṇa* or *prakāra*)¹⁷. On the other hand, there is another group of Naiyāyikas who interpret ‘*lakṣaṇa*’ as such a kind of cognition, which contains the *commonness* as its object (*viśaya*)¹⁸. This later kind of interpretation technically includes the former one. Being qualifier of any cognition means, in a sense, being the object of that cognition. For, according to Nyāya, the essential nature of an object i.e. objecthood (*viśayatā*) may be expressed in three ways: qualificandum-ness (*viśeṣyatā*), qualifier-ness (*viśeṣaṇatā* or *prakāratā*), and relation-ness (*saṁsargatā*). Therefore, when we accept the common-ness as the *object* of cognition, we, silently, accept the role of three more cognition as extraordinary relation these are the cognition of qualificandum-ness, the cognition of qualifier-ness, and the cognition of relation-ness.

Now we need to have an idea of the meaning of the term *sāmānya*. ‘*Samānānām bhāvaḥ sāmānyam*’ (*Tarkasaṁgraha*: 346) this is the meaning of the term *sāmānya*. It means the nature of being common is called *sāmānya*. This *sāmānya* or being common is a cognised quality (*jñāyamāna dharma*) that belongs to objects of similar or same category. Naiyāyikas clarify the

¹⁶ There is another interpretation of the term ‘*lakṣaṇa*’ i.e. *svarupa* or the nature. According to this kind of interpretation the common-ness (*sāmānya*) itself, directly, gets related with the sense organ.

¹⁷ *Sāmānya-prakāra-jñānam sāmānyalakṣaṇam*.

¹⁸ *Sāmānya-viśayaka-jñānam sāmānyalakṣaṇam*.

description of the quality, being common (*sāmānyadharmā*), that we just have mentioned, always does not refer to the essential quality of the object(s) i.e. *jāti*. In some cases, it also refers to some general attribute. Again, it is not necessary that the very quality has to be eternal (*nitya*) in nature and reside in many individuals (*vyakti*) of a certain category. But sometimes this quality may be non-eternal (*anitya*). Even it may be present in only one object (*ekadravya-samaveta*) instead of many.

For Naiyāyikas it is not the main issue that a quality, which is (or maybe) known as that *common-quality*, resides in one or many places (*āśraya*). The important matter is to notice is how *the quality* gets cognised. This means, to be recognised as the common-quality, the quality necessarily has to be cognised as present in more than one object of the similar or same category. If in any particular case, the quality is present in only one object in real, but by error, it is cognised as present in many, even then that very *common* quality will be recognised as *sāmānya* on the basis of *anuvṛtti pratyaya*. Thus it may be said that to be known as common-quality or *sāmānya* the fact of getting cognised (*jñāyamānatā*) as a quality residing in more than one object (*anekasamavetatvam*), matters the most. The process of the relation of *sāmānyalakṣaṇa* involves the method of *anuvṛtti pratyaya*. It is the awareness of being present of something in many places. If we perceive any particular type of objects (as representing its class), e.g. jar, at different spaces in different times and situations, and every time we *call* it ‘jar’ and *recognise* it as ‘this is jar’ then we have to understand that despite the difference(s) of spaces, etc. we have perceived something common, invariant feature among all of the jars. This common thing is called the *common-ness* or *sāmānya*. Depending on the situation, and the perspective of perception the essential quality of the jar i.e. the jar-ness or any particular quality like the colour (*rūpa*), etc. may be treated as the common-ness. Therefore, perception of common-ness becomes

possible for the function of awareness of *anuvṛtti*. According to the Naiyāyikas from the latter group, for the cognition of common-quality working as (extraordinary) relation two preconditions, that quality must be present in many objects and secondly, our visual sense organ must have an ordinary connection with any of the objects those which represents the entire class or category. Otherwise, this extraordinary relation would not be called *indriyasannikarṣa*.

The second type of extraordinary relation is known as *Jñānalakṣaṇa*. The perceptual process that involves this type of relation is known as *jñānalakṣaṇa*, too. It is such a kind of perception in which previously acquired cognition, in some extraordinary manner, works as a relation. “*Jñānam lakṣanam svarūpam jasya sannikarṣasya*” – this is the definition of this kind of relation. It means, it is such a kind of relation that itself, essentially, is cognition (*jñāna-svarūpa*). However, this cognition is not acquired by sense (*anubhava*); it is memory (*smṛti*). If in any case, the memory of some object connects it with the sense organ as the quality or qualifier of the object of the present cognition then that memory deserves to be called the relation of *jñānalakṣaṇa*.

If in any case of ordinary perception the perceiver faces such an object (as the object of perception) that she has perceived earlier also, then (this time) as her sense organ gets connected with that object (to have ordinary perceptual cognition), almost simultaneously she recalls¹⁹ some memory of that object. The content of the memory appears before her as the quality (*guṇa* i.e. *viśeṣaṇa*) of the object of (present) perception. As the result of that, while following the process of ordinary perception the sense organ was supposed to be related with the object and the form of the perceptual cognition was supposed to be ‘this is that’, now it appears as ‘this object has this quality’. In this case of perception, the relation occurs between the visual sense organ of

¹⁹ This act of recalling happens quite spontaneously; the perceiver has no control on it.

the perceiver and some quality of the object of perception, instead of the physical object itself. Where the relation could be established ordinarily, it happens absolutely in an extraordinary manner. It is to note here that in the process of extraordinary perception no random cognition plays the role of the relation. But the trace(s) (*samskāra*) of the cognition regarding the object of present ordinary perception, which was acquired by some past ordinary perception and now, is stored in the self of the perceiver (*ātmasamaveta*), appears in the form of memory.

This matter may be explained through an instance of the perception of fragrant sandalwood. Someone may wonder that fragrance of sandalwood can be easily grasped by the olfactory perception (*ghrāṇaja pratyakṣa*), which is an ordinary process; then what is extraordinary about it? Following Naiyāyikas we can answer that there is nothing extraordinary in the perception of fragrance but if the perception occurs through visual perception then it is no more ordinary. During window-shopping, if someone perceives some sandalwood in the display of a shop then quite naturally, without any effort she cognises the sandalwood as ‘(I am seeing) this fragrant sandalwood’ (*surabhi candanm aham paśyāmi*)²⁰. In this case, the trace of the sense of fragrance (*ghrāṇānubhūti*) i.e. cognition, already resides (*samaveta*) in the self of the perceiver. Later when the perceiver sees the sandalwood in the showcase of the shop, then she recalls the fragrance and perceives the sandalwood as qualified (*viśiṣṭa*) by the fragrance. In this perception, instead of the object i.e. the sandalwood, the memory of fragrance gets related with the visual sense organ and the perceiver *sees* the object of ordinary perception as this sandalwood is fragrant’ instead of ‘this is sandalwood’. This cognition of fragrance does not come accidentally or externally but it already exists in the self (*ātmā*) as its quality by the relation of inherence.

²⁰ ‘(I am seeing) this fragrant sandalwood’—in the sentence I have bracketed the beginning part to highlight its difference with the end part of the sentence. Particularly, in this case, the expression ‘I am seeing’ (*aham paśyāmi*) remains beyond our awareness. On the contrary, we quite consciously experience the fragrance of sandalwood.

Since at that very moment the process of ordinary visual perception is still continuing and for that the (atomic) *manas* remains connected with the visual sense organ (*indriya-mano-samyoga*), hence, the cognition of fragrance gets merged with the visual perception as qualifier of the cognition, and the perceiver extraordinarily perceives the sandalwood as fragrant.²¹ Extraordinary perception is determinate; it has no indeterminate state. For it depends on determinate perception, being related to it.

The processes of recognition (*pratyavigjñā*), perception of absence (*abhāva pratyakṣa*), and metacognition (*anuvyavasāya*) involves this kind of extraordinary relation as their central mechanism. Indeed, extraordinary perception cannot occur through pure ordinary relation between sense organ and object, but it depends on ordinary relation (or perception). It is to note that extraordinary perception in general (apart from the perception of sages) occurs only in mature people. But ordinary perception occurs in the people of all age groups. In the case of recognition of a person, say Devadutta as ‘this is that Devadutta’, the part, which is referred by the term ‘that’ is not the matter of ordinary perception. Secondly, in the case of the perception of the absence of a jar on the floor (*ghataḥ nāsti*), the matter called *absence* itself, cannot be grasped by visual sense organ, following the process of ordinary perception. Thirdly, in the case of metacognition like ‘I know the jar’ (*ghataṁ ahaṁ jñāmi*) or ‘I perceive the jar’ (*ahaṁ ghataṁ paśyāmi*), the internal sense *manas* is not able to grab an external jar ordinarily. That is why in these cases extraordinary relation is necessary.

Besides the instrumental cause, for the causation of perception, there are two more auxiliary connections, which are important and necessary. The first is the connection between self and

²¹ According to Nyāya, in the case of visual and other perception the form of *jñānalakṣaṇa* relation is ‘*svasaṁyukta-manosaṁyukta-ātmosamaveta-jñāna*’, and in the cases of mental perception (*mānas pratyakṣa*) and metacognition the form of *jñānalakṣaṇa* relation is ‘*svasaṁyukta- ātmosamaveta-jñānaviśayatva*’. – Bhāratīya Darśankoṣa, Vol.-1.

manas²² (*ātma-mano-samyoga*), and the second is the connection between sense organ and manas (*indriya-mano-samyoga*). These two are necessary for the causation of cognition in general. The perceptual cognition resides in the self as its quality with the relation of inherence. Self is free and ubiquitous by nature. The self, being limited by the empirical body, contains cognition. In Nyāya terminology, this limited self is called *śarīrāvacchinna-ātmā*. Like the self, the *manas* and sense organs are also attached to the body, and through the body, the self responds to the world.

2.2.2: Leading toward Action

From the realist position, the Nyāya theory of perception claims that perception is a direct process that does not involve anything as a medium. The perceiver alone can reach the object directly and perceive it as it is. In the process of perception, the role of perceiver's biological form, physical structure, and sociocultural background are quite important. For these elements directly affect the process of perception and its consequential actions. It seems to be accepted by all that there is an intrinsic relation between perception and action. For Nyāya the mode of this relation is causal. An agent's action is decided by the situation, and needs of the person at the moment in which she performs the action. Action is manipulated by the ordinary perception (*laukika pratyakṣa*) and the traces (*saṃskāra*) of previous experiences. But this act of *leading*, *directing*, or *manipulating* is not random, there are rules. To reach the action, however, the

²² In the definition of *manas* Gautama says, *jugapat-jñānānutpattirmanaso liṅgam* (*Nyāya-Sūtra*, 1/1/16). It means, non-causation of different knowledge together is the sign of the existence of manas. According to the Nyāya view manas is a kind of *dravya* or element, which is eternal, formless, and ubiquitous in nature, and atomic in size. It has motion. And besides all these manas is considered as *antaḥkāraṇa* or internal sense-organ (*indriya*). As internal sense-organ manas perceives all of the internal states like pain, pleasure, etc. This last feature of manas is accepted by the entire tradition of theist Indian philosophy including the Nyāya school of philosophy.

Here I consciously used the term 'manas' instead of 'mind' that is usually used in western tradition. For, there are conceptual differences between the two. I just have discussed the meaning of 'manas' in the Nyāya tradition as well as in Indian philosophical tradition. But the meaning of 'mind' is not like so. In western tradition mind is considered as polar opposite matter of the body that essentially contains consciousness.

process includes some more steps. On the basis of the perception of any object a desire (*icchā*) or mere wish (*abhilāṣa*) rise about the object in the mind of the perceiver. If the desire becomes deeper and the perceiver realises that ‘this is the matter to be achieved’ (knowledge of attainability or *kṛtisādhyaṭā jñāna*) and ‘this will fulfil my purpose like before’ (knowledge of conduciveness or *iṣṭasāadhanatā*), then the mental state, called will (*cikīrṣā*) occurs. Following the link of will, if the perceiver realises that the object is not harmful, it will cause no suffering to her, then volition (*prayatna*) to the object occurs. Moreover, for the occurrence of volition the involvement of the knowledge of desirability, etc. in the process of perception is essential. In that case, volition occurs in the form of longing (*pravṛtti*). As a result, the perceiver puts effort (*ceṣṭā*) to achieve the object. The sense that provokes a person to have or to move towards some object, is called in the Nyāya terminology ‘*upādāna buddhi*’ i.e. the knowledge of desirability that intervenes between will and longing for the object. And the object is called ‘*upādeya*’ or desirable. For example, when a thirsty person sees a glass of drinking water in front of her, the knowledge of attainability and conduciveness, along with the knowledge of non-causation (*ajanakatva*) of stronger inconduciveness (*balavat dviṣṭasādhantā*) regarding the water occurs, and as result, she takes initiatives to have it. But if she perceives the water is impotable or undrinkable then despite the presence of a *will*, the stronger knowledge of causation of inconduciveness (*dviṣṭasāadhanatā*) make her avoid the water. For, here, the memory of pain causes repulsion (*nivṛtti*) towards the water. *Hāna buddhi* or the knowledge of undesirability intervenes between the memory of pain and repulsion. Due to the knowledge, *the* water appears as undesirable or as an object to be shunned. Except these two there is one more state that is known as *upekṣā buddhi*. In this state the perceiver remains absolutely indifferent, longing or repulsion nothing occurs in her. In this state the knowledge of attainability, conduciveness, and

inconduciveness stay in a balanced condition, none of them comes forward as a stronger one. So the perceiver does not feel the object as desirable or undesirable. The states of the knowledge of desirability (*upādāna*), undesirability (*hāna*), and being indifferent (*upekṣā*) depend on the perceiver's instantaneous situation, need, mental state, and on the intention of the perceiver – the embodied being. Here the term '*buddhi*' is synonymous to cognition (*jñāna*). In its definition Nyāya says "*sarvavyavahāraheturguṇḥ buddhirjñānam*"²³. That means *buddhi* or cognition is the ground (*hetu*) of all actions (*vyavahāra*). *Anubhava* i.e. awareness and *smṛti* i.e. recollection are two types of cognition, though only awareness treated as *pramā* or true cognition, for we can have it through direct perception. On the other hand, the object of memory at the moment of recollection does not *physically* appear before us. From this perspective, we can translate the term '*anubhava*' as realisation or physical awareness. At the end of this section, we summarise

²³ Annambhatta, *Tarkasaṃgraha*, *Kārikā*-27.

the entire process of perception following this diagram:

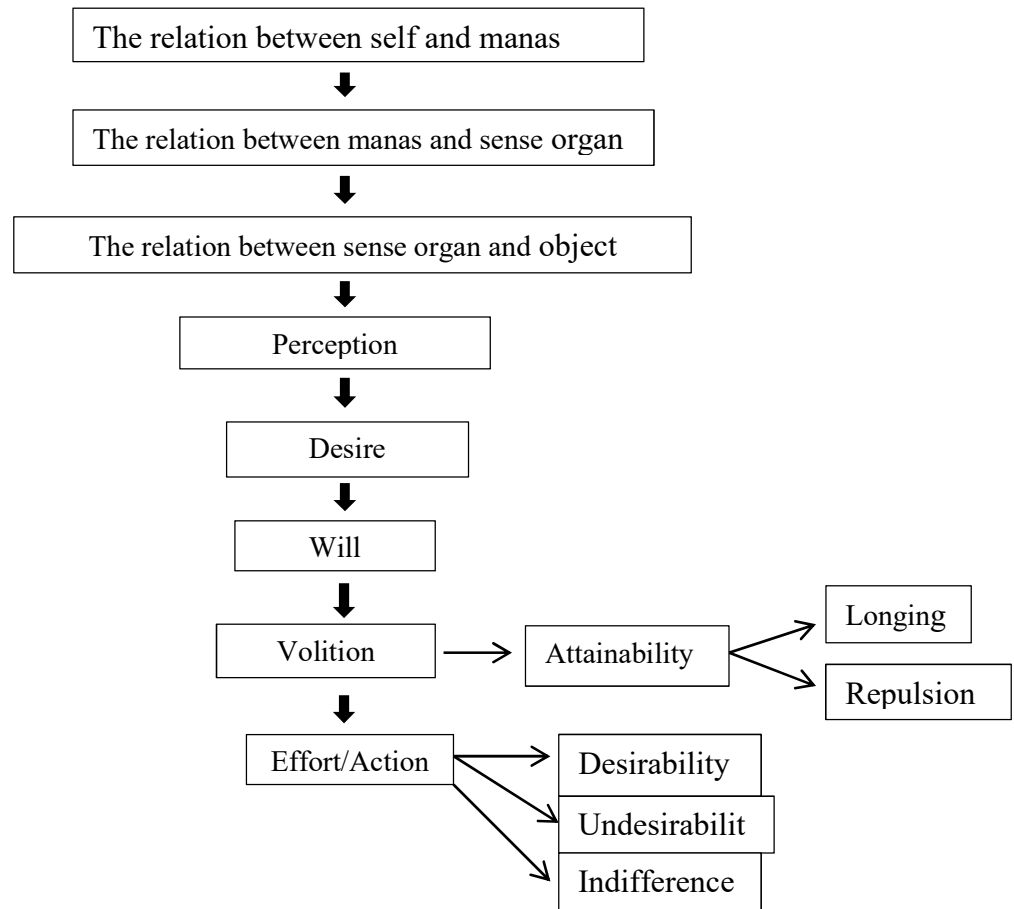


Figure: 3
Diagram of the process of perception following the Nyāya Theory

2.3: Experience: Fitting Nyāya Theory into the Frame of Embodiment

Embodiment is one of the key concepts of phenomenology that refers to the subjective experience of one's own body. This kind of experience is different from the objective experience of a *body* in general, like the experience of material objects like brown table, etc. In subjective experience, a person or the *agent* experiences her own body and its existence as the content of experience. In this course, she experiences *her* own embodied presence. On the basis of our subjective experience, we can say 'I *know* x' or 'I know y'. In the study of phenomenology, this

state or position from where a person acquires the *subjective experience* is called the first-person stance. It means perceiving something or having experience from a person's own standpoint.²⁴

The Nyāya theory of perception can be interpreted with the notion of embodiment. The Nyāya system pays great attention to common sense and experience. Here we will describe embodiment from the perspective of experience. The past experiences of any object or state remain stored in the self in the form of traces, which later work as the background or conditions of the knowledge of desirability, etc. This mechanism does not work in the case of neonatal perception; it is only a matter of mature perception. If the perceiver has never seen an object previously, later the occurrence of the knowledge of desirability, etc. about the very object is near to impossible.²⁵

During perception of a certain object, an individual perceives surroundings, present situation, space or position, where the object is grounded, etc. as constituents of the environment. Although the person consciously perceives only the particular (central) object and remaining other things appear before her as a set, including the background and horizon to highlight the object. And as a result, she experiences the object as grounded on a particular space, in a particular time, instead of as separated from surroundings. With all these, a few more things also get included in the list of her experience, such as whether the object causes pleasure or pain, whether it is an object to achieved or not, and finally, the state of her feeling of *mineness*, the experience at the moment of enjoying pain or pleasure in respect of that very object of perception, and the experience of the status of her own presence or *being there* as the *owner* of the *body* as well as the whole system. These experiences are stored in the self as mental traces. Later on, according to the situation and

²⁴ The matter of *embodiment* and *first person stance* will be explained later with some more details in the fifth chapter of this thesis.

²⁵ Here it is to mention that we generally notice a tendency in young children that they always run or move towards any object in order to grab it and to put it in their mouth. But this cannot be referred as an expression of the knowledge of desirability. For in these type of cases a child does not consider an object as desirable or else, she does not move toward the object being provoked by her volition but she does it being directed by child-nature in general, being driven by mere curiosity.

requirement, those experiences appear, in the form of memory, and take part in the perceptual process as an extraordinary kind of relation, called *jñānalakṣaṇa sannikarṣa*. That is why a mature individual immediately can decide that the object of her present perception is desirable or not, and acts accordingly. The knowledge of desirability does not always repeat itself. According to Nyāya perception is intentional. Thus even if a thing is felt as desirable in a certain mental state and situation, the same thing may appear as undesirable or a matter of indifference, at another point of time, under a different situation. For instance, despite the experience of pure drinking water quenching thirst and making one happy the same water may be the object of indifference to the same person if she is not thirsty under a different situation. Again, if someone is angry and determined to hurt her own self, then she will avoid pure water as undesirable and will try to have any harmful thing like poison as a desirable object. Here the explanation is: the reason behind this kind of behaviour is that the person has quite clear knowledge and experience about the states of pain (*duḥkha*) and pleasure (*sukha*), good (*iṣṭa*) and bad (*aniṣṭa*) as general phenomena. The knowledge and experience provide support to her knowledge of desirability, etc. For that, at the moment of action, she consciously determines an object as to whether it is desirable or not. Although, she determines the status of the object according to her instantaneous surroundings, mental states, personal need(s), etc. In such moment the whole operation is directed by her intention. As a result, the poison that is generally taken as undesirable by normal people, a disturbed or depressed minded person, at a point of time, may find it as deeply desirable and good for her own.

2.3.1: Nyāya-Realism—a Methodology to Know the World

Nyāya realism is based on a cognitive ground. Gautama in the *Nyāya-Sūtra* has talked about sixteen positive categories (*bhāva padārtha*)²⁶; among all the sixteen categories, the second category *prameya* and its related account represent Nyāya ontology. In the classification of *prameya*²⁷ Gautama mentioned twelve categories which maybe called ‘ontological categories’. The true knowledge of these twelve categories takes one to the path of salvation or *mokṣa*. Now here it is to note that all the twelve ontological categories, from self (*ātmā*) to salvation (*apavarga*), are intrinsically related with the *existence* of a human being, which is referred by the second ontological category called body (*śarīra*). The remaining fifteen positive categories, apart from the object of knowledge (*prameya*), may be considered as a methodology of apprehension of the nature of reality. These fifteen positive categories are: means of knowledge (*pramāṇa*), doubt (*saṁśya*), purpose (*prayojana*), example (*dr̥ṣṭānta*), tenet (*sidhānta*), syllogism (*avayava*), confutation (*tarka*), ascertainment (*nirṇaya*), discussion (*vāda*), wrangling (*jalpa*), cavil (*vitandā*), quibble (*chala*), futility (*jāti*), fallacious reason (*hetvābhāsa*), and an occasion for rebuke (*nigrahasthāna*), respectively. Each of these fifteen is independent methods that sequentially, like steps of a staircase, take one to the threshold of acquiring true cognition. The knowledge or awareness of every single step of it in the form of experience helps one to learn the skill to achieve the true cognition (*tatvajñāna*) that in turn helps to reach the goal of salvation. It should be noted that, among the fifteen steps or methods wrangling, cavil, quibble, futility, and fallacious reason should not be counted as constitutive to the methodology of apprehension of the nature of reality in true sense. For these five methods do not work in the same manner as other

²⁶ “*Pramāṇa-prameya-saṁśaya-prayojana-dr̥ṣṭānta-sidhānta-avayava-tarka-nirṇaya-vāda-jalpa-vitandā-hetvābhāsa-chala-jāti-nigrahasthānānām tatvajñānānīḥśreyasādhigamaḥ.*” –*Nyāya-Sūtra*, 1/1/1.

²⁷ “*Ātma-śarīrendriyārtha-buddhi-manaḥ-pravṛtti-doṣa-pretyabhāva-fala-duḥkhāpavargāstu prameyaṃ.* – *Nyāya-Sūtra*, 1/1/9.

eleven do. The follower of any of these method(s) aims only to defeat her opponent. For that, she may apply bad, erroneous, or false argument. During the exchange of argument in wrangling, etc. she consciously does not care about the deformation of truth; she only aims to win over the opponent. Therefore, it is better to keep these five aside from the main methodology. However, one can ask, despite the fact, what is the reason behind counting wrangling, etc. as parts of the methodology? It is true that the establishment of truth is not the concern of the followers of wrangling, etc. but despite that these five methods are important. Along with the knowledge of eleven constitutive methods that are associated with the process of arguing for reality or truth, one must have knowledge about these five methods. One must have the awareness about nature and style of dialogues or argument forms that she can distinguish the method of discussion from mere wrangling and others. Proper knowledge about wrangling, cavil, quibble, futility helps a person to gain consciousness about the pseudo arguments. On the other hand, by the proper knowledge of the method of fallacious reason and its different types, one can be aware of the form of pseudo ground (*duṣṭa-hetu*) of a hypothesis. This knowledge helps a person to verify the ground of any hypothesis before arguing for it to prove or establish it and its ground theory. Therefore, it can be said that it is quite justified to consider each of the fifteen methods (following the given sequence) as essential constitutive of the complete methodology of apprehension of the nature of reality. A person who is looking for the true cognition must have a clear knowledge of the entire methodology including both positive and negative steps that she can verify the ground as non-erroneous before proceeding further. The true cognition of ontological categories gradually makes a human being's faculty of intellect so mature that she can recognise the meaning and importance of salvation and wish to achieve it willingly. Each of the ontological categories is recognised as a matter of cognition (*tatva*) only after going through

every step of the methodology of apprehension of the nature of reality. As a result of going across every step, a human being earns experiences that let her recognise and achieve the true cognition. We can see, however, that achieving true cognition is such an event that occurs depending on the existence of the physical body of the human being, and in this event, the human being experiences the world along with the realisation of being embodied. That is why after crossing required steps she *re-cognises* (*anuvyavasāya*) the achieved cognition as ‘I know’ (*aham jānāmi*). The realisation of this ‘I’ (*aham*) is never disembodied; it is the *owner* of the body as well as the cognition, emotion, etc. This embodied ‘I’ is inseparable from the true cognition and the process to achieve it.

2.3.2: The Nyāya Theory of Body

To define *body* Gautama says “*ceṣṭendriyārthāśrayaḥ śarīraṁ*” (*Nyāyasūtra*: 1/1/11). That means the body is the base (*āśraya*) of effort (*ceṣṭā*), sense organ (*indriya*), and pleasure and pain (*artha*). From this point of view, we can relate the Nyāya theory of perception, broadly, with another relevant aspect of the concept of embodiment, according to which our cognition and experiences have a physical substrate or embodied appearance. This sense further can be explored through the explanation of three contents of the body.

The Nyāya concept of *effort* that is the first content of the body can be well explained in terms of voluntary action. An embodied being to obtain an object of desire or to avoid an undesirable object performs the voluntary action (Bhattacharyya, 1988: 186). The dynamic coupling of agent-environment plays a significant role in the process of the occurrence of voluntary action. It affects the perception as well as the behaviour of an individual. Here along with the external elements like the present situation, the physical structure of the individual and her perceptual

mechanism, i.e., sensorimotor system, contribute to her activity. Although it is quite tough to find out any evidence regarding sensorimotor action or similar issues, in the Nyāya theory of cognition, but it can be tried to explain the role of sensorimotor activity in terms of the very concept of the connection between tactile sense organ and *manas* (*tanmanosaṁyoga*), which is one of the essential causes of perception. In fact, the matter can be described as the mutual activity of the connection between self and *manas* (*ātma-mano-saṁyoga*), the connection between tactile sense organ and *manas* (*tvaṇmanosaṁyoga*), the connection between sense organ and *manas* (*indriya-mano-saṁyoga*), and the connection between sense organ and object (*indriya-viṣaya-saṁyoga*)²⁸. It is to mention in short, according to Nyāya, the waking state

²⁸ This description is not wrong but here one question may rise quite obviously that is: according to the Nyāya account *manas* is atomic, movable. It is supposed/bound to be connected (*saṁyukta*) with only one thing (*viṣaya*) at one moment. The connection (*saṁyoga*) between sense organ and *manas* refers to the fact that during the process of any particular perception our *manas* get connected only with the relevant sense organ instead with all five of them. For atomic *manas* cannot be connected with more than one sense organ in order to generate cognition. This feature is the sign of *manas*. According to *Nyāya-Sūtra*, “*yugapad jñānānutpattiḥ manasoliṅgaṁ*” (1/1/16). If it is true then how is it possible that the *manas*, during the perceptual process in general, simultaneously stays connected with three things, the self (*ātmā*), the tactile sense organ (*tvak*), and the particular sense organ, which is prim for that particular perception at that particular moment? To answer this question following the Nyāya account we can attempt to say this way: it is true that non-occurrence of more than one cognition simultaneously is the definition of *manas*, and for that the occurred cognition is called visual, auditory, gustatory, olfactory, or tactile. But the fact of nonoccurrence of two or more cognition simultaneously does not indicate that *manas* simultaneously, at a particular moment cannot gets/stays connected with more than one thing. The *manas* of a person, at her awaked state, always stays connected with herself and tactile sense and at different times the *manas* gets connected with different sense organs. Apart from this later type of connection, the former two types are accepted as the general causes for cognition and action in general. Therefore, there is no problem in accepting many connections for *manas*. Moreover, according to Nyāya, ‘*saṁyoga*’ (i.e. connection) by nature is non-pervading (*avyāpyavṛtti*). It means, the *saṁyoga* or connection of any object does not pervade all over the object rather it is limited only at its own location. Naiyāyika, in the definition of the faculty of non-pervasion says that “*Svātyantābhāvasāmānādhikaraṇyaṁ avyāpyavṛttitvaṁ*” [Bharatiya Darsan Kosa (vol.1) : 33]. It means, which shares a common locus with its own absence in that very locus. After the Naiyāyika we can add that, being a quality (*guṇa*) connection does not depend on part or *avayava* of any object in order to be caused. In fact, the object (i.e. *dravya*) is the inherent cause (*samavāya karaṇa*) of that connection. Connection is, in fact/ indeed, determined by particular space (*digviśeṣāvaccinna*), because it occurs in/at a particular portion (*dik*) of object. This factor of being determined by particular space is the main reason of the non-pervasion of the connection. Therefore, the connection definitely can occur in any formless, atom as well as in mans. In fact, following the argument, there should be no problem/objection in occurrence of many simultaneous connections for any atom or mind. For, the argument is, every connection is separated from each other. Each connection, as a single unit, gets determined by that particular space, where it occurs. Therefore, on the basis of this

(*jāgrat*) and the state of deep dreamless sleep (*suṣupti*) are two extreme opposite states of the self. However, consciousness is the quality of the self; only in the waking state, the self possesses consciousness. In the state of deep dreamless sleep, the self remains separated from consciousness. In the waking state, the self is connected to the *manas* (*ātma-mano-saṁyoga*), which makes the self-consciousness possible. This consciousness is internal; by no means, the perceiver (*the body*) can sense or realise it. At the next step, the *manas* gets connected to the sense organ of touch (*tvaṇmanosaṁyoga*) that makes the perceiver conscious about her body, the substratum of 'I'. All the five external sense organs, the visual, auditory, olfactory, gustatory, and the tactile, are placed in the body, and for that, through the body, the consciousness reaches to the sense organs too. But at the time of perception (here visual perception), the *manas* gets related particularly to the respective sense organ (*mano-indriya-saṁyoga*). And finally, the relation between the sense organ that is attached with the *manas* (*manosaṁyukta indriya*) and the object causes perception or perceptual cognition that resides in the self as its quality. The gist is that the body, which is materially made of muscles, sense organs, etc., works as a mechanical system. Its mobility and other activities are operated by the sensory mechanism of the embodied being that in turn is operated by the elements like environment, etc. of that being. Another fact is that our perception not only depends on, but is constituted by, our *ownership* over the sensorimotor knowledge, and the ability to keep track of our relation to the environment around us.

The actions of an embodied being depend on the capability and condition of her sense organs. Every sense organ possesses a unique sensory quality. That is why they function in different ways of grasping their respective objects. For the action of grasping objects, the perceiver's

argument the fact of simultaneous role of four connections, in order to process or cause perception, can be justified properly. We are compelled to limit our discussion here, for it is not the main concern of this chapter.

surrounding environment, her biological or physical structure, etc. make an embodied being choose the relevant object. By the expression ‘sense organ’ or ‘sense’ we usually refer to some body-parts like eye, nose, ear, etc. But, it is to note that these *body parts* are mere motor systems that operate our sensory systems like the visual, olfactory, or the auditory system. Senses or sensory systems are, indeed, quite subtle in comparison to the motor system. The Nyāya theory accepts that sense organs “are suprasensible objects, which can only be inferred from their function” (Bhattacharyya, 1988: 193).

The *sense organ* is considered as the second ground or sign that refers to the existence of the *body*. According to the Nyāya philosophy, sense organs are described as physical (*bhautika*) that can grasp the object directly to perceive it. The act of *grasping* an object, being related with that very object, is known as the faculty of graspability i.e. *prāpyakāritva*. It is an essential feature (*dharma*) of sense organs in general.²⁹ For the occurrence of this act the relation i.e. *sannikarṣa*, between sense organ and object is necessary. According to the Nyāya description, our sense organs do not grasp any random objects but only that kind of objects, which exclusively share a certain type of atom with the sense organs as their fundamental, constitutive element. Every single sense organ has its own type of object(s). For example, the visual sense organ is able to perceive only the objects that contain the atom of fire (*tejah*) as their constitutive element and

²⁹ This fact of the faculty of graspability is not applicable for *manas* i.e. considered as internal sense organ by Naiyāyikas. Buddhists, as opponent of the Nyāya system, argue that on which ground Naiyāyikas recognise external sense organs as having the ability to grasp material objects/such an device to grasp material objects (*prāpyakārī*), on the same ground *manas* should be counted as the device to grasp objects. For it grasps the self i.e. internal object (*dravya*). In the explanation of the argument of ancient Naiyāyika Bhāsarvajña Svāmī Yogīndrānanda says that the claim of Buddhists is not logical, because it involves a kind of fallacy that occurs by attempt to prove something, which is already proved (*sidhhasādhana*). For, for in the awaken state (*jagrata*) *manas* always inseparably stays with the self, only in the state of deep sleep (*suṣupti*) *manas* enters in the *puṭitat naḍī* and stays there for the entire period of *deep sleep*. Therefore, there is no point to mention separately about the act of grasping of self by the *manas*. (*Nyāyabhūṣaṇam*: 97)

have some colour (*rūpa*). For, the visual sense organ, being fire-element (*taijasa padārtha*), is able to perceive only the colour (*rūpa*) of the objects.

Gautama describes sense organs, as having the graspability (*prāpyakāritva*), are used as tools to grasp objects immediately. Our sense organs can grasp the objects of nearer distance like a grain of sand as well as far-situated objects like a big mountain. Again, the sense organs have the ability to perceive more than one object together, situated in different distances, but of course in the same direction and within the range of vision. As an example, we can talk about the perception of the moon through the gap(s) of a tree brunches. In this case, we directly perceive the tree brunches (i.e. near to us) and the moon (i.e. so far from us) together instead of separately.³⁰ At this point, it is necessary to mention that the method of grasping objects is not the same for every sense organ. In the case of gustatory, olfactory, and tactile perception, objects directly get connected (*samśliṣṭa*) with the organs, as objects come closer to these sense organs and are grasped, and as result perception occurs. But the method of visual perception (and auditory perception) is different.

Practically, as we know that for visual perception no object ever gets related to the eyeball, it is impossible. The objects of visual perception always stay at distance. Then how does the perception occurs? Here let's remind the description of the method of graspability that objects do not come by themselves, randomly or in an ordered manner, to be grasped by the sense organs, instead, sense organs directly grasp objects following the perceiver's intention. According to the Nyāya account the visual sense organ of a living being, in general, possesses a kind of ray that is physical (*bhautika*) in nature, like the ray of a lamp (*pradīpa*). Again, like the ray of the lamp,

³⁰ Though in this type of perception there are temporal hierarchy, our visual sense organ perceives nearer objects first and then far-situated objects, but the process occurs so fast to register the temporal *immediate*-hierarchy.

the ray of visual sense organ manifests objects of perception to grasp them. But the nature of the ray varies from species to species following the fate of the individual (*adṛṣṭa*). In the case of a human being, this ray has no colour (*anudbhūtarūpa*) or touch (*anudbhūtasparśa*), and for that, the ray always remains beyond experience³¹. Therefore for perception, human perceivers need the assistance of external rays like sunray, the ray of the lamp, etc. At the moment of visual perception, the ray comes out from the eye and gets related to the object to grasp it. The ray, as we said, comes out from a human being's visual sense organ is imperceptible, unlike a cat. For, it has no colour, it is unmanifested (*anudbhūta* and *aprakāśa*). But it does not mean that unmanifested ray cannot manifest other objects. The ray of visual sense organ manifests objects being associated with sunray or the ray of the lamp, etc. But it is never possible to separate the two kinds of rays from each other as they are merged together. For example, it is impossible to segregate the rays of five lamps when they blink together.

It is a fact, accepted by all that the truthfulness (*yāthārtha*) of perceptual cognition depends, from many aspects, on the structure and ability (vision power) of a sense organ. As an example we can say, the perceptual ability of a one-eyed person or a person with poor vision is less than that of a person with normal vision. For a clear and pure perception and even for the perpetuation of the perceptual process the role of the body of the perceiver is quite important and significant. It is to mention here in brief that the phrase 'perceptual processes' indicates to those functions in which we take part in being motivated by volition or reflexively. On the other hand, these kinds of activities operate our behaviour toward something or somebody. Here, by the word 'body' one should not understand only the integument or external appearance of a being, but she should take

³¹ In the case of the night creatures like owl, etc. the ray is self manifesting (*udbhūta-rūpa*) that they do not need any external support, like the ray of lamp, etc., to perceive objects in the dark. On the other hand, in the cases of the animals like cat, dog, etc. the ray is self manifesting as well as perceptible (*pratyakṣajogya*).

it as the base of some factors like emotions, experiences, self-understanding, etc. that make the person feel as embodied, as the 'I'. Since all these matters or activities occur around the body, hence we may interpret the term 'śarīra' as such that it simultaneously refers to the physical and embodied existence of the human body.

In the description of the third content, it is to say, the body is the ground of *pleasure* and *pain*. Pleasure and pain are the qualities of the self. These are objects of perception. Though an individual perceives her own pain and pleasure by introspection, these are expressed through her body postures or facial expression. In the context, we can talk about two more qualities, desire (*icchā*) and aversion (*dveṣa*) those are shaped by pleasure and pain respectively. Pleasure, pain, desire, and aversion are indeed four generic headings, under which emotions are categorised. During perception, perceiver's knowledge of desire, etc. get influenced and directed by emotions. Emotions do not directly affect the knowledge of desires. In the disguise of pleasure, etc. emotions affect the perceiver's intention as well as intentionality that in turn affect or direct the knowledge of desirability, etc. In these cases, intention becomes the object of emotion. J. Ganeri says "Emotions are felt motivational tendencies to form and sustain congruences with objects or states appraised as beneficial (*hita*), and to avoid or break congruences with objects or states appraised as harmful (*ahita*)" (2012: 276). According to Praśastapāda, pleasure is a *felt* tendency that motivates one to build congruence with the object of gratification like garland, which, she feels (perceives), as the object to be attained (*iṣṭa*) like past cases. This emotion, in turn, grounds another *felt* motivational tendency that is desire. Desire is a state of yearning or longing for the favourable object of present or past experience. Again, the anticipation ("anāsanna-kriyecchā samkalpa"—Praśastapādabhaṣyam 2/43: 431) for future pleasure also causes desire. On the other hand, pain is a kind of *felt* tendency that motivates the embodied

being to avoid the object that appraised as unfavourable or harmful. Pain and its consequential memories shape the emotion called aversion. The tendency of aversion motivates one to avoid establishing the correspondence with the object of pain or irritation.

2.4: Conclusion

As we mentioned that nowhere in the Nyāya philosophy the term embodiment or anything regarding the concept has been addressed clearly. But there is a clear indication of the concept of embodiment throughout the discussion of the Nyāya theory of perception. Almost all of the arguments that involve the role of an individual as the cogniser (*pramātā*) or doer (*kartā*), refers to that person as an embodied being, as an agent. The purposive actions of an agent like talking, moving, thinking, silent gestures, etc. are dependent on her perception and experiences. Here, the word ‘perception’ refers to the process as well as the self-understanding³². The faculty of self-understanding provides an individual authority or *ownership*, which is, latter, recognised and expressed as ego (*aḥmkāra/mamatva-bodha*), though, *self-understanding* is some more subtle factor than *ego*. According to the Nyāya account, perception causes an action (*kriyā*). Following the Nyāya terminology, we may recognise the action as *vyavahāra* that is grounded on cognition. Here, by the term ‘*vyavahāra*’ we consider only that kind of action, which involves the agency or

³² I did not mention ‘object of perception’ as one of the meanings of ‘perception’, but that does not mean that *object* is excluded here. It is just remained unuttered. In a broad sense, the meaning ‘process’ invariably includes ‘object’, in it. As we know that perceptual process begins with the relation between the sense organ and its relative object. In this sense, the object as related with its relevant sense organ (*indriya-sannikṛṣṭa viṣaya*) is known as perception.

The term *utpannam*, from the main definition of perception, which means production, refers to the sense organ and its relative object both as the producer of perception. Again, each perception of a certain category like visual perception is differs from other perception of that same category, on the basis of the form of object. For this reason the perception of a pot is different from the perception of a cloth and so on (*Nyāyamañjarī*: 267).

authority (*kartṛtva*) of the agent (*kartā*), like cooking, pottery, weaving, etc.³³, which is the outcome of the perceptual process.

Action in its every form requires conscious involvement or participation of the agent (*kartā*) not like a zombie, robot, or slave but as a free embodied authority who is the *owner* of all of her activities, intention, emotion, words, and of course of her body. Here we need to add some lines for the sake of discussion. Individual authority and ownership are not the same. *Individual authority* is better to understand as the state of the agency. In a broad sense, agency and ownership are nothing but different types of mental states, which share a few common features. But of course, there are clear differences as well. The experience of agency, no doubt, is a phenomenological matter; it is a simple state of awareness about the agent's (active individual's) own experience or involvement. According to M. Tsakiris *et.al.*, "it could be simply a matter of a very brief and minimal awareness of initiating and performing a voluntary movement or causing a certain effect in the world..." (2007: 646)

On the other hand, the sense of *ownership* is also a phenomenological matter. It is experienced by a person in her own involuntary movement. In the involuntary movement, a subject's role is passive, for it is not caused by her. In this case, she realises her *movement* as 'I am moving due to my *body* movement; therefore, it is *my* movement'. Although during the body movement, caused by the agent's intentional or reflex action, the agent feels 'it is my movement'. But in this case of voluntary movement, the sense of agency overlaps the sense of ownership. The agent perceives the movement as 'I am moving because I am doing some action by myself' like I am running to catch the bus or I am stretching my hand to grab the bag, etc. But this does not occur

³³ The term 'vyavahāra' also refers to the use of language like our everyday conversation, naming any object, etc., but in this context it is not our concern.

in the case of involuntary movement; the agent does not experience the same sense of agency for such movement, because she has the awareness that “it is not I who caused it” (M. Tsakiris *et.al.*, 2007: 646).

The sense of agency and the sense of ownership both are found in two forms, in two types of cases. In the cases of the first-order experience and the cases of the higher-order consciousness. The first order of experience is an immediate and pre-reflective state. It is the primary state, on the basis of which the experience becomes reflective and gets registered in the mind of the agent or owner (the *subject*) through the process of introspection. At the level of the pre-reflective state, the agent or the owner (both in the cases of voluntary and involuntary actions) experiences her movement as ‘I am moving’. Later, at the state of higher-order consciousness i.e. reflective state, she owns the ability to differentiate between the sense of agency and the sense of ownership. Following the senses, she can recognise herself either as the *author* of that movement or as the *owner* of it.

M. Tsakiris, *et.al.* describes these phenomenological states as states of attribution. The act of attribution is preceded by introspection. In both of the states, the subject has sufficient awareness that she can identify her role and can report or describe her experience about the reason or mode of body-movement. According to the description if a person or subject is asked about her role and experience during a certain voluntary action or movement then she would *attribute* her sense of agency or authority on to her experiencing-self (or on her status of experiencing agency) and would answer that ‘I am the cause or *author* of my own movement’. On the other hand, if she is asked to explain the same for her involuntary action or movement then she would *attribute* her subjectivity on her experiencing-self and would say, (though I am not causing my own

movement deliberately but) since *my* body is moving, it is *my* movement; I am the *owner* of the entire experience and its related action.

In a broad sense, we can say that the sense of agency gets merged with the sense of ownership at the stage of higher-order consciousness, which may be defined as the stage of the *sense of mineness*. At this stage the agent introspects herself as the owner of her body, body-movement, and all of the experiences related to the movement or action; and recognises each of these matters as ‘mine’. It happens because the sense of agency implies the sense of ownership (but not vice versa). Therefore, we proceed with this wider sense of ‘ownership’ that includes both agency and mineness. From the perspective of the Nyāya philosophy, we can say that the self owns, being a mental state, the sense of ownership (including the senses of agency and mineness); the self is the locus (*ādhāra*) of it. Being placed in the self a mental state essentially depends upon the body. This dependence is metaphysical. The body is the base (*āśraya*) of the self; it is the base of the individuating experience of the self. A well-formed combination of ownership and individuation provides a human being the awareness of being embodied.

From the standpoint of the Nyāya system, we can interpret the meaning of the term ‘agent’ or ‘the active subject’, as *kartā* and the state of *ownership* as *kartṛtva*. But the second interpretation is not applicable everywhere. According to the Nyāya context, *kartṛtva* is such a state that contains will and volition of an active agent. This state essentially possesses three components called the direct cognition of desirability, will, and attainability regarding any object or event. But always, during every action, the will or volition does not occur in the subject, though in that case also she possesses the ownership. In the cases of voluntary actions, the state of ownership of a subject possesses volition, etc. Therefore, in these cases, the state of ownership may be interpreted as *kartṛtva*. But in the cases of involuntary actions the volition, etc. remain absent in

the state of ownership; therefore in these cases, the same interpretation is not applicable. This conditional application of the term '*kartrtva*' as the interpretation of 'ownership' is true for the states of perception or perceptual cognition. Though perception occurs as the result of a direct relation between the visual sense organ and object, still it would be wrong to claim that all perception involves perceiver's volition, etc. or the perceiver always involves in the act of perception, being provoked by volition and attainability. Sometimes despite the direct relation between the visual sense organ and the object no perception occurs. For, at that moment the *manas* of the perceiver remains connected with something else, instead of the visual sense organ. This kind of state may be called the state of null-perception or empty vision. Usually, this happens when a person is plunged in some deep thought or she is in some kind of mental shock. Again, we can take the example of some cases, in which a person has a random vision of something with a steady body-posture or by turning her head around, from the inside of an enclosed place like a room or any open place like a field. This type of perception does not include the perceiver's desire or will. At any random moment of relaxing or having leisure, a person may have a conscious but indifferent view of something. She may have nothing specific to perceive. As a result of her random staring of the surrounding environment, various objects inevitably appear before her and directly get related to her visual sense organ. Unlike the previous example, in this case, her *manas* remains connected with her visual sense organ and she has no *null-vision*; therefore, perception occurs. However, in this case, on the basis of the fact of occurrence of perception, it cannot be said that the perceiver is the *agent* of this perception, though she has the *ownership* of it. For, there is no intention; she does not perceive anything being influenced by her desire. Even this act lacks the subject's will and realisation of attainability for the object(s) of perception.

Generally, it seems that our physical activities or actions are mechanical, which in fact, is not the case. These actions are not random responses or reactions towards the world but are programmed in a situated³⁴ sequential manner. We, by ourselves, control and operate this program, though we have partial awareness of our role. Major, important, and critical operations remain outside of our awareness, but not outside of consciousness. We are only aware of the actions like we perceive this pot or that glass of water, etc. We are also aware of those actions, in which we desire to move forward and grab the pot, or we reject the glass of impotable water and throw it away, etc. But how the perception of the pot, etc. occurred and what makes us behave that way—that mechanism remains out of our reach. We cannot experience those functions to occur, but there is no scope to deny the occurrences of those. We may define the nature of these functions as metaphysical that involves various phenomenal elements like intentions, emotions, subjective understanding, morals and values, etc. Phenomenal elements are constitutive of the human body; the self is the place of them. We know about their existence and activities through introspection in our own cases. But in the cases of others, we perceive them through their bodily expressions. The phenomenal elements determine different types of mental status like cognitive, agentive, or evaluative. These statuses get registered by our awareness because every status appears in our awareness being associated with the ownership. Therefore, the experiences, we acquire through these states, are recognised and addressed by us as *my experiences*. The experience itself is a phenomenal matter; it makes us feel (latently) '*I am an embodied being*', though this feeling remains unrecognised for many people (it is a different issue; not related to our present concern). Cognitive, etc. mental statuses are categorically common but from the perspective of manifestation, they are unique to every individual. It means every individual has a different and

³⁴ Here the use of the term 'situated' refers to the term 'program', in order to separate it from robotic or computational program, which runs following some certain mathematical and logical algorithm(s).

unique experience of *owning* these mental statuses because the degrees of manifestation of those statuses are dependent on the richness of perceptual cognition and experience. Therefore, it can be said that perception and embodiment are interdependent to each other from conceptual and practical both aspects.

Gregory's Constructivism: A theory of Indirect Perception

This chapter contains an elaborated discussion on indirect perception. One may find the title of this chapter odd in respect of the main title of the thesis. One might be curious about the relevance of this chapter after discussing two theories of direct perception in the previous two chapters. For now, concisely, it can be said that the intention behind this chapter is to uphold the importance and significance of the direct theories of perception, indirectly. As it is known, in order to support or pursue some thesis we need to have plenty of knowledge about its strengths and weaknesses, its logical approach, and arguments to support it. For that one should go through the arguments of the main antithesis. Hence, one should have some idea about the primary opponent's attitude toward the thesis.

Unlike the direct perceptual theorists the supporters of the indirect thesis, together, claim that the process of perception is purely indirect; it is not possible in any way to *see* the external world or object without the intervention of some mediating factor. However, they differ in the nature of the *mediating factor*. For example, some of them accept that sense-data are the mediating factor, while some others argue for representations as to the mediating factor¹. The basic argument of these theories is whatever directly encounters our sense organs are sense-data, representations, or some mediating factors. Each theory has its own arguments to establish its own position. Indirect

¹ The referent of the term 'mediation' differs theory to theory, school to school. For example, we can mention some of them. As Bertrand Russell (1912), George Edward Moore (1962) named the mediation as *the sense-data*, John Locke (1689) called it as *the ideas of senses*, Berkeley (1709) called it *the idea*, Hume (1748) called it *the impressions*, Hermann von Helmholtz called it *the unconscious inference*, Jerry Fodor, Andy Clark called it *the representation*, etc. (Paul Edwards: Encyclopedia of Philosophy)

perceptual approach, like a big umbrella, shelters various categories of perceptual theories like sense-data theory, representationalism, computationalism, and various forms of constructivism, and indirect realism of many forms. Though the salient features, including their arguments, the nature of the mediating factor, etc. of these theories are remarkably different from each other, the common thing is that they all argue for the indirectness of perception and reject the direct approach.

In this chapter, we shall have a detailed vision of indirect perception and its mechanism following Richard Langton Gregory (1923-2010). Now, one may ask, why to take Gregory's view in consideration among several options? The answer to the question is: the aim of this chapter is not just to refute direct perception in any way and to prove the sole supremacy of indirect perception. But here our intention is to see on which grounds indirect theories of perception (in general) are always ready to cut down the direct perceptual theories (in general) and how they do that. Apart from that, we want to see whether the Gregorian processes of perception can explain the notion of embodied perception over the process of direct perception, especially the Gibsonian view or not.

Gregory is such an eminent theorist who is quite aware of the direct approach as a whole, especially about Gibson's orientation, his claims, and arguments. For this chapter, on behalf of the theories of information processing approach, as a whole, we are selecting to talk about Gregory's constructivist theory of perception because it covers the core mechanism of the information processing approach, quite clearly. Apart from that, Gregory's theory has a rich influence of the traditions of Hermann von Helmholtz (1821-1894), who is famously considered as the pioneer of the indirect approach about visual perception in general. Therefore, following his theory, we can find the main arguments that we are intended to focus on to build up an

antithesis or anti-position of the Gibson as well as the direct visual perceptual approach. However, before entering into the main discussion we may have a concise talk about the Helmholtz's view to have an idea or the root of the tradition of the information processing theories.

Helmholtz was a German physician. Contemporary theories of mind and perceptual psychology consider Helmholtz's statement, visual perception is mediated by unconscious inferences (1925) as a paradigm statement of the theory of visual perception. Helmholtz maintains that the cognitive mechanism of the process of visual perception is similar to the process of inductive inference in science or in ordinary reasoning. Among the followers of Helmholtz some theorists like Gregory (1972), Barlow (1990), among others, believe that perception is truly mediated by inference or reasoning. Stephen E. Palmer in the foreword of Irvin Rock's edited book *Indirect Perception* (1996) describes the Helmholtzian view as the inferential approach. According to the inferential approach, perception is fundamentally a thought-like process. In fact, all the theories that belong to the tradition of indirect perception support the Helmholtzian inferential approach. According to Helmholtz, direct perception of external objects as they are, is not possible. The entire process of perception always remains out of the reach of our awareness. All we have directly are the nervous stimuli, though we are not aware of this fact. The process of perception initiates through the falling of (physical) light in the eyes of the perceiver. This light contains the spatio-temporal patterns of objects. People see those patterns as objects.

According to Helmholtz (1925), people always imagine that the objects are present there in the field of vision for creating the exact same impression on their nervous mechanism. Moreover, he says, as the eyeball is mechanically stimulated we imagine that we see an appearance of light in front of us. In order to stimulate the retina the light coming from outside, has to enter the eye

from the direction of the bridge of the nose. By the strength of the sensations aroused by light in the nervous mechanism of vision, we become able to form conceptions as to the existence, form, and position of external objects. These ideas are called visual perceptions. The process for perceiving, about what we are unconscious, involves some psychic activities that lead us to infer that there in front of us at a certain place there is a certain object of a certain character. As a result of the process, we get a conclusion (i.e. perception) that enables us to form an idea as the possible cause of this action. Although, it is an invariable fact that the nervous stimuli are the actions, which cause perception. In fact, the stimuli are only things that are perceived directly, instead of the external objects themselves.

3.1: Gregory

As a successor of Helmholtz, Richard Gregory supports the famous argument of unconscious inference quite boldly, but he describes the perceptual process in a little different way, as construction. On the basis of the root of unconscious inferncial mechanism Gregory says that perception is nothing but a mode of hypotheses. He claims that this process of perception is similar to scientific reasoning. But he is quite aware that there is no scientific or established account in support of the claim that perceptual hypotheses are similar to the scientific hypotheses. For that, he reformulates the claim and says that we can consider the fact this way that perceptual hypotheses provide structure to truth or reality that we receive through our sense organ in the form of sense-data. The data that we receive through our sense organ is limited; it contains incomplete information about the object. At this point, it is to note that as an indirect realist Gregory accepts that sense organs never perceive any object directly, but the sensory information or sense-data reach to the perceiver's brain following the nervous pathways, which are connected to that respective sense organs. In the brain, the incomplete data are processed by

the intervention of the brain itself. In this process, the brain fills up the data-gaps by borrowing compatible and consistent (preserved) data from the memory-bank and as the outcome of the process, we perceive the whole object and behave towards it accordingly. This method of processing is called by Gregory, construction. This *construction* is nothing but an inferential process, which is based on the inductive method. This process remains beyond the consciousness of perceiver. Now, what happens in this process? If we try to see the process from the temporal aspect then we may say that in this process depending on the familiar and known situations of past experience, which are now stored in the brain in the form of memory, the inference of new and unfamiliar situations occurs. To reach this new situation no data or information is available to us (means, to the brain) as the past situations already remain present in the form of stored data in the memory bank or the present situation remains present in the form of sensory information that reaches to the brain following the nervous pathways. In a sense, we can say, our brain extrapolates behaviour or action for new and immediate future situations, is the construction; it is a sort of invention. Now one may doubt about the requirement of the extrapolation. As we know that extrapolation is a method of inferring some hypothetical situation based on known facts. The fact is that, sometimes the perceptual hypotheses are not so predictive or predictive at all. It happens in the cases of unknown or unrecognisable situations. In these kinds of situations, when no datum from the memory bank works to bridge the gaps between continually entering data, then the perceiver or her brain extrats the outcome of the information processing using the method of extrapolation. Gregory believes that by nature cognitions are subjective, it varies person to person. Therefore, he is so interested to know about the state or condition of the observers when they perceive or acquire learning. Before entering the discussion of hypotheses

in the next section let us have an idea about learning in perception that indeed, according to Gregory, gives direction and shape to perception.

3.2: Perception is Learning

How do we know the world? How do we see? — This is an over-discussed and famous issue in philosophy and psychology. The interesting thing is in both the discipline it is accepted that we know the world through perception. This question divides the philosophers in terms of metaphysical and empirical. As it is known that metaphysicians claim that knowledge about, the world can come apart from sensory experiences. On the other hand, empiricists strictly claim knowledge depends on observation and measurement (Gregory, 1978). Empiricists say that since knowledge comes from the sense experiences there remains at least one chance (always) open for being wrong or erroneous. In other words, sensory knowledge is contingent. From Gregory's accounts, it reflects that he trusts the arguments of psychology, especially experimental psychologists' accounts. Simultaneously, we also can see a tendency in him to refute or overlook the philosophical standpoints about perception. Regarding this issue, Gregory takes an empirical stand but his approach is different from the empirical philosophers. As in philosophy, we know no empiricist supports innateness in cognition but Gregory calls some kind of behaviour as innate, though his idea of innateness is different from metaphysicians' conception. He accepts perception as a skill to see the world and behave back accordingly. However, this *learning* does not always happen directly or through a hit and trial method. The concept sometimes refers to the skills or efficiencies that a living being inherits by from generation to generation (familywise as well as specieswise). From the perspective of learning, he describes the process of perception as such, in which, especially in the case of visual perception, apart from the visual sense organ other sense organs and limbs (hands and legs) also take part. In fact, other sense organs and

limbs are treated as important tools to cause perception and behaviour, accordingly. To explore the wonder of the mechanism of learning Gregory prefers to start with the case study of child's perception. It seems that he does so because, one, children's, especially toddlers' brains are so simple or uncomplicated to calculate or manipulate sensory information. They are so young to have any type of so-called orientation or an enriched store of data that may influence their perception. Therefore, more or less, all children, specifically, infants and toddlers behave almost in the same way. And two, he must have wanted to portray a general ground of human-perception and behaviour. For, he believes, perception is unique to every individual; environment, orientation, depth and diversity in stored data, and top of it all efficiency of the brain mutually makes the perception unique. Therefore, starting from the observation of general, typical, and simple behaviour of children then moving towards the unique, learning-oriented behaviour of growing up or grown up people may provide an idea of the range and process of development of the human perception. Gregory believes that perception is something that is, categorically, all about achieving some certain types of skills to deal with the world that could be achieved only through learning.

Along with the study of the cases of children's perception Gregory also talks about the perception of blind people, especially the early blind people, who do not have the skill of visual perception. In fact from Gregory's work we can know that during his experiment or research on blind's perception he faced such a case in which the subject is early blind, and has no skill for perceiving visually. Even, at the age of fiftytwo, by an operation when he got back his eyesight,

he was *seeing* everything, but he failed to *perceive*.² By this kind of study he wants to show that perception is all about learning, which in turn builds the ability of hypothesising perception.

3.3: The Construction

There is a close association between seeing and knowing. This association makes the world understandable to us. According to the Gregorian stand, this association is the outcome of our brain's active mechanism. Gregory says, "[b]y coming to understand how we see might we not at one stroke also discover how we think, remember, formulate hypotheses, appreciate beauty and most mysteriously accept pictures and words as symbols conveying not merely present reality but other realities distant in space and time? And if seeing involves all this, surely the net of understanding must be cast wide" (1972:1). For him perception is not something given, it is rather constructed by complex processes of the brain. Being signaled by the senses, from the fleeting momentary fragments of the data and some snippets from the past memory, the brain constructs perception. This construction is, in Gregorian terms, imaginative and fictions-based. The term 'fiction', in this context, does not refer to its synonym 'false', but it refers to advanced thinking or assuming the future. Therefore, it is better to understand the imaginative function of constructions in terms of speculation. In Gregory's words, perception is an active mutual combination of features stored in the brain from the past and simultaneously built and selected hypotheses, by the (same) brain. In a sense perceptions is essentially fictional or predictive. This is, for Gregory, an active view and on this view both veridical i.e. correct-predictive and illusory

² Regarding the issue Gregory had an investigative research work named "The case of Recovery from Early Blindness". In the investigation there is a blind person i.e. the subject named S.B., who was born completely blind and at the age of fifty two years he went through an operation and got her eyesight back. Gregory noticed that even after having a normal eyesight the person was behaving like a blind, he still was living his early life, as if the eyesight had added nothing new in his life. But with time, like a child, he was taught to see and he started to use his vision for seeing only depending on practices. However, it did not work for her for a long time and gradually he was loosing almost all of his excitement and interest for visually seeing the world. as a result of that he started to suffer from depression and after that within a few years he died. (For more details see the appendix-1.)

i.e. false-predictive perceptions are equally fiction. On this ground, Gregory rejects Skinnerian behaviourism³ and more essentially J. J. Gibson's claim of direct visual perception (that we have discussed in Chapter 1). Behaviour, in this case, is the outcome of the brain-process; it does not require a continuous supply of sensory information as input. Behaviour may continue to be appropriate despite long gaps in sensory data. Most of the time, in our everyday activities, we are not calculative enough or cautious about our behaviour. Let us take the instance of one of our common or familiar habits that is the case of placing our bag and stuff on the table or couch. In this case, every day after coming back home we throw our bag, key chain, etc. aiming at the table or couch. We do not at all think about the solidity or capability of the table or couch, every day, before aiming the stuff towards it. We do not even calculate the direction and distance of the table or couch from our position, or the speed of throwing. We behave this way completely out of our habit. Now, if we consider those days, when throwing the stuff was yet to become our habit, there were the supplies of sensory data as the input for our behaviour. When the couch or table was new to me, I barely started to use them. There used to be a flow of sensory data whenever I enter my living room and encounter them. The phrase 'sensory data', in this context, refers to the colour, shape, size of the couch or the table. Along with these the solidity and capability of the material by which the things are made of, their structure, the wideness in length and breadth of the surface of the couch seat or the tabletop, their direction and distance in respect

³ Burrhus Frederic Skinner (1904-1990) was an American psychologist and behaviourist. He is famous for his concept of operant conditioning in the process of learning. He believed that the best way to understand behaviour is to look at the causes of an action and its consequences. According to him, operant conditioning demonstrates the effect of positive and negative reinforcement on behaviour. For example, children can receive rewards like money for good behaviour or showing responsibility towards something that leads them to keep on repeating that kind of behaviour to receive the rewards, which in turn strengthens their behavior with positive reinforcement. One can also use negative reinforcement to strengthen positive behaviour by removing or stopping an unpleasant experience. Operant conditioning not only strengthens one's behavior, but it can also help to get rid of undesirable behaviour. For example, taking away privileges from a child as punishment for talking back to their parents will/may lead the child to not to behave in disrespectful manner from next time.
[<https://dandradebehaviorism.weebly.com/bf-skinner.html>]

of the front door, etc. worth to be mentioned. However, as the situation gradually becomes familiar, the gaps between the sensory data started to increase accordingly. Following the ratio of increasing, gradually, *throwing* becomes our habit. After passing some more time, the amount of sensory data to generate behaviour reaches almost zero. In familiar situations, our brain does not require current sensory data to control or operate behaviour; it produces this kind of (habitual) behaviour on the basis of the stored (repetitive) data from the past memory. The most dominant fact that works behind this mechanism is that perception is predictive or hypothetical. We shall describe how this prediction develops, in the next section. Gregory considers the brain as the information handling system that works uniquely. He is afraid that some physiologists may drop out the fact of brain fiction as it is unnecessary. Even they may cancel the scope of cognitive concepts as those are metaphysical and deserve to be explained away by physiological data. They claim Gregorian perception or, more specifically speaking, predictive hypotheses are simply alien. According to these physiologists, there should be more physical data. Gregory in defense of his own position says that predictive hypotheses, though not supported by any core concept of physics, still it can be claimed that those are based upon scientific logic. For there are dot to dot similarities among the steps of the mechanisms of scientific hypotheses and predictive or perceptual hypotheses. It is a fact that the importance of the role of perception in the form of observation, vision, or visualization in the domain of science is undeniable. Observation is essentially required, in artificial or controlled lab-situation as well as in a natural environment, to collect readings following given data of experiment in general.

3.4: Hypotheses: the Mechanism Behind the Process of Construction

It is the fact for every human being that for perception a person needs to generate some hypotheses. Gregory calls these kinds of hypotheses as perceptual hypotheses, which have very

close similarities with scientific hypotheses. In support of the *comparison* Gregory argues that for constructing perceptual hypotheses the scientific instruments and procedures and the sense organs and their neural channels are considered as parallelly essential characteristics. In this process the sense organs and the neural channels work as the scientific instrumental transducers that transmit coded data. Moreover, Gregory assumes that the scientific procedure used for data handling is essentially the same as the cognitive procedures carried out by perceptual neural processes of the brain. However, there are a number of differences between the two types of hypotheses on surface level and in some deeper level than that, but the numbers of overall similarities are more than that. Gregory finds some significant conceptual identities between these two types of hypotheses. Gregory clearly claims “(1) that perceptions are essentially like predictive hypotheses of science; (2) that the procedure of science are a guide for discovering processes of perception; ...” (1980/2002: 112). Now, the question is how the hypotheses are generated. According to Gregory’s account during perception the sense organs of human beings work as instruments and the neural channels, which are connected with the respective sense organs (here only visual sense organs are our concern), plays the role of transmitter of sensory information or sense-data. He considers eyes, etc. sense organs not merely as physical organs or body parts, but as some special kind of devices (i.e. transducers) that receive information coming from the external world and transmit them to the brain. For that, technically, Gregory in his theory talks about photocells instead of eye, microphones instead of ear, etc. The photocells of a human being receive patterns of light and energy, convert them into signals and transmit to the brain. For the convenience of our discussion we may consider the eye i.e. the place of photocells, as information detecting instruments like voltmeter, etc. Now let us see what are called signals. The perceptual hypotheses are built gradually following its two immediate previous steps.

Among the two, in the first step signals are generated and formed, and in the second step, data are extracted from the signals in order to constitute hypotheses. According to Gregory, *signals* are “[p]atterns of neural events, related to input stimulus patterns according to the transducer characteristics of sense organs” (1980/2002:113). The process of the generation of signals follows some “logarithmic relation” between intensity of light and the firing rate of the neurons. This logarithm is, usually, not understandable by common people, but a physiologist can describe the neural signals as data representing state of affairs. The step of the generation of signals is intrinsically related to the step of data interpretation. Signals always contain some meanings in the form of data that depends on the attention (not intention) of the perceiver in order to be interpreted. Therefore, at this point we need to have some idea about the Gregorian account of data.

According to Gregory *data* are “[n]eural events that are accepted as representing variables or states, according to a code which must be known for signals to be read or appreciated as data” (1980/2002:113). Signals always contain some data in a particular manner, as coded. Therefore, to get the signals that convey data it is essential to recognise the code first and then to decode it. Decoding is not a random job anyway. To decode a particular code one needs to know or learn that particular technique as well as the logarithm, following which the data has been coded. Data are highly peculiar, unlike signals or codes they are beyond the reach of physical concepts, though without data the description of the physical world becomes impossible. By nature data are quite arbitrary and held conventionally. For that, two different persons may interpret one common data differently. The fineness and richness of the interpretation of data may differ according to the depth of knowledge, training, intelligence, and culture of the interpreters. The technique of decoding is unique for every category of instances. To explain the nature and

significance of code, in the context of data, Gregory uses the example of Morse Code that used to be the part of the technology of sending telegraph from one place to another. Morse code is such a thing that contains only dots and dashes. These dots and dashes themselves have no meaning or significance unless someone extracts any meaning from them. Here, ‘meaning’ refers to the data. To extract meaning a person has to decode the code and for that, she essentially needs to have plenty of information regarding that code.

The signals can be read or interpreted only if they are received being wrapped inside some codes that are previously known or familiar to the perceiver’s brain. In this context Gregory clearly mentions that this mechanism of decoding, interpretation of data, etc. are complicated to state clearly in the case of perception unlike the cases of the mechanism of any scientific instruments. During the perceptual process, the eye (i.e. instrument) provides highly structured signals allowing identification of the source; but visual sensory data can be ambiguous. In fact, Gregory claims, “all sensory and instrumental data are, strictly speaking, ambiguous” (1980/2002: 114). He proposes that to overcome the ambiguity a perceiver must know the signal code along with that to identify and read the code as data the perceiver should necessarily be aware of some contextual knowledge. In our natural process of perception the *contextual knowledge* is generally implicit and in most of the cases the perceiver can recognise its contribution.

As Gregory was quite conscious that there is no established support for the claim that perception are like hypotheses, therefore, to prove his own point he described the mechanism of perceptual hypotheses under the light of the method of scientific hypotheses, in a comparative way. Theoretically, every hypothesis has its own predictive ground. However, these kinds of prediction possess no logical guarantee but their structure or conformity can be decided by observation and induction. According to him, “hypotheses are selections of signalled and

postulated data organized to be effective in typical (and some novel) situations. Hypotheses are effective in having powers to predict future events, unsensed characteristics, and further hypotheses. They may also predict what is not true. I shall assume that we accept that these are important characteristics of scientific hypotheses and perception” (1980/2002: 115).

Gregory claims that perception is processed by such a method that is similar to scientific method of hypotheses. In order to describe how perception occurs Gregory says that as in the field of science prior to performing any experiment the experimenter builds some hypotheses and by the experiment she verifies the validity of those hypotheses. Similarly, in the case of perception our brain produces perception and behaviour accordingly, on the basis of certain hypotheses, which are also the productions of our brain. Now, there are already some methods in science to verify the hypotheses and to provide the mental construction in an abstract but physical structure (or form) through diagram or graph. On the other hand, there is no system in which the hypotheses can be verified. In perception the validity of the hypotheses only can be proved by experiencing its result. Despite, for Gregory, perceptual hypotheses are important and meaningful. In both cases of science and perception, hypotheses are nothing but mental constructions built inductively based on prior *relevant* experiences. Experiments are required only to know whether those are practical. Gregory suggests that to understand the procedure of the perceptual hypotheses clearly we better follow the process of verifying scientific hypotheses in general. Here for example, following Gregory, we may talk about the method called the least square method. One point is to mention here that there is a reason behind choosing the least square method among various hypotheses-determining methods. This method, according to Gregory’s description, is ideal to describe perceptual hypotheses. This method is used mainly for plotting

experimental points on a graph that one may get from the experiment, done on the basis of a particular set of hypotheses.

Now, let us see how following the *least square method* a set of hypotheses may be verified through a graph. As the experiment proceeds, we get some experimental points (experimental points represent the ratio of changes in the variables on y -axis in respect of the changes in the variables on x -axis), which are supposed to be placed on the graph inside the area of x -axis and y -axis. In this area, x -axis carries independent variables and y -axis carries dependent or constant variables. The relation between x and y is $y = f(x)$ that means y is the *function* of x . Again, there is a rule or formula that is: $y = mx + c$. In this rule m represents slope or gradient i.e. how *steep* the line is; $m = \text{change in } y / \text{change in } x$. And c represents the y *intercept*, which means it represents the point where the vertical line crosses the y axis (in our context there is no scope for c therefore, in figure 1 we are not showing it). Following these elements, we can have a general idea of a graph:

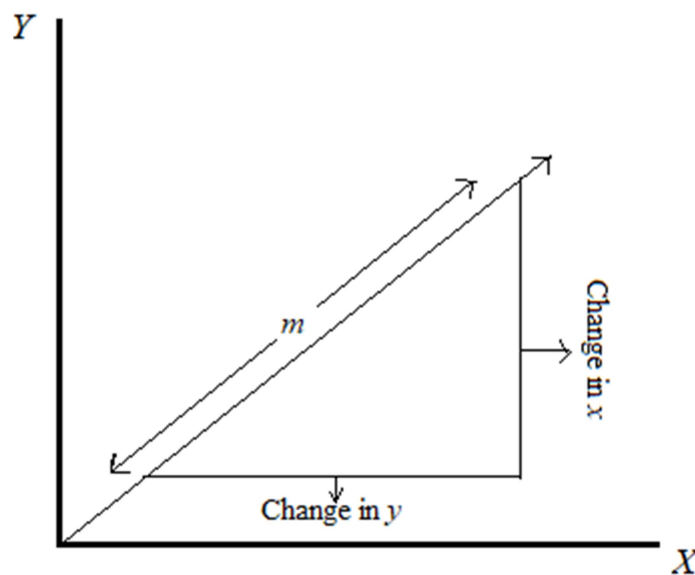


Figure: 4

Diagram of the general idea of a graph that metaphorically refers to the brain state that is ready to process perception

At the next step, we want to get the behaviour of the variable, which we measure experimentally from the points in the graph. Generally, it is observed that experimental data points cannot be placed on a single line (or curve), because there is always a deviation of the experimental points from its exact value. Least square method is used to get the nearly exact nature from such data points. There is a rule: the line, which is drawn by least square method from the experimental data points, will be such that the sum of square of deviations of experimental points from the corresponding points in the line will be minimum. For example, let us consider a resistor having a constant value of resistance R . Now, voltage is applied across the resistor and we measure the current I that flows through the resistor by varying the applied voltage V . In the graph, a straight line will represent the measured current versus applied voltage. From the straight line, we can get the value of the resistance. Least square method helps us to get the *straight line*, which gives the value of the resistance *closer* to the original one. From experimental errors, the points will not be exactly on the straight line but very near to it as shown in the figure below:

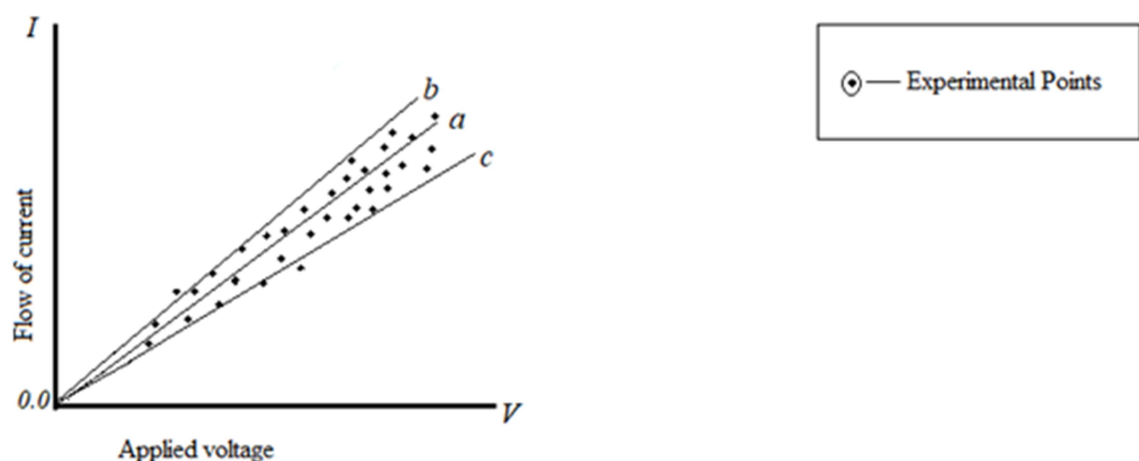


Figure: 5
Diagram of the static simulation of the process of perception

Here we observe that all the three straight lines drawn in the graph have some experimental points on them. But only the line (a) represents the exact experimental behaviour, because the sum of square of deviation of experimental points from the corresponding point in the graph is minimum. It is to note that this straight line may be drawn from down to upward or from up to downward. Metaphorically, it may be said that the straight line, indeed, builds a *bridge* across the experimental points by filling gaps among them. Technically the act of *bridging* is known as interpolation. Two procedures are usually followed for the bridging. The straight line, in any graph of experimental or observational data, “is a kind of fiction, accepted as the fact of the situation”(1980/2002: 117). According to the rule, this line is not supposed to touch any of the points indicating the readings. Gregory says this procedure is called *bottom-upwards*, for the straight line is drawn from the readings of bottom to upwards, without reference to contextual consideration. As in completely new or unknown situations, we try to deal with new or unknown objects on the basis of either hit and trial method or by permutation and combination of our prior knowledge, though almost none of them refer to present context or situation. For example, think about someone’s behaviour if she is suddenly placed in such a country or human community, where language, culture, food habits, etc. everything is unknown, unfamiliar to her. On the other hand, in the second kind of procedure the straight line or the curve is not supposed to be drawn without any reference to contextual consideration. We have to select some preferable reference(s), on the ground of some theory or on any general ground like aesthetic, prejudice, etc. Gregory calls this second kind of procedure as *top-downwards*. For in this procedure, like the former one we are not supposed to connect across the fleeting sensory information of present and snippets from past memory. Here, however, we choose or, better to say, select and pick any ready-made curve or line that is drawn previously in some similar situation or context (and may

be it has already been used many times). Although, in this procedure the line or curve may be set technically by linear or logarithmic manner like the former one, but the mechanism behind that is not like (metaphorically speaking) searching in the dark. The curve or line may be set in this procedure by the preference or any particular consideration of the perceiver (i.e. of her brain). Our brain opts for this procedure for perception in known, familiar situations or unknown but similar situations. According to the nature of hypothesis, in general, it is true that no hypothesis is beyond the scope of error. Considering this general nature Gregory reminds us that both of the procedures have some risks or flaws. In his words: “the first biases towards the accepted, and the second tends to perpetuate false theories by bending the data in their direction” (1980/2002: 117).

Now, let us talk about interpolation that signifies or means to connect two successive data points by a line. This line may be straight or curved. From the interpolated graph, we can get the value of the dependent variable for the independent variable, which is not/cannot be measured experimentally. To cover the range of variables required for experiment a particular interval is set and data is taken in that interval. The data in gap between two successive points is taken from the interpolated line. Sometimes intervals are taken to avoid a large number of data points because a limited number of data points is sufficient to generate required graphs/patterns. Sometimes it is not possible to take data below a particular interval because instrumental resolution does not allow us to do so. Consider the example of the resistor. Suppose, the voltmeter cannot measure data below 1V so it will not be possible to measure current for 1.5V or 2.1V, etc. Therefore, we have to measure current in intervals of 1V and then draw an interpolated line by such points and have to find out the current value corresponding to 1.5V or 2.1V, etc. Now consider another situation when we have to measure current for a voltage range 0V to 100V

then it will be very difficult or time consuming to take data in an interval of 1V. In that case, we may choose a 5V or 10V interval and can produce the required line from the measured data points.

3.5: Perceptual hypotheses

Now let us apply the entire description of scientific hypotheses, including the notion of interpolation, on perception to understand Gregory's position. We already have mentioned several times that for perception our brain generates hypotheses as a scientist generates some hypotheses for her project. At primary stages, the hypotheses are formed in the scientist's or the perceiver's head as some abstract matters. Later, in the case of science, they are developed and expressed in the form of numeric figures or symbolic figures, which have the potency to be expressed again in the form of propositional language with technical terms. These expressions are essential for further activities. On the other hand, in the case of perception, in advanced stages also the hypotheses are not expressed (outside of the brain) by any kind of language, for by nature it is beyond any *intelligible* language. People are not even aware of these *constructions*; it happens absolutely inside the brain, by the brain. Brain acts in lightning speed that perceiver only realises or recognises the state of perception i.e. the result or performed state of the hypotheses. Whereas in science the hypotheses are generated in the *mind* of the scientist in her conscious state, it means the scientist is aware about it. Therefore, she easily can express them in symbolic form or else according to the need of her project. At this point, we may be asked that if it is true that perceptual hypotheses are not expressible by language, especially by propositional language, then how come it is possible that when someone is asked about the reason of her any specific action(s) then she answers quite logically in hypothetical form, using propositional language. For example, regarding the previously mentioned instance of placing a

bag on table (see p.9), if I am asked, what made me throw my bag on the table just after entering the room? Then I would say that I saw or found that I can place my bag on the table. More specifically, I may say that I saw that the surface area of the tabletop has sufficient space to accommodate my bag and the table is firm enough to bare its weight. For, I know in all the cases, if y's weight and size is more than x's weight and size then y can bear the load of x (in this instance 'x' stands for my bag and 'y' stands for the table). In the entire answer of mine, there are two parts. In the first part, I explained the reason of my behaviour or action, and in the second part, I explained the hypothesis that indeed caused the particular action in the particular situation. Again, all these, if clearly possible to explain in language through *propositional form* then why it is said that perceptual hypotheses are not the matter to be expressed through propositional form? In reply, we can say that firstly, it is noticeable that to answer in such an organised way is not the job for everyone. Apart from children, autists, or insane persons it is near to impossible for the majority of *adult* common people. In most of the cases, they usually talk about conventions or habits as the reason of their doings. The persons who have adequate knowledge or awareness about brain mechanism, philosophy of mind, physics, natural laws, logic, language, etc., perhaps, only she can explain (or at least think about) the entire matter in such organised and intellectual manner. Secondly, their so-called *organised* answer does not represent the current state of brain as it is processing hypotheses inside the brain now. Instead of that, their explanations represent the facts that is realised depending on the past experiences of success or failure. Linguistic presentation of the experiences in a hypothetical form is not the very brain-fact. Brain has its own language "underlying spoken and written language" (1980/2002:117).

Further, in order to have some more description of perceptual hypotheses our eye may be considered as an instrument like resistor that has a certain limit of ability of receiving data, it is constant. Moreover, the sense-data that comes from the external world is free, independent. As sense-data in the form of signals enters the eye, the photocells (i.e. transducers) in the eye receive them and convert into data. Changes in the intensity of sense-data bring changes in the promptness or degrees of activation of photocells. We can take figure: 5 as the model-graph of our visual perception/perceptual hypotheses, in which the y-axis represents the limit of our vision that is dependent by the ability of photocells and x -axis represents intensity of sense-data (like applied voltage). Variations in the degrees or intensity of entered sense-data affect our vision.

We human beings are not motionless or immovable like statues, in our waking state and our surrounding environment is not empty or vacuous in pure sense (of physics). We move here and there in the environment by walking *through* the transparent curtains of air, sound waves, patterns of light, etc. Therefore, the sense-data coming from some objects in two consecutive moments are not exactly the same. Besides that due to the external or internal disturbances in the eye (i.e. the instrument) or due to some restlessness in the perceiver's body the differences or error in received sense-data may occur. So the scatters i.e. experimental points in the figure: 5 may be considered as the presenters of the different readings, which indeed represent the ratio of the changes between the value of visual capability and flow of sense-data. Now to get proper value of each reading brain (metaphorically) draws a straight line across the scatters. This straight line represents, we may say, *the perceptual construction*. In the terms of science, the method, following which the straight line is drawn is known as interpolation. Our brain fills the gaps between sensory information with the snippets from past memory. To fill the gaps, the brain does not select some random fragments of past memory. It always selects relevant and

compatible fragments that the ordering of the information has some consistency. This selection is maintained by the brain's own logarithm. This ordering allows continuous behaviour and control with only discontinuous signals. "Interpolations may be little more than inertial or may be highly sophisticated and daring constructs....Perhaps interpolations are generally regarded as gap-filling in situations for which we do not have complete or strictly adequate readings, but interpolation can be far more elaborate than this, for example postulating unknown species to fill gaps in evolutionary sequences"(1980/2002: 116, 117). In this context, we may show the role of interpolation in visual perception by borrowing a figure from Gregory's own account.

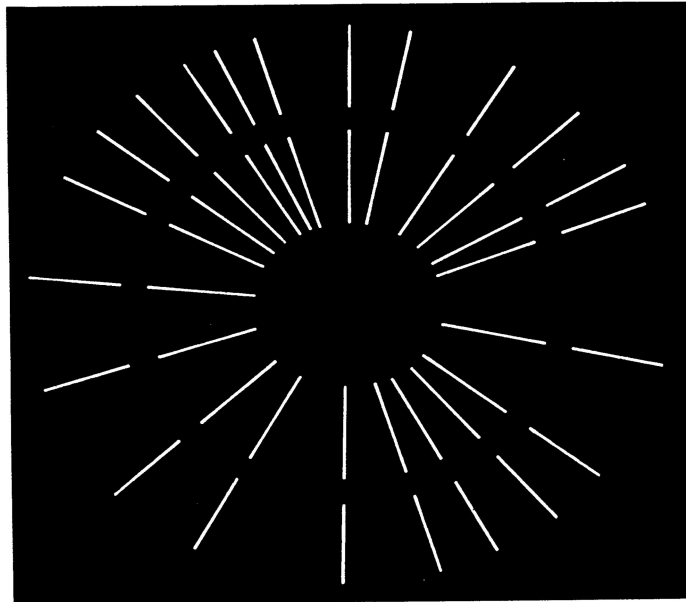


Figure: 6

Illusory contours and regions of modified brightness seem to be postulates of nearer eclipsing objects, to 'explain' unlikely gaps. It seems that an essentially Bayesian strategy is responsible.⁴

In the article "Perception as Hypotheses" (1980/2002), Gregory provides this figure to explain the example of interpolation in the field of visual perception. The case is we all have noticed that if some covering or eclipsing object obstructs the light coming from its source directly then it

⁴ R. Gregory(2002), p. 118

disperses around the object instead of being stretched further. Let us think about the instance of total solar eclipse, especially the moment when the earth, the moon, and the sun lie along a line and the moon covers the entire disk of sun, and casts the darkest shadow or the umbra on the earth. Apart from this natural case, we also can take the situation when (in the respect of some particular angle) the head of a tall person, passing across the corridor or standing there, covers entirely a heavy watt electric bulb hanging on the wall. From a certain distance, the dispersed light looks as if there are a bunch of contours of light coming out from the behind of that eclipsing object. Gregory warns us that these visible contours are mere illusion; he calls them as “illusory contours”. Now, let us explain what illusion is there in the contours. The obstructing or eclipsing object does not cover the light entirely, but from one particular side (let’s consider that the perceiver is standing at the covered side). Therefore, as the other sides of the light remain open, the brightness of the light is dispersed around the object. We *see* the dispersed lights as they are coming forward in a straight line, without any break or gap, if there is not any accidental obstacle. But the real scene is, none of these rays of light come to us in a straight line; they get scattered in the environment as far as they can. Though there is no continuation, we intertwine the scatters by our imagination. As a result, we perceive as if there are organised contours of lights instead of scatters. Our brain interpolates across the gaps and makes us *see* the contours. According to Gregory’s interpretation from this systematised act of the brain it seems that an essential mathematical strategy is responsible for all these.

After perception, following that exact continuation, our brain generates action or behaviour. Generation of behaviour, may be said, is the last and final step of the perceptual hypotheses that concludes the entire process. The factor called *behaviour* or action is not random, it is linked with the pattern of perception that occurs just before it. Following the link or, it is better to say,

the algorithm of perception action takes place. According to Gregory, we do not have any direct conscious control over the entire perceptual process including its two major pillars, namely, perceptual and action. All our sensory and cognitive activities are controlled and directed by our brain. Now the question is, how does behaviour occur? Is it just another aspect of *perception*? Gregory says no, it is not. Perception occurs by the combination of present and past sensory information, but behaviour occurs from zero data or information. Following the terminology of science, Gregory describes the process of behaviour as *extrapolation*. Therefore, to understand behaviour let us know, in brief, what is known as extrapolation. Extrapolation is a method used in graphs to generate a line or curve in such a region, where no experimental data exists. By this method the behaviour of the line or curve of a known region (i.e. the area inside x -axis and y -axis), where experimental data points exist, is extended to the required region considering that the variable has the same nature in that zone too.

Let us consider this case for the above example. Consider that the voltmeter cannot measure voltage above 100V. Now, if we want to know the amount of current flowing through the resistor when the applied voltage is 1000V, we have to extend the straight line, which is drawn by the experimentally measured points up to 100V, up to 1000V in the graph considering that the resistance remains constant at that applied voltage. Extrapolation may or may not give correct value. If the nature of variation of the variable remains the same in the extrapolated region then we get the correct value from the extrapolated line. But sometimes the nature of variation changes in the unknown region from the known region. So if we extend the line from the known region into an unknown region, we will not get the correct value from that extended line. Now let us understand and explain the matter in terms of perceptual process. Extrapolation, in a very simple sense, may be described as the method of jumping or taking a leap from present states to

future states, from sensed i.e. known features to *unsensed* features. In Gregory's word, “[e]xtrapolation allows hypotheses to take off from what is given or accepted, into the unknown. Going beyond accepted data is not very different from filling gaps, except that interpolations are limited to the next accepted data point; extrapolations, however, have no endpoint in what is known or assumed, so extrapolations may be infinitely daring, and so may be dramatically wrong” (1980/2002: 118).

How behaviour can be determined may be described by the application of the method of extrapolation. Behaviour or action succeeds perception immediately. Either we try to have that object, try to use it for some purpose otherwise ignore or reject the object as we feel that is unnecessary or harmful. Besides these two options, sometimes, we may remain indifferent towards it. It may be noted that despite the use of the phrase ‘we do’, which may seem to be indicating conscious intention, the perceptual process as described by Gregory is not a conscious one. Our activities are determined and directed by our brain. Our brain takes care of whether in some situation, familiar or unfamiliar, whether we feel some object as interesting or useful, or whether we reject it. As we have seen previously that perception occurs by bridging across the gaps in fleeting sensory data by the snippets of past stored memory. However, the fact is there is always sufficient information for perception, whereas to determine our behaviour in respect of that perception the brain has no information, indeed. In this case, the brain extrapolates our behaviour depending on the quality and nature of the bridge or interpolated line across the sensory information. Now if the sensory information of present and surrounding information of the perceiver is familiar then the extrapolated behaviour proves valid. On the other hand, if the surrounding information or environment is unfamiliar or completely new to the perceiver in some situation then the brain has to put more effort to interpolate across the sensory information.

And later on the basis of that interpolation if the behaviour is decided then the chance that behaviour to be proved as valid becomes less. For it involves the scope(s) of illusion or error. The main point is, the nature of our action or behaviour towards the object of perception remains included in the entire process of perception. Here the word ‘included’ does not signify that *action consists in perception* (like Gibson’s interpretation). Depending on the predictive power of the perceptual hypotheses, our perceptions as well as actions are inferred following the inductive method.

3.6: Objects—that We *See*

In this section we are going to talk about the content of perception. As a type of cognition or process of cognition perception has to have content or object for perceiving. Now the question is how Gregory in context of the constructivism will describe the nature of the percept i.e. object of perception. From the discussion we have done so far, it is clear that according to Gregory we do not see objects directly as it is. Then what is it that we recognise as the *object*? In the earlier part of this chapter, from the description of the Helmholtzian view, we have seen that according to him instead of object the pattern in light is captured in our retina and on the basis of that we *assume* that we are seeing objects. In short, we do not *see* objects but we *imagine* them. In fact the entire tradition of the supporters of indirect perception considers that there is no object even in the outer world. For them object is something that is out of the reach of us and our possible experience. Following in the footsteps of the predecessor Gregory believes that we, in a sense, create objects by inference for the fulfillment of our cognitive and other purposes. In his words, “[t]he perceptual selection of sensed characteristics may create objects. There is also strong evidence for creating visual characteristics from what is accepted as objects” (1980/2002: 119). As in the case of the description of perceptual process scientific procedures help us to understand

the internal mechanism of perceptual hypotheses, but we cannot say the same in this case. As we do not get an object directly as it is, we never can know its complete structure or any of the characteristics. In science, according to the requirement of the project, a scientist collects data about some objects through required and compatible medium i.e. instrument, etc. Now, no instrument of science is able to reveal all faces and facets of an object completely. Therefore, what science describes as an object that not always corresponds to the context of perception. It means, what appears to the senses as an object is not the same as science's object. We sense or "know too little about the criteria for assigning data to objects, and creating object-hypotheses from data" (1980/2002: 119).

According to Gregory, it is not possible for us to know an object directly as it is. Hence, we are bound to depend upon the sense-data, which are received by transducers as signals. Signals contain so many data but our brain decodes only such data, which are relevant to the situation and context, and construct hypotheses with those data following upwards or downwards procedures⁵. Here it is worth mention that Gregory, unlike Gibson, is very much influenced by Gestalt psychologists. According to Gestalt psychologists, we possess such an innate tendency that makes us to see everything as a whole-form that is constituted by many parts of that object. These parts are moving in the environment may be as together or arbitrarily. Here by 'parts' one should not understand physical tangible parts or particles of objects. We have to take those as non-physical but real things, because those are the parts of the *form*, which is in itself nothing but a concept. These parts in the form of sense-data, being wrapped in the signals, enter through our eye, get received by transducers, and transmitted to the brain. There either by *imagination* i.e. downwards method or by *fiction* i.e. upwards method, brain creates object(s). In this case the

⁵ In the context of constructivism the phrase 'upwards or downwards procedures' simply refers to the 'bottom-up' and 'top-down' methods, respectively.

parts may be considered as the characteristics of the object, like its edges, depth, etc., depending on which we create the object. Gregory thinks, “[m]ost objects are closed in form, and their parts move together. These common object characteristics become identifying principles—and may structure random patterns to create object forms, even from noise” (1980/2002: 119-120).

3.6.1: Recognition of Objects

For valid perception, object-recognition or object-creation is important. As we see in the gestalt laws, there are some rules to recognise or create objects. Now, these rules are applied in perception as upward procedures to filter the data and to provide a structure to the perception. In the cases of some mature or experienced adults, regarding some familiar or everyday situations or (may be in the case of perceiving) same objects in unfamiliar situations, these rules applied by the brain from a general perspective, as generalised from of the categorically analogous or close experiences. As a result of that, in further cases forms are applied following the downwards method. A little earlier we knew that sometimes objects are recognised or created from their own parts or characteristics. However, here we are seeing that *parts* are also recognised by the perceivers as individual objects as independent of form or name of the object that the parts belong to. This is possible only if we have clear knowledge about that *whole* particular object previously. These parts as the criteria or characteristics, become the *identifying principles* of the object(s). For example, let us consider an object, which as a whole-form is known as a chariot but apart from the whole structure we can recognise and name its parts individually as wheel, etc. Without the adequate knowledge about chariot as well as its parts, we cannot do these. If we are asked to assemble a chariot by collecting its parts from separate places, where each of its parts are hidden among other objects of the same category, then we may not easily be able to can find and recognise the right wheel, right bar, etc. to build the given type of chariot. For, we know

about wheels in general and chariot's wheels in specific. In these cases our brain works in a downwards manner.

3.6.2: The Status of Objects

After the context of construction and recognition of objects it is important to talk about the status of objects. In this subsection we want to find out the following Gregory's account how the objects of perception should be categorised, physical or non-physical. On the one hand, Gregory accepts that we never can perceive any physical object directly as it is situated in the external world. We know objects through fiction or imagination. On the other hand, empirically we see the objects as serving our purposes. Therefore, how should we describe the nature of the objects of perception, as non-physical or physical? What would Gregory say? Do the objects at all have any stable and concrete existence outside our brain or do they exist only in concepts, like numbers or formulae of mathematics? Numbers, laws of physics, etc. are considered as conceptual objects or abstract objects. That means those are non-physical, no one can see or sense the objects. According to the general concept, the object of perception has to be sensed by the perceiver and to be sensed the object should be physical or material. Whereas, no abstract object exists anywhere in the physical world; it has no physical qualities like extension, shape, size, etc. Despite the differences it is to note that physical and non-physical or concrete and abstract, both types of objects are known as *objects*, they have a status called objective. The point is, quite naturally having the quality of *being physical* provides an object of perception the name of 'object'. Similarly despite *being non-physical*, the abstract objects also hold the status of 'object'.

Regarding the context of the existence of the object of perception and science, let us consider another perspective that concrete objects have some features that are abstract, and science supports the fact. The centre of gravity no doubt is a conceptual object but it is intrinsically connected with concrete objects in general. Every physical object like a stone has its centre of gravity until it exists inside the planet earth and this is a fact of science. Here we can see that a sensible object stone and a non-sensible object centre of gravity both are simultaneously knowable and public. Therefore, it is difficult to differentiate between physical and non-physical or concrete and abstract objects. It seems almost impossible to decide what is concrete or abstract in pure sense. For, our experiences do not provide sufficient evidence in support of the matter. When we recognise something as having triangular shape then, though the object is physical or concrete, we cannot deny to recognise its *three* sides, *three* angles, and top of it all its *triangular* shape that directly derives from the *concept* of geometry called *the triangle*. We cannot deny their intrinsicness. Following Gregory we may say that this intrinsicness is not the matter to be perceived directly but it is certain and logical to be cognised through hypotheses that in turn refer to inference—the Helmholtzian *unconscious inference*. It is right to consider this way. If, for the sake of argument, it is considered that by direct contact between sense organ and some object, someone may *see* the *physical object* like table or stone, but still no one ever can claim that she directly *perceived* the *number* of the sides of the table or *the centre of gravity* of the stone. We may add more following the link that the role of inference is the part and parcel of the entire process of perception including the process of object recognition and creation. It ensures the indirectness of the process that in turn highlights the scope of erroneous or misperceptions, which is a natural and a lived fact to every person.

3.7: Erroneous Perception and its Process

A misperception or erroneous perception is a well-known part of the experience, part of our life. Although in the western tradition the erroneous perception or perceptual experience has no such epistemological value, since we are concerned about the process aspect, therefore it would not be wrong if we talk a little about this context. Like veridical perception it also happens, practically. We are curious to know whether there is any special mechanism behind erroneous perception or it follows the regular one, too. If it does so then how does it become erroneous? Along with this, we have another intention behind discussing this topic in the context of the process. In support of the information processing system Gregory argues that since objects are not tangible and we do not have the ability to see those directly, instead we are bound to construct objects, therefore, there is open scope for being wrong. Moreover, he accepts that there are gaps in the supply of the sense- data, therefore, during processing the information the brain fills those gaps by memory-clips. In that process also there is an open scope for mistakes. For, the entire process of perceptual construction depends on the hypotheses, which are by nature contingent. Whereas, the proponents of direct perceptual theories claim that we are quite able to see objects as they are. Gregory argues, if that is true then there should not be any kind of error in perception as well as in the process. However, unfortunately, the supporters of direct perception also face misperception. Therefore, before having the conclusive discussion for this chapter that how the model of direct perception is better than the model of indirect perception for reconceptualising the visual world of the embodied human being, in this section let us have some more idea about the Gregorian process of perception following the context and a few reasons that make a perception erroneous. Among many reasons in the following subsections we will talk about only five such reasons that make us face erroneous perception in most of the cases. The reasons are an

illusion, ambiguity, distortion, paradoxes, and fiction⁶. One thing is to acknowledge here that in the following subsections, for the sake of explanation we have used some figures that we have borrowed from Gregory's own work.

3.7.1: Illusion

The account of illusion in Gregory's theory of perception is considered as one of the important pillars that provides support and balance to the entire system (theory). Illusion, according to Gregory, is a natural phenomenon. Its existence is equally accepted in the domain of natural science and in our everyday experiences. From the perspective of the process, there is no such huge difference between perception and illusion. The basic difference is that illusion represents non-veridical perception. In a broad sense, the illusion also comes under the domain of the perception, though it does not provide proper knowledge that we get from veridical perception. Wrong interpretation of the stimulus pattern in the primary stage of the perceptual process causes illusions. Perception and illusion both share the same mechanism. It seems that the truths of perception are revealed more clearly through illusions. In Gregory's words, "[i]llusions become no longer trivial effects of certain patterns, but rather tools for investigating basic processes involved in perceiving the world" (1978: 152). Simple objects may appear as ambiguous or illusory as their orientation, shape, or size is changed. For, with these objective changes, the image in the perceiver's retina does not change. The brain creates hypotheses according to the retinal image, which in the case of changes prove wrong or misleading.

Illusions are run by our expectations. We, human beings have a typical habit of expecting everything in our favour irrespective of conditions and situations. Somehow, we do not want to

⁶ Though we are going to discuss ambiguity and three other kinds of reasons for erroneous perception, after illusion, practically, ambiguity, distortion, paradoxes, and fiction all these four reasons are categorically four types of illusions.

leave or change our own world, with which we are accustomed. This attitude or practice affects our perceptual process rather than the brain process. All adult normal people have their own data bank. Therefore, as they receive some different or unfamiliar data, they try to interpret them depending on their previous experiences or stored data and as result, they face illusions, though there is no necessary connection, sometimes they may become successful. Probability and improbability, likeliness and unlikeliness, or truth and error together are hidden in the stimulus pattern. Our brain is always prone to interpret the signals and to read or decode the data inside them following known, familiar ways. But sometimes, in some atypical situations or environments that require new types of interpretation or reading for the perception of objects, our brain runs in the same way, with which it is used to. And as a result, an error happens.

Conceptually, for Gregory, visual illusions may be classified as physical, physiological, and cognitive. By physical he refers to those reasons which are independent of the perceiver or her participation. Mist shadows, sticks in the water are some examples of this category. By physiology, it is clear that he refers to the illusions that occur by the disturbance or disabilities in the perceiver's physique, especially in her sense organs. Lastly, cognitive illusions, according to Gregory, occur due to some lacking, limitations, or misapplication of stored data. Among the several kinds of illusions, Gregory picks only ambiguities, distortions, paradoxes, and fictions. These four are, according to him, illusions in a pure sense and provide an overall picture about illusion, in general.

3.7.2: Ambiguity

Ambiguity in perception occurs due to spontaneous alternation and disagreements. The fact is that there is no stereotypical pattern in the external world that is considered as the source of

sense-data or sensory information. Similarly, the sensory information also is not bound to be served only in a certain way in order to generate the perception of a certain object table, for instance. Therefore, alternative hypotheses can be elicited by the same signals, depending on some factors like context, situation, ambience, culture, orientation, etc. In different situations, a person can perceive an object differently. For example, when in the winter morning white mist shadows the covers the entire surroundings, our vision fails to see anything clearly. We cannot guess even the (classes of the) objects in the close distance, though we can recognise them as objects. In this kind of illusion, our role is neutral, nature is responsible for this. This kind of error is the instance of physical ambiguity. In this situation, the homogeneous dense mist resists the heterogeneity in light and other associating factors of perception. Since in this condition the vision of the perceiver does not resist completely. The signals continually get received and her brain keeps trying to interpret those signals, depending on the *probable* and *likely* features in the signals. This effort provides an ambiguous visual perception.

Again, ambiguity in perception may occur in the case of size perception if the perceiver has a single stationary eye, between the two. This is the physiological reason for ambiguity. However, we have two eyes, but our vision or perception is one. Eyes or visual sense organs are instruments and its photocells are receptors and transducers of signals. Both eyes together collect data and send them to the brain and as output, we get the perception of the object of perception. Since, in this case, the person's one eye is static or motionless, it cannot scale the proper size of the object and its location, whether it is in the left or right. Whereas, the other normal eye scales the size properly. But when these both, proper and improper signals of size reach to the brain via transducers, the brain gets confused and as a result, the person gets the ambiguous perception.

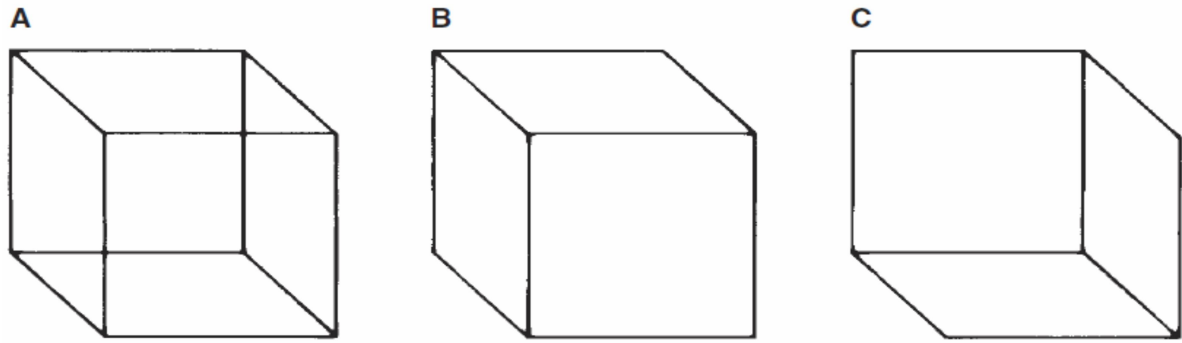


Figure: 7
Diagram of Ambiguity in perception⁷

3.7.3: Distortion

Distortions occur mainly in the case of space perception. For that sometimes, Gregory has described it as a “geometrical illusion” (1963: 678). It may occur at the signal level as well as in the data level. At the signal level, distortions occur due to the problem in calibrating in sensory adaptation. It also occurs by the reason of mismatch of transducers of the instruments i.e. sense organs, to input. For example, let us take the case of a stick in the water. A stick submerged in a glass of water looks bent. It is an example of physical distortion. The perceiver has no role in it, other than to experience it. According to the law of physics, light travels slower through water than air. As the light enters the glass of water, and as it leaves the glass, it changes speed and direction, making the stick look bent. This phenomenon is called refraction.

Light travels in a straight line, through some medium. But when light passes from one medium to another, its path bends and refraction happens. The refraction occurs only at the boundary of two

⁷ “The so-called Necker illusion, named after L. A. Necker, the Swiss naturalist who developed it in 1832. The essence of the matter is that the two-dimensional representation (a) has collapsed the depth out of a cube and that a certain aspect of human vision is to recover this missing third dimension. The depth of the cube can indeed be perceived, but two interpretations are possible, (b) and (c). A person’s perception characteristically flips from one to the other.” --- Marr, David. “Selections from Vision” in Alva Noë and Evan Thompson (eds.), *Vision and Mind: Selected Readings in the Philosophy of Perception*, Massachusetts, The MIT Press, 2002.

media. As the light crosses the boundary, it again continues to travel in the straight line. But the direction of the path of light in the latter medium differs from the former one. If during the time, when we are looking at some object, and the (continuous) light from that object changes media on the way to our vision, a visual distortion is expected to occur. In the case of our example, as we see through the side of the glass at the portion of the stick located above the water's surface, light travels directly from the stick to our eye. In this case, no refraction occurs and we see this portion of the stick as it is, since the light does not change medium. But, when we see the portion of the stick that is submerged in the water, light travels from water to air or from water to the glass to air. This time as the light ray changes media, subsequently it undergoes refraction. As a result, we see the stick as bent. Apart from that, the submerged portion of the stick appears wider than the portion of the stick, above the water surface. These visual distortions are explained by the refraction of light.

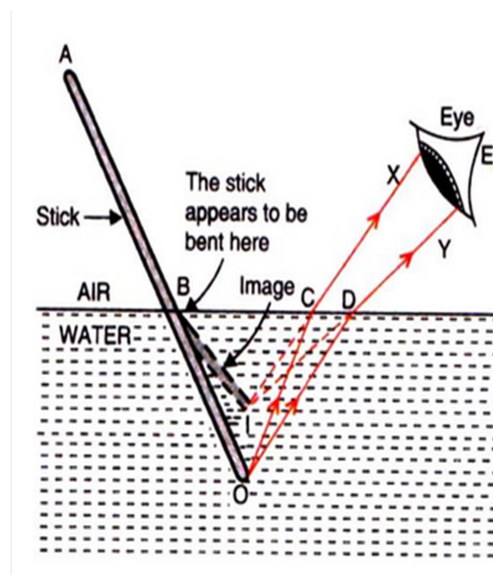


Figure: 8
Distortion in visual perception

For our convenience, we mark the part of the portion of the stick above the water surface as S1 and the submerged portion as S2. There is no problem with S1. During S2, the light rays undergo deviation from their original path and travel from the submerged portion of the pencil, through the water, across the boundary, into the air, and ultimately to the eye. As they come across through different mediums, naturally, they refract. Our visual system cannot run or compete with these changes; the eye-brain interaction fails to count the refraction of light. In such a situation, our brain judges the image location as the location from where the light rays originate. This image location is such a spot where either reflected or refracted rays intersect. Our brain assumes that light travels in a straight line and then extends all incoming rays of light backwards until they intersect. But practically, light rays from the submerged portion of the stick intersect in a different location than light rays, in respect of the portion of the stick that extends above the surface of the water. For this reason, the submerged portion of the stick appears to be in a different location than the portion of the stick that extends above the water.

In the explanation of the reason for the size distortion of the stick, we can say, our size perception depends on the position of our eyes. By the left eye, we see the left portion of the object and by right eye, we see the right portion. When we see the submerged portion of the stick from a God's-eye viewpoint, the light path from the submerged portion of the stick to each of our two eyes remains there. However, this path (virtually) appears as one, containing the holistic size-pattern, but our left eye considers the only extreme vision of the left portion of the submerged portion of the stick and right eye considers the extreme right portion. This virtual path refracts at the boundary of water and air media. The virtual lines of our vision of two eyes extend back into the water and these extended lines intersect at a given point. The point

represents the image of the left and the right edge of the stick. That makes us see the submerged portion of the stick as wider than the portion above the water surface.

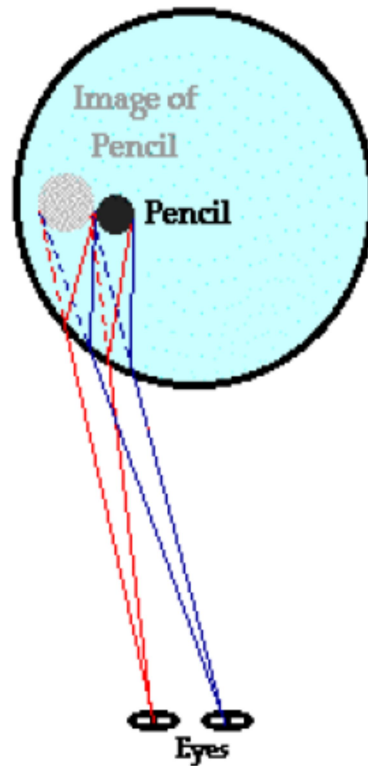


Figure: 9
The image of the stick is located where the refracted rays intersect

3.7.4: Paradoxes

Paradoxes as a reason for misperception mainly refer to the visual difficulties in space perception. Gregory says “[p]aradoxes can be generated by conflicting inputs, or by generating hypotheses from false or inappropriate assumptions. A well known conflicting-input perceptual paradox is given by adapting one hand to hot water and the other to cold, and then placing both hands in a dish of warm water. To one hand this will be cold and to the other hot” (1980/2002:

125). Paradox is a kind of cognitive error; it occurs due to misreading of signals as data. Problems in calibrating incompatible signals produce paradoxes of feeling an object as both hot and cold at the same time. Paradoxes occur in visual perception, too. The visual paradox is not imaginary, it occurs in science too. For example, it is a fact, the object ‘light’ accepted as both wave and particle in physics. Moreover, sometimes paradoxical matter may appear as non-paradoxical. The paradox of the impossible triangle is the most suitable example here. One of the important reasons for cognitive error is misapplication or, sometimes, misunderstanding of own (stored) conceptions. In such cases, though conceptions i.e. stored data provide strength to the hypotheses, sometimes these conceptual understanding become weak or powerless to correct some unusual or odd perceptions. According to Gregory, we can *see* paradoxes, for we have the capability of holding incompatible hypotheses and conceptual hypotheses (i.e. already stored with a compatible form), simultaneously. Before proceeding let us have a brief introduction of the *impossible triangle*, which is also known as the “Penrose tribar”⁸. L.S. Penrose introduced it in psychology in the context of impossible objects of perception, which are as real as the other so-called ‘natural and normal’ stuff. “It consists of three square bars (prisms), oriented in three orthogonal directions; each joined to the next by a right angle; altogether extended in 3-space,...” (Francis, 1987/2007: 65).

⁸ “The first formal examples of impossible objects were published by the father son duo, the psychologist Lionel S. Penrose and the physicist Roger Penrose in 1958 in their seminal article “Impossible objects”. They introduced the tribar, which later became known as the Penrose Triangle, and the endless staircase, later known as the Penrose staircase. Their work brought *impossible objects* into public awareness.

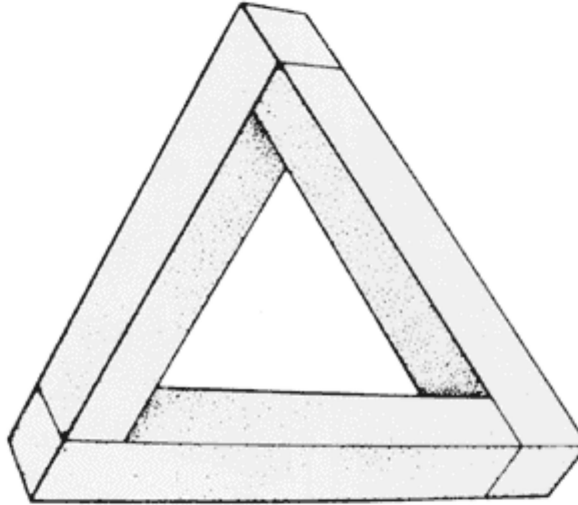


Figure: 10

The Penrose “impossible triangle” drawing. This appears paradoxical; but it can be an object lying in normal three-dimensional space.⁹



Figure: 10.1

This wooden object represents Penrose tribar in 3D space. It appears paradoxical when viewed from a critical position.¹⁰

⁹ R.Gregory (2002), p. 125

¹⁰ Ibid. p. 126

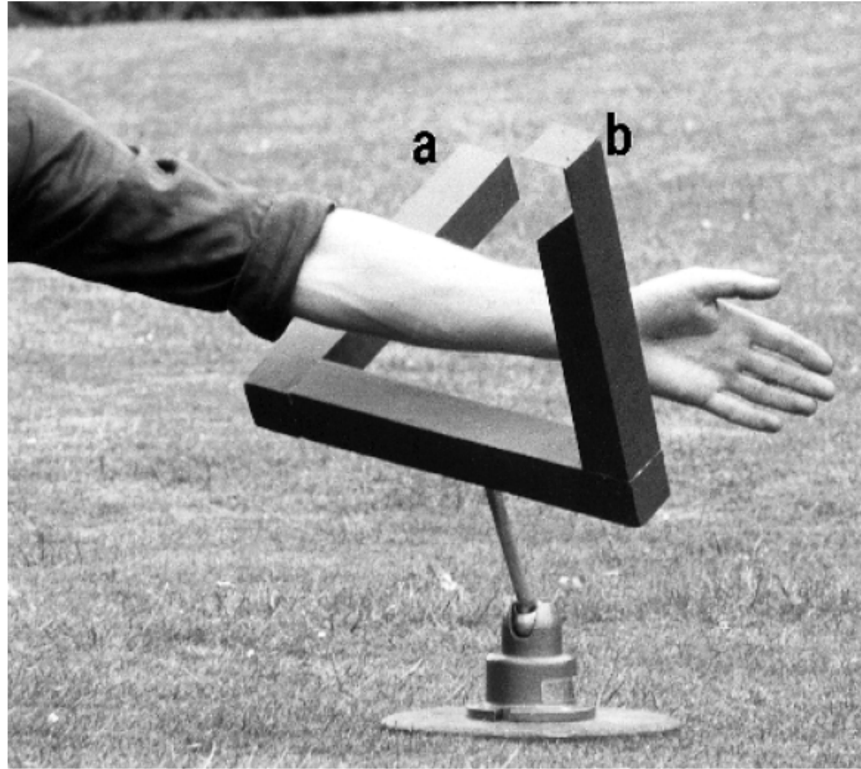


Figure: 10.2

The same object viewed from a non-critical position. The true structure is now evident. This is as true of the object itself as of the photograph.¹¹

This triangle apparently may be viewed as a normal object. But “when viewed from the critical position, the perceptual system assumes that two ends of what appear to be sides of a triangle are joined and lie at the same distance, though they are separated in distance. Even when we know this we still experience the visual paradox. It is very interesting that this false visual assumption—that the ends are at the same distance though they are separated—can generate a perception which is clearly extremely unlikely, and recognized as unlikely or even impossible” (Gregory, 1980/2002: 126-127). This argument for once again proves convincingly that perceptions are built up by following rules from assumptions that are an expression of *inference*. “Since perceptions can be extremely improbable and even impossible, it follows that perceiving is not merely a matter of accepting the most likely hypotheses. Figures and objects of this kind

¹¹ Ibid. p.126

present useful opportunities for discovering perceptual assumptions and rules by which perceptual hypotheses that may conflict with high level knowledge are generated “upwards” from assumptions by rule-following” (Gregory, 1980/2002: 127). This *fact* also shows that perception demands learning. Our ability to generate and accept extremely unlike, improbable perceptions helps us to survive in nature. By the help of this ability, we can appreciate the occurrence of unlikely events and situations around us. We earn this ability by learning the method of assumption. Depending on nature and given features of the object or event our brain-process runs following the principles of upward or downward. Usually, we get perception, either probability or likeliness. But practically, this world contains probable-improbable, likely-unlikely features together, in a random manner. Therefore, for proper perception, we need to learn to see the improbable along with probable and unlikely along with likely ones. To make clearer his point, Gregory, in this context, brought the example of the perception of the hollow mask. Let us think about such a kind of mask of a human face that is 2D in real, but appears as 3D, from a certain angle(s). This mask is completely hollow from its backside. Only having a stereoscopic vision¹² of it, one can know or see it as hollow. In this kind of paradoxical perception, our brain at first generates hypotheses by upwards processing, which may be highly unlikely and even clearly impossible. After that by downwards processing our brain, looks for likely features from the data-store in order to fill the gaps, which may be fictional or false. If our

¹² Stereoscopic vision is the single or separate perception from each eye that provides a slightly different image from each eye. It is the part of the mechanism of depth, shape, and distance perception. In stereoscopic vision, transduces of each eye capture their own signals, convert them into image(s) and send them to the brain for further processing. As our eyes are placed in the left and right sides of the frontal part of our head, therefore, the left eye receives the left vision and the right eye receives the right vision of the object. When the images from two eyes arrive simultaneously in the brain, they are united into one picture. Our brain by its processing combines the two images by matching up the similarities and adding in the small differences to derive the final picture, which contains the three dimensions — height, width, and depth. This combined form of the final picture is more than the sum of its parts. Stereoscopic vision is also known as the binocular vision.

perception would be biased by probability or likelihood then it would never be possible to see the hollow mask as hollow.



Figure: 11

The “face” on the right is in fact the hollow mould of the face on the left. Though hollow, the mould appears as a normal face. Texture and even stereoscopic counter-information are rejected to maintain this highly probable (but incorrect) hypothesis.¹³

3.7.5: Fiction: The Cognitive Contour

The fifth famous reason for the error in perception is called fiction. Generally, the term ‘fiction’ represents the sense of creating some impossible stuff possible in imagination with some pretentious events. In this context, however, the very term is used to represent completely different matter that is the part of perceptual processes. In the Gregorian context, Fictions are necessary to complete perception. In a sense, we can say fictions are positive kinds of illusion, which plays a constructive role in perception. We can *see* perceptual fictions in phenomena such as the illusory contours. Gaetano Kanizsa (1976) describes these contours as *subjective*. For,

¹³ Ibid. p. 127

these are not physical (or objective), but its visibility depends on the perceiver. According to Kanizsa, “[c]ertain combinations of incomplete figures give rise to clearly visible contours even when the contours do not actually exist. It appears that such contours are supplied by the visual system” (1976:1). A contour is perceived when there is a jump in the stimulation between adjacent areas. The jump or gap may be caused by a difference in brightness or colour. For the visibility of the contours, the visual areas have to be completely homogeneous. Otherwise, the heterogeneity in visual areas becomes itself a big jump in comparison to the differences in colour or brightness and overlaps them. In that condition our visual system becomes busy to adjust that heterogeneity instead to compensate for the (small) differences. Therefore, we can say following Gregory that the visual fictions come under the category of cognitive error. For, the phenomenon like illusory contours is there to cover unexpected gaps in the figures or shapes that appear before the visual system.

The fact can be illustrated with an example that we are borrowing from Kanizsa (1976). Along with the figures we are borrowing a part of his description in this regard.

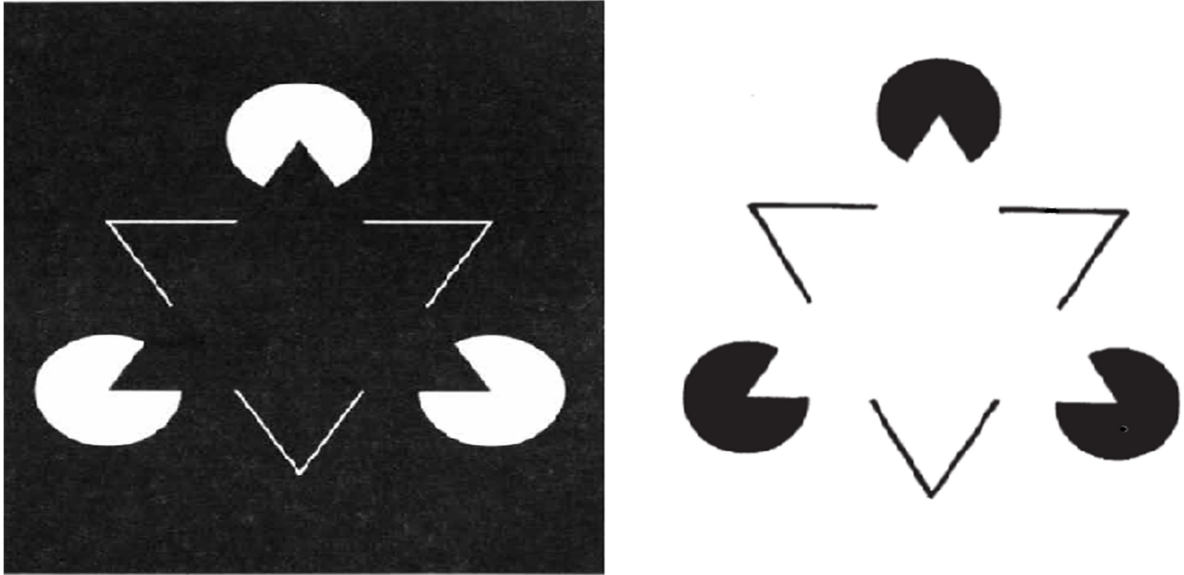


Figure: 12

Diagram of Cognitive (subjective) contour¹⁴

“For example, in the illustration below the solid triangles in the center of each figure appear to have well-defined contours, but close examination of the contours where they cross an open area reveals that they have no physical basis. If you fix your gaze on one of these contours, it disappears, yet if you direct your gaze to the entire figure, the contours appear to be real. The phenomenon of contours that appear in the absence of physical gradients has aroused considerable interest among psychologists on both the experimental and the theoretical level. A number of variants of the effect have been discovered, and several explanations have been proposed for it. Here I shall describe some of the more interesting properties of the effect and examine some of the attempted explanations. First, however, let us consider a related visual phenomenon: the phenomenon of virtual lines” (1976:1). Now let us see how illusions occur in

¹⁴ “TWO SUBJECTIVE TRIANGLES, one whiter than white and the other blacker than black, appear to have distinct contours, but when the contours are examined closely, they disappear. The contours are subjective and have no physical reality. The region bounded by the subjective contours appears to be more intense than the background even though the color of the inner and the outer regions is identical” (Knizsa, 1976: 48).

visual fictions. Following Gregory let us think about the instance of shadow writing. Here the term ‘writing’ is metaphorical; actually, it represents a particular form of art (or fictional vision?), Gregory by the example of visual art says, think of an artist, writing or, better to say, drawing some word(s) containing some real letters as if the letters are opaque objects and shadows of the letters are falling on the ground. In this artwork, we see the letters to cast such shadows, but practically, there are no stimulus patterns of the letters present there at all. Here the letters are evidently fictions that occur to explain what are accepted as shadows by postulating letter-shaped objects. From the example, we know that in this case, fictions fill the *gaps* in the signals to complete our vision. Now through this instance, we learned that not just gaps but the complete *absence* of signals also can make us see (regarding) objects by data through visual fiction. In this second kind of instance, our brain opts the method of downward processing to process perceptual hypotheses. Although visual fiction is a positive kind of illusion, it generally proves quite useful, but essentially it is wrong. Being illusion, nature wise, fictions contain enough potency for deception. These examples show that in the Gregorian context of perception, “we cannot equate neural signals with experience” (1980: 128).

3.8: Conclusion

In the beginning of the conclusion of this chapter let us remind once again that in the introduction of this chapter, we anticipated a question that what is the significance of having a discussion about a model of indirect perception in middle of the thesis that potentially considers the direct approach towards perception as appropriate for conceptualising the visual experience of embodied human being? In reply, we said that our intention is to highlight the process aspect of direct perception, via demonstrating that the indirect approach to perception is inadequate as a conception of human visual experience. First of all, it must be pointed out that there are a

numbers of points ,on the basis of which the supporters of indirect perception criticise Gibson's theory of perception. We will mention a few of them, which are relevant to the central theme of the thesis. They argue that Gibson does not talk about the role of the brain in his account, which makes his theory unscientific and so, unacceptable. Two, the concept of direct perception of external objects and the external world is absurd because for them it is impossible to perceive objects as they are in themselves. Objects are inferred by the perceiver depending on the relevant sense-data. Three, the proponents of direct perception, including Gibson do not consider learning as an innate factor in perception. Instead, it gives priority to the faculty of experience. Four, Gregory and other information processing theorists argue that Gibson's concept of direct pick up of information is not intelligible, because information is always supposed to enter through the sense organ for mediating perception—this is an obvious fact. In the case, the perceiver has no control. But the phrase 'pick up' indicates the conscious and intentional state of a person during perception. These are the four main objections against Gibson's theory among many. However, these four points do not embody flaws in Gibson's theory per se. We already have talked about Gibson's position regarding all of these *objections* in the first chapter. Yet it will be useful to recall responses to these objections from a Gibsonian perspective in the present context. In response to first objection, Gibson says in the 'Introduction' to his book, *The Ecological Approach to Visual Perception* (1979) that he does not deny the presence and role of the brain because that would be insane and no one trying to understand the mechanism of perception can do that in his or her right mind. In fact, Gibson suggests that the picture that vision depends on the eye, which is connected to the brain, is over-simplistic. The total picture is that "natural vision depends on the eyes in the head on a body supported by the ground, the brain being only the central organ of a complete visual system" (1979/1986: 1). Selective mention of the brain is

unwarranted as Gibson's aim is to provide a holistic understanding of how vision occurs. Further, under no interpretation can his theory be considered unscientific because Gibson being an empirical realist builds his theory on the foundations of geometry, physics, and physiology, which are among the established sciences. In defence against the second objection, it can be said that as an empirical realist he has plenty of arguments to accept the existence and perception of physical objects as they are. These arguments are mentioned in great detail in Chapter 1. According to Gibson, people can *directly see* objective information, which acts as material for perceptual processing. Sense-data or stimuli are just one type of ingredient for perceptual processing; they are neither the only ingredient nor the most important ones. Hence, they are not the ultimate determinants of the entire perceptual process. The following diagrams will show how the contrast between the Constructive model and the Direct model may be conceived.

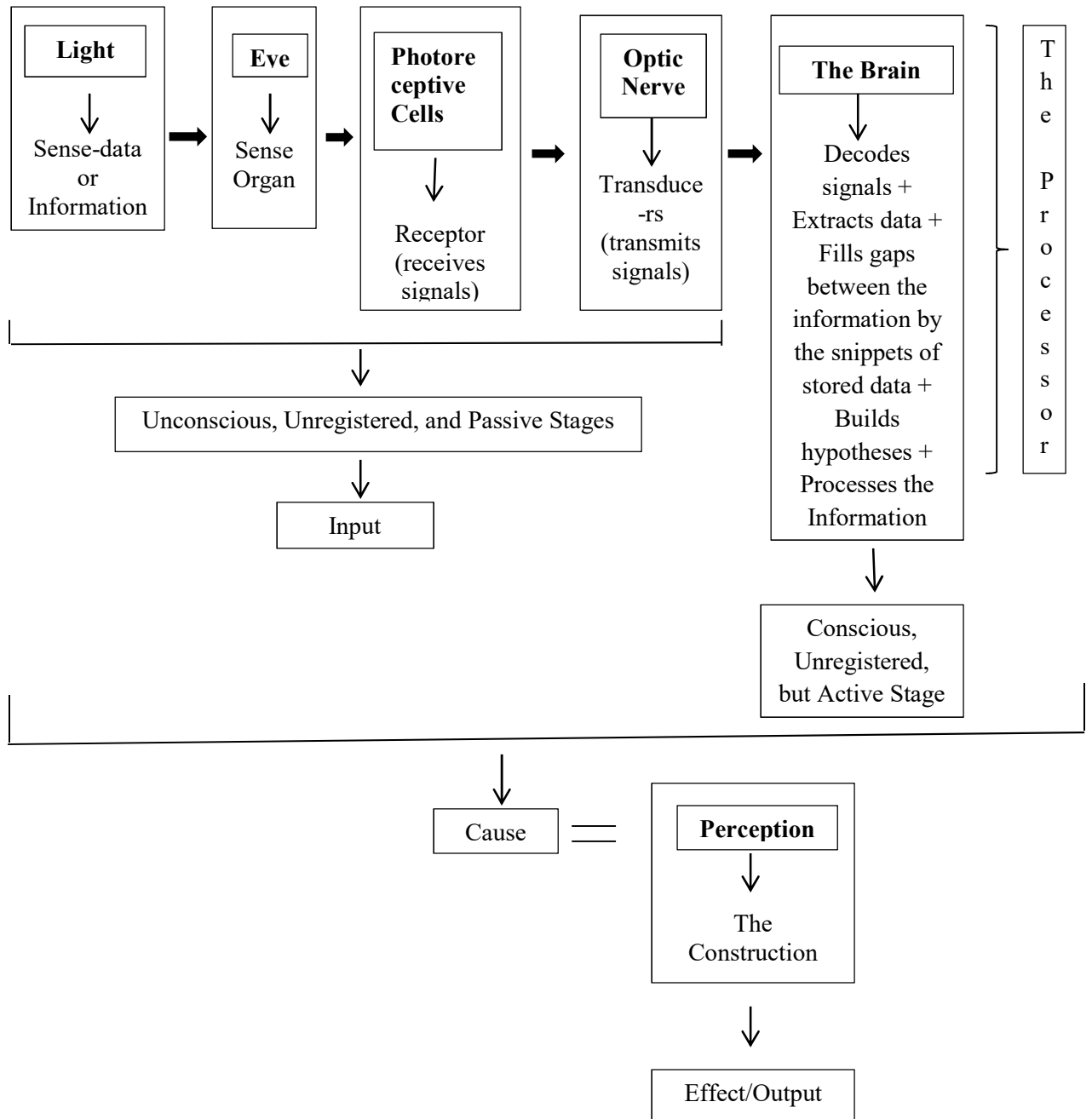


Figure: 13

The Diagram of Constructive Theory of Information Processing View

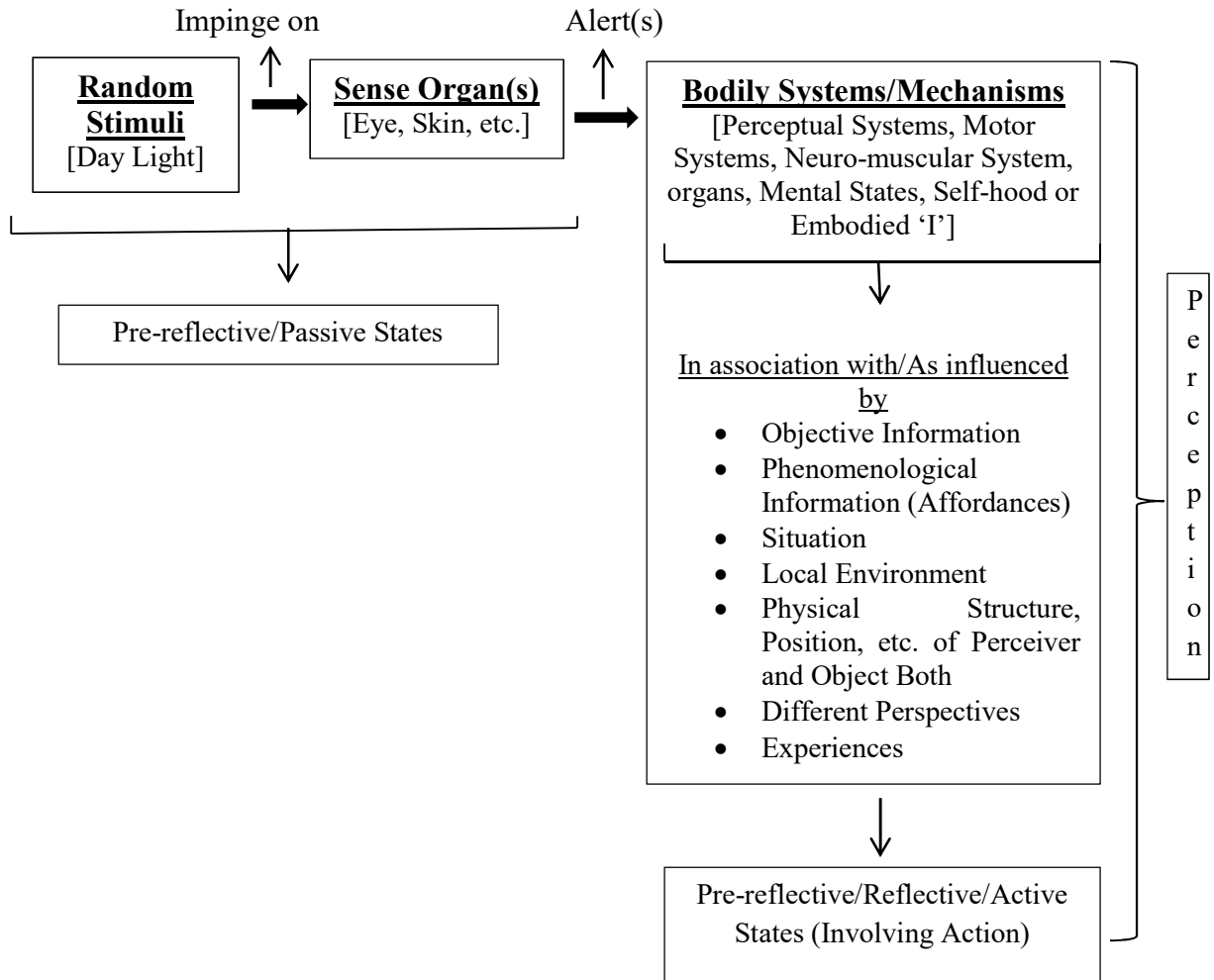


Figure: 14

Diagram of J.J. Gibson's Theory of Visual Perception

Well, before answering the third objection we need to recall the meaning of 'innateness' in the field of constructivism following Gregory. His sense of 'innateness' is different from the metaphysical sense of innateness, which refers to the notion of knowing something before experiencing or perceiving it due to the very existence of the innate knowledge in the person concerned. Unlike the traditional sense of innateness, Gregory does not say that a person inherits the *content* of knowledge in the form of an innate idea or principle, for example, we can talk

about the innate ideas of triangle, God, mind, principles of logic, etc. The knowledge of these kinds of entities does not depend on experience as they seem to be embedded in the very existence of the person.

Gregory considers the notions of innateness in a different manner. He argues that perception itself is a kind of skill to see or know the world and to behave accordingly. The skill is dependent on the faculty of learning. He adds that, learning shapes perception. For him, the faculty does not only involve experience, experiments, or trial and error methods. Sometimes it requires the help of inherent characteristics or abilities also, which a human being inherits from her ancestors, through the genetic code. Gregory (and the indirect theories, in general), accepts the presence of such innate elements along with memories and the activities of the brain as the *subjective contribution* to perception. As the proof of the role of innateness in perception, Gregory mentions the case of the experiment of “Visual Cliff” (1960) by Eleanor J. Gibson and Richard D. Walker (see Appendix-2). Through the experiment, they show that infants of all animals, especially human infants have the inborn ability to perceive depth and to avoid sharp edges as they move about. With the reference to this experiment, Gregory says further that the case of responding to mother’s words and gestures by an infant, without knowing the meaning of the language used in the words, also refers to the presence of innate elements in learning perception.

J.J. Gibson does not admit innateness either in learning or in perception. For him, perception is all about *direct* pick up of information from the surroundings. Here, by the term ‘direct’ he means an immediate encounter between perceiver and the percept. By learning, Gibson understands the experience. Experience of how to interpret information to see the right meaning of the percept or sometimes, seeing some different aspects or meanings of the same object apart from the conventional one. It is not the case that Gibson denies the fact of inheriting some

properties from the family-gene. But for him, these properties shape the orientation of a person, influence her body-perspective but apart from this little contribution the inherited properties have nothing to do in the process of perception. Regarding the experiment of the visual cliff, on behalf of James J. Gibson, we may argue that it is not the case that the inherited knowledge or tendency of avoiding depth or sharp edges makes the child-subject avoid the particular side of the box-surface that is hollow from the inside. It happened because the child's perceptual system and her body directly see all of the information that is available there and picks only familiar ones. In the experiment, the infant starts to crawl from the solid-looking side of the box and the solid-looking part of the box's surface is wide enough for her body. Therefore, during crossing across from one side to another side she picks up a particular type of information and pattern from the ambient optic array, which she sees as providing support to her body. However, as the edge of that portion appears suddenly the hollow portion that represents *the visual cliff* appears before her with completely different and unfamiliar information. Therefore, naturally, this new situation makes her uncomfortable, anxious and she leaves or avoids that side of the box to crawl on. Since she does not have enough experiences or zero experience about the new situation that is why she or her body chooses to leave that hollow-looking side and turns back from the edge of the wooden bit that represents the sharp edge there. It is a universal tendency of the organism in general that its body is accustomed to avoiding an unfamiliar, unknown object, situation, or environment. Therefore, it is unnecessary to say that some innate learning makes the child-subject to avoid the depth and the sharp edge. For, there are some examples of such cases where it has been seen that in real situation infants access such an object, part of some surface, (or allow some person to come near to her), which she was rejecting or avoiding repeatedly, before. The explanation is, through the repeated encounter with the unfamiliar object, etc. slowly the

body of the perceiver recognises the object being avoided as the ‘unfamiliar object’ becomes familiarised to her with that name. And after some time her body starts to collect information from that object or the part of the surface to access it. According to Gibson instead of subjective innate elements, the phenomenon of body percept works here.

In defense against the fourth and last objection, it can be said that, for Gibson, every perceiver, over and above being a human being or a person, is an *individual*. As an individual everyone carries her own identity, intentionality, responsibility, etc. for her desires, actions, and other things. As an action, perception also depends on the individual’s wishes, needs, etc. Therefore, for perception which information is to be picked and which is to be left out or ignored that also naturally depends on the perceiver. As an intentional individual everyone has their own choice for selecting or picking up information.

Again, in respect of the main focus of our thesis, we can say that the proposal that perception is indirect and is the result of information processing by the brain is not irrational or totally beyond logic but it is not well-suited for the goal of understanding vision as embodied. Following the method of information processing, in general, and the process of construction, in specific, it is difficult to explain how perception may be embodied. Let us see how and why the model of perception that emerges from the constructivist view of indirect perception is inadequate for an understanding of embodied perception.

Although, we will discuss embodied perception elaborately in Chapter 5, still to keep the relevance of the arguments, here, I am discussing the concept of embodiment and the embodied perception in brief. Embodiment is one of the core concepts of existential phenomenology that pays importance to the body of human beings. It considers the body as a complete structure that

includes the brain, sense organs, motor organs, neural system, muscular system, mind, mental states, everything along with the self-hood or the 'I' as the owner of the (conscious) body. It emphasises the aspect of the role of the body of an individual and refers to the subjective and lived aspect of her experiences. In this context, the body is not considered as a mere mechanical device that works only at the level of physiology. It works dynamically. The embodiment theory and the theory of perception complement each other. The important thing in this context is that the concept of perception that is complemented by the embodiment theory is not the indirect one. It involves the direct and immediate presence of the perceiver during the occurrence of perception. This concept involves the role of an individual's conscious bodily interaction with the environment and situation(s). It refers to the actions of the motor system, perceptual system, etc. of the body. The theory holds that the cognition of an individual is shaped by the experience of her body. The cultures, education, thought, training, etc. of a person are *embodied* by her body and are expressed according to the situation through the way of *enactment* of the required and relevant actions. From this perspective the body is not merely a material incrustation or container of the internal material stuff like blood, flesh, or neurons. But the body works as an intentional object that makes a person fit in some environment and deal with the present circumstances. From the perspective of embodiment the surroundings of the perceiver and the object both, their shapes, sizes, position, etc. mean a lot to process perception. These things affect the view and vision of the perceiver.

In this third chapter, we are trying to see whether our research hypothesis that 'it is only possible to explain the mechanism of embodied perception of a human being following the approach or model of direct perception, instead of the established approach of indirect perception' can be justified or not. We already have known about the mechanism of the *information processing*

scheme following one of its representative theories called constructivism by R.L. Gregory. Now, we will see whether our hypothesis proves as justified or not.

Let us start with the central problem in the indirect perceptual approach, that is, it does not talk about the involvement of the role of perceiver's body in the process of perception as the theories of direct perception do. According to constructivism, perception is an *active*¹⁵ process, in which the sense-data, at first through the sense organs and then following the related nervous pathway, reach to the brain. The brain actively processes the information that comes with the sense-data. Perception is a product of this processing. In this entire process apart from the brain of the perceiver, nothing else has any active role.

Sense-data from the external world enter through the sense organ *naturally*, because no one has control over it. Perceiver's role in this case is passive. As the sense-data enters through the retina of the perceiver's eye, they are received by the photocells in the eye. Photocells, as transducers, transfer those data to the brain. This act of transformation happens completely mechanically because the perceiver cannot control it and simultaneously she is not aware of it. Again, in this Gregorian process of perception, the role of the body is not just passive but mechanical. For it moves or works according to the command of the brain by the force of the motor system. Therefore, there is no active contribution of the body itself in the expression as well as the application of perception. As the brain drives it, it is driven.

The behaviour of the perceiver towards a particular object or the world in general is directed by the brain through its instructions. Therefore, we can say that the body is nothing but a device of

¹⁵ Let me remind, constructivist Gregory describes perception as an active process because according to him the entire process is dependent on the brain's activity only.

the brain, which is merely programmed to work in accordance with the brain's commands by the mechanical force of the motor system.

Constructivism accepts physical or *bodily* passivity and provides the credit for all kinds of action, irrespective of whether physical or mental, to the brain. The body, from head to toe, is like a chariot and the brain is the charioteer. This approach somehow indicates the categorical difference between the brain and the body, one as active and the other as passive. In this picture, it is difficult to represent the mutuality of the mind and body that is part and parcel of the idea of embodied perception. The body includes the brain and the motor system, and the body has consciousness, too. Together these work as a complete structure or system; none ruling over others, which is quite unlike the picture of the brain as boss, presented by the information processing approach.¹⁶

Constructivism does not accept the direct contact of the sense organ with the object. According to the view, no one can ever perceive the object as it is. Constructivism maintains, perception is a mediated process and it is mediated by some hypotheses. On the other hand, the idea that perception is embodied perhaps hangs best with the idea that perception is the direct interception of the object by the body and its sensory systems. In this (last) sentence, the term 'idea' that has been used a second time, represents the idea of embodiment as well as the direct perception. It involves the objective appearance of objects and accepts that everyone perceives objects as they are. The notion of direct perception argues that if the objects and the world remain out of the direct reach of the observer then how will the perceiver embody the utility of the object that she needs according to her present situation.

¹⁶ Although one may influence the others or the body may act independently, like in the cases of reflex actions.

This matter should be explained. The objects that are there in the environment all of these have some ability or abilities to serve some purpose. These features of *special* abilities of the objects are there in the environment as the features of those objects, being independent of all relative conditions. Now, when someone interacts with the environment then she can directly perceive the objects as well as the features of the objects. As the result of that, she can pick up or select those objects or objective features, which match her present need, desire, mood, situation, etc. and fulfills her own purpose. Sometimes, in some cases, if the expected object is not available at that moment in the surroundings then the perceiver picks up some completely different object and uses that to solve the need. It becomes possible because one, the perceiver, can see the special feature of the object called the ability directly and two, she perceives the *ability* in correspondence of the relation of compatibility between the form and shape of her own body and the aimed or perceived object. In the perception of the feature of ability she embodies the feature by the phenomenal form (or the body) of the relation of compatibility between the form of her own physical body and the form of the physical object. This process of embodying happens at a phenomenal level, in respect of the first person viewpoint of that perceiver. The entire process does not involve any concept-dependence or alike something and it remains beyond the reach of the awareness of the perceiver. The direct bodily involvement or participation of the perceiver makes the thing possible. It is to note that the special ability of some object is perceived with a generic form. That is why the perceiver can pick up the individuality of the feature along with the feature and therefore, she can embody it in respect of some substitute objects in absence of the exact expected object. The matter can be explained by an example. The special ability of the object named 'chair' is *sit-in-ability*. The ability as one of the features of a chair remains there in the environment independently. A person, who is familiar with the object chair and accustomed

with its use, can perceive the feature of sit-in-ability directly just by seeing the object. Simultaneously, she can embody the feature in respect of her own body and other features of the chair. For that reason, if at the moment of perception, she needs to sit, then just by looking at the chair she moves towards the chair to use it. The same behaviour she does if she finds some sit-able object, like an upturn bucket, the edge of a big suitcase, a big piece of rock, etc. instead of the conventional sitting-object chair. This kind of behaviour is intrinsically connected with the fact of direct perception as well as the fact of perceiving objects as they are in real.

‘Perception is all about learning’ — this claim of constructivism, seemingly, discriminates between perceivers of different backgrounds. In this context, it is important to note that *learning* separates *perception* from random seeing or vision. There are some skills required for perceiving, which are subject to learning. Learning of skills helps in forming hypotheses and having the perception, which is then reduced to just another form of inference. It is a fact that learning is necessary for the formation of cognition, being connected with the surroundings. But it is not so necessary to have some rigid belief in this regard. By the expression ‘rigid belief’ I mean that when someone learns how to recognise an object by its name and learns its use in some context and situation, then quite naturally that learning shapes her belief regarding the use of that object (as conventional one). But later in some other situation and context that object may be used purposely in some completely different manner, though the object’s name and the shape, etc. remain the same. For example, one may use her suitcase’s edge as a place for sitting while waiting for the train for a long while, despite knowing that a suitcase is not meant to be used as a sitting-object. The established and conventional use of a suitcase is containing cloths, toiletry, etc. kind of objects that can be carried during travelling. Now, if the person would have a rigid belief that the object called suitcase cannot be or should not be used for some other non-

conventional purpose then she would never sit on the edge of her suitcase. Inclusion of the characteristics that I am calling *the rigid belief* in learning stops a person to see the various uses of an object that it affords to the environment independently. The term ‘learning’ refers to the imbibing of socially and culturally established conventions, which include the familiar and safe use and understanding of names, concepts, and other specifications regarding any object of perception. This kind of attitude seems a little conceited as it broadly discriminates between different classes of perceivers on the basis of their learning and as learning depends on social status and other socio-cultural and political factors, this view of learning-based-perception is discriminatory to say the least. Also, one would be curious to know how such a theory of learning-based perception would explain the perception of such individuals as Tarzan, Mowgli or Robinson Crusoe. Also, there are people with unconventional attitudes like creative or literary geniuses whose visual experiences may not be fully captured by the picture presented by this idea of perception. Such elitism or discriminatory intellectualism is unheard of in the thesis of embodiment or in the notion of embodied perception. As I have construed the notion of embodied perception in later chapters, every organism on earth perceives things with only its body, bodily placement, orientation, needs, and requirements in consideration. There is a great amount of freedom in acts of seeing. For example, one may see an empty, big, and wide table as an object to sleep on and may do so. Civil society with its pre-conceptions born of regimented learning may deride this kind of action but under no circumstances can it be denied that the person ‘saw’ or ‘perceived’ the table as a place to lie down. Roadside taxi drivers often sleep on the hood of their taxis! Our learned brains tell us that the top is curved and it could lead to a bad fall! But even though we do not lie on taxi-tops in regular life, taxi drivers often do! They obviously see the hood as a place to lie on! The point is, the thesis of direct perception as well as

the embodiment thesis do not differentiate between seeing and perceiving. If the matter of learning refers to anything at all, then it can be nothing other than experiences gathered from previous perceptions, which instead of limiting one's perspective to pre-established systems of learning provides the perceiver, ground to find out more facts, more options, more uses, and gives greater flexibility to embody the situation. Moreover, by 'skills' the notion of embodied perception refers to the skills of coping that is done by the body only, outside the rule of the brain, by its own. The term 'coping' represents a special kind of action, in which a human being's body tries to match the surroundings in relation with time and situation to be fit in the environment. For surviving and making the environment a habitable place the body of a human being continuously keeps reading and understanding the environment as minutely as possible. The act of coping makes a person, especially her body, to become an expert in recognising the nature of the local environment and present situation and to respond or behave accordingly. Coping runs as an inseparable and essential part of the process of perception. Coping is a natural and instant action. It is a natural process, happens in a person's body at a very physical level. It is natural because the agent of perception or the owner of the body i.e. 'I'-consciousness does not have any control over the action. In fact, the agent is no way aware of the occurrence of the process. It is instant because the body does not wait to get the brain's command or any other kind of instruction in order to occur. As a person steps in some unfamiliar, unusual environment or situation her body instantly starts to cope up with the environment to recognise whether its ambiance is safe or not, habitable or not. From the beginning of life in this world, the body of a person starts coping with the surroundings in order to find their own place here. Sometimes it works, sometimes it fails. As the person grows up and becomes mature, the scope of failure

decreases. In short, the act of coping makes a person's body accustomed with its local environment and present situation. In effect, the person can behave or react properly.

We have criticised the issue of learning in perception from the perspective of a normal adult person. S.B.'s case (see footnote 2 and Appendix-1) and other similar cases are not our concern. For, in such cases, the mechanism of visual perception is different from that of persons with normal eyesight. Moreover, if the occurrence of perception were really dependent on the brain's ability of information processing or making hypotheses on the strength of sense-data, then sense-data was available to S.B.'s brain too. But every time his brain was failing to form hypotheses because he had zero visual *experience*. Simultaneously, one should note that his tactile, auditory, olfactory, and gustatory systems were working properly, because he used to possess the experiences, i.e. memory in Gregorian terms, regarding those kinds of perceptions. Lack of visual experiences was preventing him from *embodying* his surroundings, which made him a failure, visually insecure, and depressed. This shows that for perceiving embodying is necessary, and for that, *experiencing through direct contact* is essential. In connection with the issue of experience, one point that needs to be highlighted is that even in the embodiment thesis, the term 'experience' refers to the first-hand experience and in order to have first-hand experience, a person must have direct contact with the object of perception. But the position of constructivism denies that strongly and establishes the account of indirect and mediated perception that creates a distance of the constructivism from the embodiment thesis and makes the development of any notion of embodied perception on the basis of constructivism difficult if not impossible.

In addition, Gregory's account of the process of erroneous perception and its explanation does not help the view to come any closer to the thesis of embodiment either! Gregory, at the beginning of his description of erroneous perception, declares that erroneous perception or

illusion does not involve any separate kind of mechanism but also happens due to the same hypothetical process. The account of the erroneous perception given by Gregory can be used to criticise Gibson's model of direct perception because Gibson does not provide any separate account of erroneous perception or cognitive error. But that also does not help constructive account of indirect perception to reach closer to the notion of embodiment. Let me explain the matter concisely. It is true that there is no argument or explanation for the erroneous perception in Gibson's account of perception. But it is not difficult to understand the explanation behind the reason of error in perception. The basic process of the erroneous perception is not different from the veridical perception. Due to some disability or defect in visual sense organ, lack of experience, mental stress, etc., impulsive attitude of the perceiver, etc. internal problem the perceiving agent may fail or mistake to pick up proper information regarding the percept. As a result of that, her perception becomes erroneous. Apart from the internal reasons, there are some external reasons that are responsible for erroneous perception. For example, distance between the positions of the perceiver and the percept, condition (transparent, translucent, or opaque) of the medium of the environment, clarity and sufficiency of light, etc. are some of the mentionable reasons. Due to these reasons, the act of picking up information gets disturbed and following that error occurs in perception. It means, for erroneous perception also the participation of the perceiver herself in the process of perception is considered as one of the primary conditions. Therefore, on the ground of the absence of the explanation/account of the erroneous perception the Gibsonian view cannot be rejected.

We may see that the view of constructivism that represents the method of information processing cannot explain the meaning of embodiment in terms of embodied perception. Throughout the discussion of chapter one and two that represent the models of direct perception, do not contain

these flaws. In fact, those two models on the power of their empirical approach make the journey, towards the embodiment, smooth. The models of direct perception not only value the role of the body in the process of perception but both of the models prioritise the perceiver as an independent individual who has her independent desire, will, ability, etc. The matter of considering someone as an individual refers to the fact of paying importance to the presence of that person. This fact, in turn, values the action, emotion, decision, judgment, etc. of the *individual personality* or the *self-hood* of that person, which is embodied by a conscious object called the body.

Sautrāntika Theory of Perception: A Constructivist Perspective of Indirect Perception

I am going to talk about Sautrāntika Buddhists' view of perception that belongs to Indian philosophical school of Sarvāstivādī Buddhism. The approach of Sautrāntika philosophers towards perception has two different layers or aspects. Initially, it represents perception as a direct process but according to second kind of explanation perception is mediated. Apparently, it may seem confusing. However, both of the aspects appear, indeed, in a sequential manner and there is no confusion. Together the aspects complete the circle of perception and perceptual experience. In this thesis, I have chosen the view of Sautrāntika Buddhism in the category of indirect perception. I am aware that the step of mine is unusual, questionable. Perhaps no one will support it, because the Buddhist theory of perception, in general, is famous in the domain of Indian philosophy as one of the theories that claim perception occurs directly, without depending on any mediation. I am not denying the fact that according to Buddhism, especially the Sautrāntika Buddhism perception occurs directly. All I want to say is that in this thesis there is already a model of hard-core direct perception that has been presented and explained through the theory of J.J. Gibson (Chapter 1) and the theory of the Nyāya school of Indian philosophy (Chapter 2). In respect of that particular model of direct perception, Sautrāntika theory appears as not-direct. On the other hand, this theory fits well in the framework of the model of indirect perception that is represented by R.L. Gregory's theory of constructivism as well as the information processing theories in general. In the chapter, I will discuss the view of perception of Sautrāntika system in two sections. In the first section, I will describe the view of Sautrāntika

philosopher Dharmakīrti¹ on perception, following one of his significant writings, named *Nyāyabindu*. In this section, I will emphasise on the aspect of true perceptual cognition and the process of its occurrences. In the latter section, I will describe perception following Sarvāstivādin Vasubandhu's *Abhidharmakośa*. This section will contain the description of the process of empirical aspect of perception that represents perceptual experience and its application. Well, it is important to mention at this point that according to the philosophy of Sarvāstivāda, especially Sautrāntika system, the Sanskrit term '*pratyakṣa*' does not stand for both the aspect of perception that is cognitive aspect and empirical aspect. According to the Abhidharma schools of Buddhism, '*pratyakṣa*' exclusively represents the cognitive aspect. There is another term called '*saṃjñā*' for the representation of the empirical aspect of perception. These two aspects are sequentially linked to each other. *Pratyakṣa* precedes *Samjñā*. The basic internal mechanism of perception, whether it is cognitive or empirical, is quite similar² to the model of indirect perception that is represented through Gregory's theory of perception. For that reason, I have picked the Sautrāntika view as the anti-position of the model of direct perception. In the chapter, my main aim is to see, whether the position of Sautrāntika theory of perception is able to make a path to the notion of embodied perception that values the perceptual experiences of the embodied human beings, regarding this world.

In this introductory section of the chapter let me add a brief introduction of Sarvāstivāda as well as Sautrāntika system of Buddhism. Sautrāntika is a branch of Sarvāstivāda that belongs to the ancient school of thought of Buddhism called Theravada. Sarvāstivāda holds a kind of realism

¹ According to another interpretation or some *sūtras*, Dharmakīrti is interpreted belong to Yogācāra school as well. But I am not going into the that interpretation of Dharmakīrti because that will not serve our purpose. We will go with the Sautrāntika interpretation of Dharmakīrti.

² The issue of similarity between the Sautrāntika and Gregory's position will not be discussed separately with a deep emphasis, in the main body of the chapter. At some of the point of arguments, the issue may be just mentioned to maintain the relevance, nothing deeper than that. I am consciously avoiding the discussion in this chapter because one, it is little deviating from the main point of the thesis and secondly, it will take a separate chapter like space.

that fundamentally claims the real (*sat*) existence of everything in this world (*sarvam asti*). Sarvāstivāda, again, is divided into two schools of beliefs. One is called the Sautrāntika school and another is well known by the name of Vaibhāṣika school. According to the Sautrāntika school, physical world and objects exist but people can cognise them by inference only. Those are cannot be perceived, because the reality of those objects is hypothetical. On the other hand, Vaibhāṣikas belief that external objects exist and we can get them through perception. The objects are real (*sat*). It would be relevant to mention in this context, there are some fundamental theories in Buddhism like the theory of non-soul (*anātmavāda*), theory of momentariness (*kṣaṇikatvavāda*), non-permanence (*anityavāda*), and the theory of dependent origination (*pratītyasamutpādivāda*). These theories refer to the truth of the theory of non-divine cause (*anīśvaravāda*). Sarvāstivādins say that Gautam Buddha, categorically, neither accepts nor denies the existence of objects. Therefore, the claim of Sarvāstivāda is not, technically, inappropriate. The terms '*dravya*' means object and '*sat*' means real. This branch of Buddhism represents a kind of realism, though, whether this kind of realism goes with the notion of western realism that is a matter of debate. In this chapter, I am interested in concentrating only on the Sautrāntika view of perception.

After this introductory part in the next three sections, I will discuss the indeterminate perception following the view of Dharmakīrti's *Nyāyabindu* and determinate perception following Vasubandhu's *Abhidharmakośa*. Depending on the entire discussion, in the last section, including the conclusion also, I will see whether there is any road that can take one from the Sautrāntika view of perceptual process to the notion of embodiment or the embodied perception, or not.

4.1: True Perceptual Cognition

Nyāyabindu is one of the significant books of Dharmakīrti. Dharmakīrti belongs to the school of Sautrāntika Buddhism. According to Buddhism, in general, perception and inference are only two valid means of true cognition. In the chapter, I will only emphasise the process aspect of the theory of perception. But before knowing about the process it will be good to discuss the nature of true cognition that is called *samyag jñāna*, in short. At the beginning of *Nyāyabindu* Dharmakīrti, in the context of true look, says that “*samyag-jñāna-pūrvikā sarva-puruṣārtha-siddhiriti tad-butpādyate*” (*sūtra*-1). It means the true cognition is there in the root of all successful achievements (*puruṣārthasiddhi*). In *Nyāyabindu*, the intention of Dharmakīrti is to establish the true cognition and its importance through the refutation of opposing or differing arguments against it. By ‘*puruṣārtha*’, in this context, only the states of desire (*upādāna*) or rejection (*hāna*) to be understood. Technically, the sense of desire or rejection known refers to the state of attainment (*prāpti*). Dharmakīrti describes true cognition as *avisamvādaka*, which means, it is not contradictory or contingent in nature. On that ground, the true cognition itself is treated as a valid means of cognition (*pramāṇa*).

By the means of true cognition, it becomes possible to reach real (*dravyasat*) object without any error or illusion. In Buddhist context, only that kind of objects is considered as real, which is able to produce some meaning (*artha*) or effect (*kārya*). This nature of the object is well known in Buddhist terminology as *arthakriyākāritva* and the objects are called *arthakriyākārī*. Real objects by nature are there in the causal chain of creation because of the influence of the law of dependent origination. Again, there is another aspect or role of the true cognition. It causes volition (*pravṛtti*) for the attainment of a real object(s). True cognition contains only that kind of content that is not attained yet (*anadhigata*). There are only two types of objects that are

considered as the contents of true cognition—one is the bare particular (*svalakṣaṇa*) and another is the universal character (*sāmānyalakṣaṇa*).

Regarding the issue of true cognition, in the context of perception, it is to add here that according to Dharmakīrti indeterminate (*nirvikalpa*) perception is the actual form of perceptual cognition. Indeterminate perception represents the immaculate form of cognition that contains only the first representation of bare particular. It occurs as the immediate result of direct contact between sense organ and the percept. On the other hand, Dharmakīrti does not accept the determinate form of perception as ‘perception’. According to his explanation, if perceptual cognition involves something that determines the cognition then the cognition loses its purity and naturally becomes impure. Like erroneous elements, any kind of determining features of object also considered in the Buddhist system as false, unreal. For, these determining elements are not real but mere mental construction. Being imposed on the cognition, the elements create a kind of deception that makes a person consider the determinate appearance of cognition as real and persisting. For that reason, Dharmakīrti and other Buddhist philosophers do not agree to count determinate perception in the category of *pratyakṣa*. In the next sub-section(s) I will describe the nature and process of indeterminate perception. And after that I will focus on the description of determinate perception, separately.

4.1.1: Defining Dharmakīrti’s Account of Perception

In the definition of perception, Dharmakīrti says “*tatra pratyakṣam kalpanāpoḍam jñānam abhrāntam*” (*Nyāyabindu*, *sūtra*-4). Dharmakīrti, following the tradition of Buddhist epistemological, accepts that perception and inference are only two types of means of true cognition are there. In the definition of perception by the first word ‘*tatra*’, he refers to these two types. According to him, between these two kinds, perceptual cognition has to be free from all

kinds of conceptual construction (*kalpanā*). It also has to be free from all kinds of errors and illusions (*abhrānta*). To explain the meaning of conceptual construction Dharmakīrti says that “*abhilāpa-saṃsarga-yogya-pratibhāsā pratītiḥ kalpanā*” (*Nyāyabindu, sūtra-5*). That means conceptual construction is such a type of cognition that is open to be associated with verbal designations (*abhilāpa*). The expression ‘verbal designation’ includes spoken words, names, etc. qualifying features that have some meaning and reference. If someone, looking at some object, recognises it, and says ‘it is a table’ then it is clear that the person is aware of the *concept* and *name* of the object. For that reason, she can properly associate the designator (*abhidhāna*) to the right object called the table (*abhidheya*). In this regard, Dharmottara adds that through conceptual construction the association between the designator and designated is presented being wrapped in a piece of cognition³. Well, in this context the word ‘designator’ refers to the name, etc. attributes and the word ‘designated’ refers to the substance, on which the attributes are supposed to be applied. In the above-mentioned example, the word ‘table’ is the attribute of the substance table. It is important to add here that by conceptual construction, not just spoken words or verbal expressions are represented but the *ability* or *probability* of verbal expression also get represented. The term ‘*yogya*’ in the definition means the capability of verbal expression. Following this link, it is also to say that the description of conceptual construction, by Dharmakīrti, includes the conceptual constructions of infant, mute, and dumb people too. It means that there is no reason to consider that the people, who do not have the capability for using verbal expressions, they cannot have conceptual construction. The idea of *kalpanā* includes conceptual construction in general, whether it has an association with words, articulated

³ “*abhilāpyate-aneneti abhilāpaḥ vācakaḥ śabdaḥ. Abhilāpena saṃsargaḥ--abhilāpasamsargaḥ--eksmiṇ jñāne-abhidheya-ākāśasya-abhidhāna-ākāreṇa saha grāhya-ākāratayā tatou jada-ekasmīna-jñāne-abhidheya-abhidhāna-yorākārī samnibiṣṭou bhavataḥ-tadā saṃsr̥ṣṭe abhidhāna-abhidheye bhavataḥ. Abhilāpa-saṃsargāya yogyo-abhidheya-ākāra bhāso yasyā pratītou sā tathouktā.*” (*Nyāyabindutīkā*, p.47-48).

representations or not. The very idea of *concept* includes symbols, signs, gestures, also along with spoken words. Everyone has her own concepts in her own mind. Therefore, when a mute person or an infant by listing the word ‘table’ moves or simply look towards a real substance *table* then their behaviour prove that they have the understanding of table, they have the conceptual construction in a latent form.

On the other hand, the meaning of the term ‘*apoḍam*’ is absence or negation. Therefore, together ‘*kalpanāpoḍam*’ refers to such a state of (perceptual) cognition, in which there is no conceptual construction. According to Buddhism in general, the perception has to be indeterminate (*nirvikalpa*). The indeterminate character of perception makes it pure. According to Dharmakīrti, (unlike the Nyāya System) in the indeterminate state the perceiver only receives the manifested appearance (*sphuṭa rūpa*) of the object of perception.

The second term of the definition is ‘*abhrāntam*’. Dharmottara in *Nyāyabindutīkā*, to explain ‘*abhrāntam*’ says that “...*abhrāntam-arthakriyākṣame vasturūpe-aviparyastam-uccate*” (1971:41-42). It means that the non-erroneous cognition never opposes or contradict the capability of an object’s causal efficiency i.e. *arthakriyāśakṣmatā*. To describe the matter of capability of an object’s causal efficiency Dharmottara again says that “...*arthakriyākṣamam ca vasturūpam sannibheṣa-upādhi-varṇātmakam*” (1971:42). The phrase ‘*sannibheṣa-upādhi-varṇātmakam*’ in this description defines the capability of an object’s causal efficiency. Durvek Miśra, to explain the phrase ‘*sannibheṣa-upādhi-varṇātmakam*’, says that the term ‘*sannibheṣa*’ refers to the form, shape, or structure of the object. The term ‘*upādhi*’ refers to the qualifications of the object like meaning, name, etc. The term ‘*vastu*’, in Dharmottara’s description, refers to the qualities of the object like colour, etc. Every object definitely owns some shape like circular, square, etc. However, these shapes are nothing but the ephemeral qualities (*prātibhāsika*

dharma) of the object. The colour, size, etc. qualities are not there in the object as its constituting elements, but those appear only in the cognition of that object. Therefore, to Dharmattaro and other Sautrāntikas, these qualities are considered as mere ephemeral. According to Dharmakīrti, a physical object is constituted by the association or collection (*samaṣṭi*) of atoms (*paramāṇu*). That is why the object also is known as *paramāṇu-saṃghat*. Depending on the particular arrangements or orders of atoms' association, the form, etc. qualities of objects varies. And, following those variations, the causal efficiency of objects varies. Due to different arrangements of the atoms' association, the causal efficiency and use of the objects varies. For that reason, the purpose of a jar differs from the purpose of a table. According to Buddhism, since atoms are perceptible, therefore, the arrangements of the atoms' association that form different objects, are also perceptible. Along with the object its unique characteristic i.e. the causal efficiency becomes perceptible, too. The perceptual cognition in a certain and non-erroneous manner represents the causal efficiency and simultaneously it denies the presence of conceptual construction in perception.

4.1.2: An Account of Error in Perception

In the context of the extended discussion of the condition '*abhrāntam*', Dharmakīrti has talked about four kinds of reasons that cause error in perception⁴. Those are *timir*, *āsubhramaṇa*, *nauyāna*, and *saṃkṣobha*. In this part of discussion, Dharmakīrti mentions that like erroneous perception pseudo perception also is barred by the term that refers to the negation of error. In some cases, it happens that the perceptual cognition represents the causal efficiency of the percept, but the cognition itself is not free from error. For example, during traveling in a speed-boat a person sees the trees in the river banks as moving in the opposite direction of the speed-

⁴ “*Tayā rhitam timira-āsubhramaṇa-nauyāna-saṃkṣobh-ādi-anāhita=bibhramam-pratyakṣam*”—*Nyāyabindu: sūtra-6*

boat. In this case, the cognition is free from conceptual construction and the perceiver receives a sort of causal efficiency of the trees, too. In this case, the motion of the trees is not the perceiver's mental construction instead, her perception occurs directly. Due to the law of relativity, the motion of speed-boat is imposed on the trees in the river-banks. However, the fact does not make the visually received cognition of trees in the river-banks, true (*saṁvādaka*). To make sure the truth or purity of perceptual cognition, Dharmakīrti consciously adds the term '*abhrānta*' in the definition. The fact is, referring to the causal efficiency of the percept, alone, does not make a cognition veridical or true. Simultaneously, the cognition has to be free from every kind of errors, whether it is caused by physiological or cognitive reason.

Moreover, there is another reason for what Dharmakīrti emphasises on the condition of being non-erroneous that is sometimes due to some reason or situation the perceptual cognition, despite being free from the cognitive construction, may not refer to the causal efficiency of the percept. In this kind of cases, the cognition instead of being perception becomes *pratykṣābhāsa* or pseudo perception. As an example of that, we may mention the cases of perception with a defective eye. Due to the defect in visual sense, the perceiver faces problem in receiving the bare particular as well as the causal efficiency of the percept, properly. To keep outside the inclusion of these kinds of fallacious cases (*ativyapti*) the term '*abhrāntam*' has been added in the definition. Usually perception is affected, broadly, by two kinds of reasons. The first kind of reason occurs due to cognitive construction or insufficient cognitive awareness (*jñānagata aparyāptatā*) and the second kind of reasons happen due to some lacking in sensory organ or some physical disturbance. Under these two broad categories, Dharmakīrti has talked about four such reasons that cause error in perception. Those are *timir* i.e. defective or morbid vision, *āśubhraman* i.e. rapid movement of the object of perception, *nauyāna* i.e. traveling on a fast-moving vehicle (that

represents the rapid movement of the percept as relative to the motion of perceiver and her location), and *samkṣobha* i.e. physical disorder.

Now, we can have some idea about the four kinds of reasons for the error, in brief. *Timir* is a kind of disease of the eye. It causes defect in vision by affecting eyes of a person. Therefore, we can say that this case of illusion is located in the sense organ. *Timir* is only one example of *physiological reason* for erroneous vision. However, by this particular example of *timir*, Dharmakīrti refers to all kinds physiological cases that are responsible for the defective or morbid vision. The other three types of reasons are responsible for cognitive error in perception. Regarding the morbid vision, we can argue, due to the physiological reason the sense organ of the perceiver gets affected. Following that, the contact of sense organ and percept also get affected. As the result of that, despite the presence of bare particular, due to the defect in internal constituting arrangement of visual sense organ, the perceiver fails to receive the causal efficiency of the object of perception. On the other hand, in the cases of cognitive error, the contact between sense organ and object get disturbed and so, the error occurs. In the case of the rapid motion of fire band, because of the rapid motion of the band, the perceiver, who is standing in a far distance, cannot see (or understand) that the moving band is not completely on fire. Instead, at seven or eight points in it, around its gyre, there are fires. Therefore, as her sense organ is connected with that moving band, instead of getting individual and separate bare particulars from each of the fire-points on the band's gyre, the perceiver receives all of the particulars together, in a merged manner. Due to the rapid motion, the gaps between two successive bare particulars of fire-points become merged with each other and as a result of that, the perceiver sees a whole circle of fire. In this case, perceiver remains static and the object of perception moves in such a

rapid motion that it becomes impossible for a human being's visual system to go with. Therefore, the illusion occurs.

Again, in the case of traveling in a fast-moving vehicle, the rapid motion causes the illusion. However, in this kind of case, the object of perception remains static and the perceiver moves. Due to the rapid motion of the visual sense organ, it fails to receive individual bare particulars in respect of individual trees in the riversides. The speed of the vehicle as well as the perceiver's visual sense organ, get imposed on the object of perception i.e. the trees in the riversides and the perceiver sees the trees as moving in the opposite direction. The rapid motion disturbs the contact between the sense organ and its object of perception and so, illusion happens. The perception becomes inaccurate or erroneous. The third and last reason for the cognitive error is different from the previous two. This is the case of hallucination. In this case, the objects of perception are illusory. The sense organ of the perceiver is connected with imaginary or hallucinatory objects, like burning pillars, etc. The perceiver being affected by internal elements like gas (*vāyu*), bilious (*pitta*), etc. In this case, since the object of perception itself is not real but hallucinatory, therefore, there is no scope to get the bare particular or the causal efficiency of the object.

4.2: Types of Perception

According to Dharmakīrti, there are four types of perception – *indriyajñāna* i.e. sensory perception, *manovijñāna* i.e. mental cognition, *ātmasaṃvedana* or *svasaṃvedana* i.e. self-consciousness or self-cognition, and *yogijñāna* i.e. yogic apprehension⁵. Dharmakīrti defines the **sense-perception** only by the term “*indriyajñāna*” (*Nyāyabindu*, *sūtra*-8). Dharmottara interprets the definition by saying that the cognition that is produced depending on the sense organs is

⁵ In this chapter I will not talk about yogic apprehension, because it does not involve the perception of common people but the ascetics' and seers'. Therefore, it will deviate the approach of the proposed context of the thesis to some other direction.

called sense-perception.⁶ Durveka Miśra adds in the support of the interpretation that there are five types of sense-cognitions like visual, auditory, olfactory, gustatory, and tactile. Every type of cognition dependent on its relative sense organ in order to be produced.⁷ For example, visual sense-cognition occurs depending on the eye, auditory sense-cognition occurs depending on the ear, and so on. In this context, it is necessary to note that according to Dharmakīrti, cognition, in general, causes by cognition (*vijñāna*) only, instead of the sense organ. Sense organ is merely a physical part. It does not possess the capability to produce cognition. Sense organs only remain present there to be connected with the physical objects (although this contact between sense organ and object is not as prominent as Naiyāyikas describes, because according to Buddhist account, physical objects cannot be known as it is due to the law of momentariness and law of impermanence). Each of the sense organs can be connected only with its own type of objects. for example, eye only can be connected with the colour (*rūpa*) of objects because the eye and the colour of objects both are made by the fire element (*tejas*). Therefore, in the case of sense-perception also cognition perceives the colour, etc. of objects. The bare particular of an object does not appears before its relative *sense organ* instead, it is represented (*pratibhāsita*) in the sense perceptual cognition. A person attains objects by perceptual *cognition* only. It is true that, in a sense, sense-perception is based (*āśrita*) in the sense organs, from which it literally follows that sense-perception is based means contained in the sense organs and it is produced by those sense organs, too. But Dharmottara says that is not the correct interpretation. He explains that though this is the etymological meaning (*byutpatti-nimitta*) of the phrase ‘*indriyāśrita*’, it is not applicable here. In this context, the phrase ‘sense-perception’ refers to the production of the cognition through the attainment (*prāpti*) of the senses. The cognition of sense-perception that

⁶ “*Indriyasya jñānam indriyajñānam. Indriyāśritm yat tat pratyakṣam.*” – *Nyāyabindutīkā*: 56

⁷ “*yad-indriyeṇa janyate tad-indriyasya bhabati...*” – *Dharmottarapradīpaḥ*: 57

occurs by attaining its relative sense-organs, like eye, etc., in that cognition the act of direct encounter with the form (*artha-sakṣātkāra*) of the object also coexists. This act of the direct encounter with the form of object, indeed, is the actual reference (*prabṛttinimitta*) of the term *pratyakṣa*. Dharmottara adds that the case of acceptance of referential meaning, instead of etymological one, makes possible the inclusion of mental cognition, self-cognition, and yogic apprehension under the coverage of the definition of perception. For, these three types of perception do not involve direct contact with the sense organs, in order to be produced. For Dharmakīrti instead of the senses cognition is the cause of other cognitions. Therefore, in this case the cognition i.e. *samayag jñāna* is considered as both cause (*pramāṇa*) and effect (*pramāṇa-phala* or *pramā*).

At next to define the second kind of perception that is called **mental cognition**, Dharmakīrti says, “*svaviṣya-anantara-viṣaya-sahakāri-indriya-jñānena samanantara-pratyena janitaṁ tat-manoviñāna*” (*Nyāyabindu, sūtra-9*). *Manoviñāna* i.e. mental cognition is little complicated to understand in comparison with the first one. In mental cognition, the object (*viṣaya*) of the sense-perception, is involved as the subject-matter of this very state. In the definition, the term ‘*sva*’ refers to the cognition of sense-perception itself. Mental cognition is generated by sense-perception. Mental cognition immediately succeeds the sense perception. Mental cognition’s content is homogeneous to the sense perception (*samanantara pratyaya*). This homogeneous cognition co-operates (*sahakārī*) with the immediately succeeding copy of moment (*kṣaṇa-santāna*), which is the second moment of the content of the sense perception.

More clearly explaining that the content of the sense perception is the main percept i.e. the bare particular of the object (*vastu svalakṣaṇa*). At the immediate (*anantara*) next moment of the contact between the sense organ and the bare particular (*svalakṣaṇa*), the sense-perception

occurs. Although the moment of the *occurrence* of cognition is considered as the very first moment of sense-perception, from the perspective of existence, this moment is, technically, the second moment of existence of the *object* of sense-perception. According to the law of momentariness no object exists at its second moment, but it leaves its copy (*santāna*) at that second moment. Therefore, at the exact existing-moment of the sense perception, the cognition of sense-perception and the copy of bare particular, stay together. and at its immediate succeeding moment the sense-perception causes mental cognition, which (directly) involves the copy of bare particular that is the coexistent of the sense-perception.

That is why the content of the sense-perception and mental cognition are homogeneous. The bare particular appears (*pratibhāsita*) for the very first time in the state of sense-perception. In respect of that moment, the immediate second moment is the moment of the mental cognition. Since this second moment of mental cognition is homogeneous to its preceding first moment, it is called *upādeya kṣaṇa* or the caused moment. On the other hand, the moment of sense perception is called *upādāna kṣaṇa* or the causing moment. It is to note that in this context we are talking about *moments* from the perspective of the appearance of the object for the very first time in perception. In the definition of mental cognition, Dharmakīrti has used the term ‘*viṣaya*’ twice. I just have discussed the significance of the first application of the term. Regarding the second application, it is to say that to avoid the inclusion of the associating conditions like light, etc. in the definition of mental cognition, Dharmakīrti put the term ‘*viṣaya*’. At the moment of mental cognition, along with the copy of bare particular, the copies of associating conditions like light, etc. also remain present there. Since apart from the copy of bare particular nothing can be the percept of mental cognition, therefore, to avoid misinterpretation as well as the fallacy of over pervadedness the term ‘*viṣaya*’ has been added there. At the next it is to say that the term

‘*sahakārī*’ in the definition of mental cognition refers to the sense perception, once again. The content of the sense perception and the mental cognition are not just homogeneous but in respect of cognition they are co-operative (*sahakārī*) with each other. In description of homogeneous cognition Dharmottara says, in a continuous stream of cognition, when one cognition causes another cognition, then the cognition of the first moment is recognised as the cause (*hetu*) of cognition of the second moment.

Ātmasaṃvedana i.e. **self-consciousness** is the third type of perception according to Dharmakīrti. It is also known as *svasaṃvedana* i.e. self-cognition. To define this type of perception Dharmakīrti says, “*sarva-citta-caityānām-ātmasaṃvedanm*” (*Nyāyabindu*, *sūtra*-10). Here the terms ‘*citta*’ means consciousness that may be considered as the mind and ‘*caitta*’ means mental phenomenon. The meaning of the definition is that every consciousness and every mental phenomenon are self-conscious. The term ‘*caitta*’ refers to those states, which apprehend the specific aspects of the object. It also refers to the states of pleasure, pain, aversion, indifference, etc., which are related to those apprehended specific aspects of the object. According to Dharmakīrti, all kinds of mental states can be cognised directly. Self-consciousness represents such a kind of cognition that is capable to apprehend the mind and mental states. Therefore, in respect to the process of self-consciousness or self-cognition, it can be said that it is the result of the act of cognising the cognition itself. According to Dharmakīrti, cognition, in general, always contains the form (*artha*) of the objects. In this case, also self-cognition contains the forms of objects, whether those are universal (*pāramārthika*) or conceptually constructed (*kalpita*). Regarding self-cognition, it is important to mention that there is a special significance of the term ‘*sarva*’ in the definition of self-cognition. Dharmakīrti says that every human being is aware of the feelings or felt states of pleasure, pain, etc. (*vedana*) These states are manifested (*sphuta*) to

everyone. In self-cognition, instead of having feelings about the content of cognition, a perceiver feels (cognises) the states of pleasure or pain itself. By the term, ‘*sarva*’ Dharmakīrti refers to all kinds of cognitive states irrespective of *citta* or *caitta* divisions and says that people have the perception of all kind of cognition itself. This perception is indeterminate because it is free from verbal expression and cognitive construction. Moreover, in this kind of perception perceives cognise their self-existence, though they do not registrar the fact. In this mode of perceptual action the self-cognition (*ātma-bodha*) appears in an indeterminate manner, instead of the form of the explicit-‘I’ (*aham*).

4.3: Object of Perception

Following the link of the discussion of perception, it is necessary to talk about the *viṣaya* of perception. to describe the object of perception Dharmakīrti says “*tasya viṣayaḥ svalakṣaṇam*” (*Nyāyabindu*, *sūtra*-12). In the description, the term ‘*tasya*’ refers to the perception or perceptual cognition. According to him *svalakṣaṇa* i.e. the bare particular is the object (*viṣaya*) of perception. All the four kinds, for indeterminate perception, cause depending on the bare particular.

In order to describe the etymological structure of ‘*svalakṣaṇa*,’ Dharmottara says, “*svam-asādhāraṇam lakṣaṇam tatvam*” (*Nyāyabindutīkā*, 70). In this description, the term ‘*svam*’ refers to the unique feature (*asādhāraṇa lakṣaṇa*). The feature is called unique because a bare particular exclusively belongs to its base-object only, and nowhere else. And as the meaning of the term ‘*tatva*’, the pure nature (*svarūpa*) of the object can be understood. Following the link, Dharmottara adds that the features of an object, in general, dividable into two categories of universal and unique. The universal features belong to every individual object of a particular category (and species). On the other hand, the unique feature belongs to a particular object as its

exclusive property. One can have this unique feature only through perception. The universal feature is not the object of perception but inference.

At the next, Dharmottara adds that from the perspective of the means of cognition (*pramāṇa*) the object of cognition appears in two different modes. One is called *grāhya* i.e. object that could be received and the other is called *prāpanīya* that can be interpreted as the object of attainability⁸. When the represented form (*pratibhāsita*) of an object of cognition completely matches the form of the real object, then the object *in* cognition, having the represented form, is called the *grāhya* or receivable object. In this sense, only bare particular deserves to be called a receivable object of perception. This receivable object provides ground (*hetu*) to other things to be caused. For that reason, in Buddhist terminology, it has a technical name i.e. *ālambana pratyaya*. On the other hand, the object of attainability does not appear in the cognition but it is cognised by the cognition. The attainable objects, definitely, are not true objects of perception and so the perception of this kind of objects, naturally, involves conceptual constructions. In the comparison of an attainable object with a receivable object, it can be said that a person does not feel the receivable object as desirable or else, because it is beyond the reach of her awareness. Whereas, an attainable object is meant to be desired or shunned, in short, to be attained.

Well, in the definition of the object of perception i.e. bare particular, Dharmakīrti says, bare particular is such a thing that affects (*bheda*) the degrees of manifestation (*sphutatva* or *asphutatva*) of the representation of percept in cognition, being in a closer (*sannidhāna*) or in a far distance (*asannidhāna*), from the perceiver⁹. Again, Dharmakīrti says that bare particular is

⁸ “*Dvividha hi viśayaḥ pramāṇasya—grāhyaśca yad-ākāram-utpadyate, prāpanīyaśca yam-adhyavasyati. Anyo hi grāhyo-anyaśca-adhyavaseyaḥ.*” – *Nyāyabindutīkā*, 71

⁹ “*yasya-arthasya sannidhāna-asannidhānabhyam jñāna-pratibhāsa-bhedasya-tat svalakṣaṇam*” (*Nyāyabindu, sūtra-13*)

the ultimate true (*paramārth-sat*) object¹⁰. For, only the bare particular owns the capability to reach the causal efficiency of an object. This is the unique feature (*asādhāraṇa tatva*) of bare particular¹¹. In this context, regarding the unique feature, i.e. the *arthakriyākārītva* Dharmottara says the term ‘*artha*’ refers to the volition (*pravṛtti*) of the perceiver. She may desire (*upādāna*) for something or may reject (*hāna*) something. It is to note here, unlike the Nyāya system, Dharmakīrti considers the state of indifference (*upekṣā*) as included in the category of the state of rejection.

Moreover, is to add here that the first moment of perception is the moment of bare particular. It cannot be attained directly. The bare particular perishes after the first moment of its appearance in the sense-perception. After that moment, from the immediate second moment, only its stream of copies remains there. These copies play the role of the attainable objects. These copies make a person desire or reject the object of her perception. Since the concept of an attainable object involves the copy of bare particular, instead of the bare particular itself, and depends on the cognised cognition (*adhyabasāya* or *niścaya-jñāna*). Therefore, one may deny calling an attainable object as the object of perception. She also may disagree to describe the state of cognition that involves an attainable object, as perception. That person may argue, in the state of cognised cognition the perceiver knows an object as qualified or determinate by its features. For example, the perceiver cognises a jar as ‘it is a jar’, ‘the jar is blue’, etc. Secondly, for desiring or being indifferent to the blue jar, the perceiver involves memories. Therefore, categorically this phase of cognition should not be called as *the perception*. In reply to this objection, it can be said, it is right that the cognition of the second moment is not perception, in true sense. But in the figurative (*oupacārika*) sense the phase of cognition can be described as perception. In a

¹⁰ “*Tadeva paramārtha-sat*”—*Nyāyabindu*, sūtra-14

¹¹ “*Arthakriyā-sāmartha-lakṣaṇa-tvād vastunaḥ*”—*Nyāyabindu*, sūtra-15

figurative sense, the copy or copies of a percept is considered as the object of perception. Moreover, according to Dharmakīrti, the perception will be considered as a complete means of cognition (*pramāṇa*) only if it proves as both the means of the reception and the means of attainment of the percept. As indeterminate, it fulfills the first condition i.e. reception of the percept. But to fulfill the second essential condition the perception is supposed to be taken in figurative sense i.e. its determinate appearance. By determinate perception, the condition of attainment becomes complete.

4.3.1: The connection Between the Indeterminate and the Determinate Perception

Now it is to recall that Sautrāntika Buddhists accept the existence of the external object as inferential. It means for them the external objects can be achieved by inference only, which indicated towards mediatedness and so, indirectness. For them instead of visual sense, the cognition perceives (cognises) objects. As an object, only bare particular is represented in the cognition at the very first moment of the contact between sense organ and the bare particular. At the second moment of this contact the representation stays there but the bare particular passes away. As we already have seen that this second moment is the moment of the cognition called sense-perception. At its next moment (which is the third moment in respect of the contact between sense organ and the bare particular) the copy (*santāna*) of the representation of the bare particular (*svalakṣaṇa-pratibhāsa*) remains there and the representation perishes. At this moment and its next continuing moments, the stream of the copies of the first representation of the bare particular provides content to the empirical cognitions. These copies are nothing but conceptual construction and so hypothetically real. Perception happens in these continuing moments also by depending on the constructed and hypothetically real objects. The cognition of these further continuing moments makes a person see an object as whether it is desirable or not. The

perception at the level of attainability is called ‘perception’ only in figurative sense, not in true sense. It represents determinate perception. In true sense this is the state of inference. Maybe for this reason, from the perspective of attainability of the object, the Sautrāntikas accept the existence of the external world and its objects as the subject of inference (*bāhyānumeyavāda*). In order to attain something the perceiver recalls the memories that are related to the copy (i.e. the percept) of the present moment and compare between them. She sees whether following the present situation and need the object of attainability should be desired or ignored. One more thing happens in this case. Since the cognition of the second moment (of indeterminate perception) appears before the perceiver in a complete form like ‘this is a blue jar’, ‘this is a mango’, etc. Therefore, the perceiver easily can recall her previous feelings and experiences regarding those objects as ‘the blue jar is useful for having water’ or ‘the mango is sweet in taste’, and so on, and can make a decision for the present situation. It is to note that when someone recalls the mango as ‘a sweet object that provided pleasure before’, then the object-mango and its sweetness, and the sweetness and the pleasure related to that very sweetness appear before the perceiver as inseparable pairs. These pairs represent a relation of invariable concomitance (*vyapti*), between the general sweetness and general pleasure that is (usually) available in ripe mango. These generic forms refer to the ground (*hetu*) of inference. Perhaps, for this reason, Sautrāntika sarvāstivādins claims that attainability of object dependent on inference.

4.4: Introduction to Determinate Perception

In the first half of this chapter, I have discussed the process of the indeterminate perception that is considered in the Sautrāntika system as true perception. However, since true cognition remains out of the reach of common people therefore, it is not able to fulfill the empirical purpose of the life of common people. Until someone is achieving the ultimate goal of *nirvāṇa*, she is bound to

live the empirical life in this material world. Therefore, despite the unreality of the empirical world, its objects and organisms, and the needs of the organisms cannot be denied or refuted completely. In this empirical life, people deal with the world through perceptual or inferential approaches. In the context of the discussion of perception, it is important to know about the mechanism of empirical perception and its related issues. Empirical perception cannot be indeterminate. It is essentially determinate. Vasubandhu in *Abhidharmakośa* provides an enriched account in support of the determinate perception. According to Vasubandhu, determinate perception is the reason for living experiences. It is true that according to the Buddhism true cognition is the ultimate goal, experience, and other related issues are merely unreal. Despite the truth, according to *Abhidharmakośa*, the stages of living the experiences of the unreal world also have a kind of significance and importance. Through living these experiences, one can recognise and realise the falsity or emptiness of the external world. This realisation makes that person steps forward to the path of liberation i.e. *nirvāṇa*. Therefore, in a sense, the mid-phase of the life-cycle between the two extremes of true cognition of bare particular and liberation is not ignorable; its existence has a different degree. People, going through this phase feels the reality of the phase as well as the external world by her physical body and mental body, both. The physical existence of a person is determined by her biological body and mental existence is determined by her psychological states of emotion, etc. In following sections, I will describe the process of determinate perception, which is called by Sarvāstivādins as *saṃjñā*, and some related issues to see whether the Sautrāntika view of perception is able to define the visual experience of the embodied human being or not.

4.4.1: Contribution of the Determinateness in Perception

In this context, we can talk about the initiating *kārikā*-s from *Abhidharmakośa*. In the context of explaining the meaning of the term ‘*abhidharma*’ Vasubandhu says that immaculate cognition (*anāśrava prajñā*) is followed by its attendants i.e. the elements like mind, mental faculties, etc. Technically, pure cognition derives gradually by means of other impure cognition. The phase of perception, in which mind, mental faculties, objective characteristics are perceived, is also one type of impure cognition.¹² “The word ‘dharma’ of ‘Abhidharma’ here signifies that which carries a proper character (*svalakṣaṇa*); and Abhidharma is called ‘Abhidharma’ as it envisages (*abhimukha*) the ‘dharma’ which is the object of supreme cognition, or the supreme ‘dharma’ to realise Nirvāṇa, or as it envisages the character of the dharmas—the proper character and the common character” (Chaudhuri, 1976: 70). Again, regarding *Abhidharmakośa* Vasubandhu says, the human body that is constituted by the mass of discerning qualities like physical form or corporeality (*rūpa*), sensation (*vedanā*), perception (*saṃjñā*), pre-disposition (*saṃskāra*), consciousness (*viññāna*), impermanence (*anitya*), suffering (*duḥkha*), non-self (*anātma*), etc. is quite necessary for one, wishing to be free from the bondage of life, to be emancipated.¹³ It means to realise the futility of worldly discerning dharma and to realise the pure nature of the object as the ultimate truth, one should go through the phases of worldly impure cognitions by cognising the mass (*rāśi* i.e. *skandha*) of corporeality (*rūpa*), sensation (*vedanā*), perception (*saṃjñā*), pre-disposition (*saṃskāra*), consciousness (*viññāna*). Therefore, the phase of determinate perception has importance in this context.

¹² “*prajñā-amalā sānucarā-abhidharmaḥ
tat-prāptaye yāpi ca yucca śāstram.
Tasya-arthato-asmin sama-anuprabeśāt
sa va-āśraya-asyetya-abhidharmakośaḥ.*”—*Abhidharmakośa*, 1/2

¹³ “*tatra prajñā dharma-pravicayaḥ. Amaleti anāśrava. Sānucareti saparivarā. Evam-anāśavaḥ pañca-skandhako-abhidharma ityuktam bhavati. Esa tāvat pāramārthikī-abhidharmaḥ.* – *Abhidharmakośa Bhasya*, Vasubandhu (p.11).

4.4.2: *Samjñā*: The Empirical Perception

In *Abhidharmakośa* Vasubandhu described *saṃjñā* as “...*saṃjñā nimitta-udgrahṇātmikā*” (*kārikā*-1/14)¹⁴. In the explanation of this *kārikā*, in *Bhāṣya* he says “*yāvat-nīla-pīta-dīrgha-hrasa-strī-puruṣa-mitra-amitra-sukha-dukha-ādi-nimitta-upagrahaṇam-sau saṃjñā-skandha*...” It means, “[t]he perception (udgrahaṇa) of various characteristics (Nimittas) such as blue, yellow, long, short, male, female, agreeable, disagreeable, pleasant, unpleasant, etc. of some object or objects is called *Samjñā-skandha*” (Chaudhuri, 1976: 78). From this explanation, we can see clearly that in this phase of perception, instead of the pure unique (*anadhigata*) true form (*svalakṣaṇa*) of the object, its specific qualities or features appear as a percept. In this phase, a perceiver can see¹⁵ and recognise the functions of an object by seeing its particular features. Therefore, she can consciously decide whether to desire or ignore the object in respect of the present circumstance. To decide the action for the object the perceiver recalls the sensation that is related to that object of her perception. There is the significance of the term ‘*skandha*’. Literally, the term means *rāśi* i.e. mass or aggregate. Every individual aggregate represents its own combination of appearances from past, present or future, as internal or external, as crude or subtle, as inferior or excellent, as distant or near, etc. For example, in the case of the aggregate of perception, the aggregate as a combined form represents each type of the perceptions of visual, auditory, olfactory, gustatory, tactile, and mental, together. Simultaneously, it also represents all of the forms of appearances of a percept from the past, present, future, internal, external, gross, subtle, etc., regarding each of the types of perception. however, in the aggregate the lived experiences do not get merger with each other, as if each experience is limited (*paricchinna*) by its own contour. For that reason,

¹⁴ “*Indriyārthāsta ebeṣṭā daśa-āyatana-dhātavaḥ. Vedanā-anubhavaḥ saṃjñā nimitta-udgrahṇātmikā.*” –(*kārikā*-1/14).

¹⁵ In this context by the term ‘see’ or ‘seeing’ I am intended to mean the case of having visual perceptual cognition, instead of mere contact between sense organ and its relative percept.

according to own need the perceiver can recall the exact experience and can complete the act of perceiving. For example, if someone has experiences of some regular kind of flower vases those has/had usual shapes like round bottom, long neck, etc. and colours like red, blue, yellow, etc. However, at present if she perceives a different kind of vase that has a different shape and different colour on it, which she has not been experienced yet, in that case also the perceiver can recognise the object as a ‘vase’, the special kind of shape as ‘the shape’, and new type of colour as ‘the colour’, in general. For Sautrāntikas, the aggregates are *prajñaptisat*¹⁶ i.e. unreal. Maybe that is why this phase of perception is conceptual construction in true sense and the percepts are considered as real (*sat*) in figurative sense only. As *prajñaptisat* aggregates refer to determinations (*pariccheda*) of its constituting individual experiences.

The Buddhist concept of perception i.e. *sañjñā* indicates a determination or interpretation of sensation (*vedanā*). This process of interpretation is not a simple one. It is a complex but organised process. It involves various modes of mental elements like memory, past image, recognition, comparison, examination, judgment, relation, discernment, even symbolic expression, etc. In the process of determining, the status of perception (determinate cognition) is relative to the intensity and extensity (*byapakatva*) of the content i.e. the object of perception, which is technically called *ālambana*¹⁷. *Ālabana* indeed represents the presentative (directly

¹⁶ The literal meaning of the term ‘*prajñapti*’ is ‘which makes known (something)’. In this sense, it refers to meaningful words, names of things, or conceptions about things. Chiefly there are two kinds of *prajñapti*. *Śabda* or sound *prajñapti* and *artha* or sense *prajñapti*. Although, definitionally the two are relative so complements each other. Sound *prajñapti* is synonymous with name *prajñapti*. For, ‘*śabda*’ in the sense of spoken sound indeed represents spoken names i.e. a word as containing some meaning in it. On the other hand, sense *prajñapti* means the concept of a thing denoted by its attributes and connoted by a term. Five aggregates i.e. physical form, sensation, etc. are real only in the highest sense of existence, where there is no connotation or denotation. But as the sense of the aggregates involves names or meaningful words (*abhilāpa samsarga*) the existence (*sattva*) of these aggregates at the material knowable level, becomes conceptual construction i.e. pseudo or *prajñapita* in nature. This kind of *prajñapti* is called *vidyamāna prajñapti*, which is a type of sound *prajñapti*.

¹⁷ ‘*Ālabana*’ means support (*avalamban*). This term indeed refers to the object’s visible form, etc. qualities, depending on which a consciousness or mind (*citta*) arises. In arising of consciousness the eye, etc. six sense organs (including manas) serve the purpose of the passage of entry or door (*dvār*), because a consciousness finds an access

apprehensible) content of mind. In the process, the spatial position of the perceiver is important. Due to the spatial position of the object of perception as well as the perceiver, if the object (*rūpa*, etc.) is failed or interrupted to enter through the door of the sense organ (*citta-dvāra*) then the status or intensity of the consciousness, get affected. It becomes indistinct or obscure. Generally, if the object of perception remains out of the range of vision then the quality of the consciousness regarding that object gets blurred or obscured. On the other hand, if the object is placed absolutely near to the eye, in that case also, perception gets disturbed. Again, sometimes depending on the extensity of the object the quality of the cognition is affected. If the object is so big or so wide that it is impossible to see at once, in that case also perception is interrupted. The disturbance in consciousness affects the (entire process of) perception. In the situation, when the presentative content alone proves insufficient for the construction of perception then the cognition takes help from the representative elements of mind like memory of past consciousness, image, etc. With the help of these representative elements of mind, the consciousness constructs perception following the method of hypothesising. Depending on the past memory, past image or information, etc. the cognition fills up the gaps and *infer* the use or application of the object of perception in order to fulfill the perceiver's purpose.

The aggregates of corporeality, sensation, etc., together, affect a person in living her experiences of past, present, and future. Precisely speaking, among the five kinds of aggregates apart from the last one, i.e. the aggregate of consciousness, remaining four operate a human being's empirical life and give it a shape. These four aggregates together are known as *nāmarūpa* that

through the door only. for example, when a consciousness arises seeing some form (*rūpa*) through eye, then its door of entry is the eye. In this example, the perceived *form* is the object (*rūpa ālambana*) of the form-consciousness (*rūpa citta*). Every single consciousness or mind is the composition of its inherent (*sahajāta*) conscious or mental faculties (*caitasika*), therefore, naturally both the mind and mental faculties depend on the support of the same object.

represents the psychophysical combination of an organism. It is considered as one of the spokes of the wheel of existence (*bhavacakra*), which causes *ṣaḍāyatana* i.e. the six sense bases of a human being. Technically, the sense organs are known as *āyatana* i.e. the bases. Among the four, the aggregate of physical forms, alone, is called *rūpa*, which is responsible for the formation of the physical body. On the other hand, the aggregates of sensation, perception, and pre-disposition together are called *nāma*. This three constitute the mental body or mind (*citta*). As the constituting element of mind, each of the elements of sensation, etc. considered as the separate mental faculty (*caitta* or *caitasika*). It is to add in this context that the aggregates of sensation and perception are different from other aggregates because of their nature. These two influence the event of a repetition of the existence of a being (*saṃsārāvartan*). Simultaneously these are the roots of all disputes of the human mind. Depending on sensation and perception love, attachment, wrong view (*mithyā dṛṣṭi*), false notion, etc. arise in a human being's mind regarding some worldly objects. Although sensation and perception works almost inseparable, indeed these two are separate from each other. Perception is the effect of sensation. Regarding the relation between sensation and perception, it can be said, if sensation causes the attachment (*anurāga*) for some object then perception makes it tasteful (*rasa*)¹⁸.

¹⁸ One thing is to mention here that, one should not confuse between the phrases 'wrong views' i.e. '*mithyā dṛṣṭi*' and 'erroneous perception' i.e. '*bhrānta pratyakṣa*'. These two are not the same. Well, we still need to be clarified the difference between the two matters, in brief. Since in both the cases according to Sautrāntika belief, the percept is unreal, mere mental construction, hence the apparent confusion may occur in some novice's mind. Sautrāntikas consider the external world is the matter of inference only. Therefore, when someone cognises the particular features like blue colour, big size, etc. as real (*sat*), then the false notion regarding the existence of those features (and its regarding object) arise in the mind of the person. Now, the person imposes the mental construction of blue, etc. on the objects, and cognises the objects, the features, and the qualified or featured objects as real and graspable. These kinds of cognition are *mithyā* i.e. false. Due to the wrong view and false notion the attraction and attachment arises in the mind for the percept. On the other hand, the matter of erroneous or illusory perception is not like that. In illusory perception the notion of one object, mistakenly, is imposed on another object. The imposed object is perceived or considered as the actual percept that is there in the outside. In the erroneous perception of silver on a shell, for example, it is the mental idea of silver that comes out and manifested as external object after being superimposed on the shell. Here the illusory silver is of the nature of cognition.

4.5: The Sensation

In *Abhidharmakośa* Vasubandhu in the description of *vedanā* i.e. sensation says that “*Vedanā-anubhava*”.¹⁹ To explain the description he says, the aggregate of sensation is the composition of three variations of sensations viz. pleasant (*sukha*), unpleasant (*duḥkha*), and neither pleasant nor unpleasant state (*adukhasukha*). Through the contact of six sense organs, six kinds of sensations are possible. These sensations like the sensations of colour, smell, sound, taste, touch, and mind, which arise from the contact between the eye and its object colour, nose and fragrance, ear and sound, tongue and water, body and touch, and the mind and mind-objects, respectively.²⁰ Yaśomitra, in this context, further says that there are three categories of sensation – *anubhūti* i.e. affection, *anubhava* i.e. realisation, and *upabhoga* i.e. enjoyment. All of these three kinds of sensation arise depending on the mind (*citta*) or physical objects (*pudgala*). Well, at this point it is to clarify that the categorisation of Vasubandhu and the categorisation of Yaśomitra, both are right; there is no conflict between the two. However, their explanations vary due to the difference between their approaches towards the nature of content of sensation. Vasubandhu categorises sensation from the aspect of worldly object. On the other hand, Yaśomitra’s divisions represent the aspect of mental content. As the physical object comes in contact with its relative sense organ, at the immediate next moment of that contact, the sensation of pain or pleasure arises *in* the (body of a) perceiver. This pain or pleasure is about physical sense or awareness (*bodha*). Following the same content of sensation, at the immediate next moment of the primary moment (stage), another phase of sensation comes out. This second stage is all about mind and mental content called emotion. In this second stage, the emotion like joy (*hlād*) or grief (*paritāp*) that arises depending the content and joins the sensation of pain, pleasure, etc. Therefore, at the

¹⁹ See footnote 12.

²⁰ “*Trividha-anubhava vedanāskandhaḥ--sukhaḥ, duḥkhaḥ, aduḥkhāsukhasca. Sa punrbhidīyamānaḥ saṭ-vedankāyaḥ cakhu saṁsṛpa vedanā yāat-anyan sṁsṛpasajāḥ vadaneti.*” –*Abhidharmakośa Bhasya*, p.48.

next step, the perception is caused by the sensation. Following the sensation, through perception, the perceiver moves to attain (*prāpta*) the object of sensation.

4.6: The Pre-disposition

In the description of *saṃskāraskandha* Vasubandhu says, “*caturbhye-anye tu saṃskāra-skandhaḥ ete punaḥ-trayaḥ. Dharma-āyatana-dhatu-byākhyāḥ saha-avijñapta-asamskṛtaiḥ*” (*Abhidharmakośa*, *kārikā*-15). It means, *saṃskāraskandha* i.e. the aggregate of volition is a separate kind of mental faculty (*saṃskāra*) from the aggregates of physical form, sensation, and perception. This particular kind includes only those conditions (*dharma*), which are not there in any other aggregates of physical form, sensation, perception, or consciousness, yet. The *saṃskāraskandha* represents six classes of volitions (*cetanā*). The aggregate of volition is called so because it conditions (*abhisamskāra*) the conditioned *dharma*s (*saṃskṛta*). It creates and determines the five aggregates of future existence.²¹ The aggregate of pre-disposition or volition comes in the fourth position among the five aggregates. Again, in the cycle of existence, pre-disposition comes in the second position as the least connection of past life and causes consciousness (*vijñāna*). Pre-dispositional consciousness i.e. volition forms a dynamic continuity between the two different temporal-stages of lives of past and present. It determines action (*karma*). Without the presence of volition, action cannot occur. Ignorance (*avidyā*) is the root cause of all volitions. Volition arises in the mind of a human being only if she is seized by ignorance. The life of a person, who is in bondage, is full of actions (*karmamaya*). She is bound to do actions for living. From the perspective of action there are three types of volitions –

²¹ “*Rūpa-vedanā-samjñā-vijñānebheyah-caturbhyayo-anye tu saṃskārāḥ saṃskāraskandhaḥ. Bhagbatā tu sūtre “ṣaṭ cetanākāyāḥ” iti-uktam; prādhānyāt. Sā hi karma-svarūpatyad-abhisamskaraṇe pradhānā. Ata ebaktam bhagavatā—“saṃskṛtam-abhisamskaroti tasmāt saṃskārā upādāna-skandha iti-ucyate” iti.anyathā hi śeṣānām caitasikānām viprayuktānām ca saṃskārānām skandha-asamgrahād duḥkha-samudaya-satyatvaṃ na syāditi parijñāparihāṇe na syātām. Uktam ca bhagavatā—“na-aham-eka-dharmam-api anabhijñāyāparijñāya duḥkhasya-antakṛyām vadāmi” iti. Evam “aprahāya” iti-uktam....” – Abhidharmakośa-Bhāṣya, p.49.*

meritorious or good (*punya/kuśala cetanā*), demeritorious or bad (*apunya/akuśala cetanā*), and formless or neutral (*arūpa/ānenjñā cetanā*). Meritorious volitions like love, devotion, sacrifice, etc. influence a human being to perform good ethical actions like charity, prayer, etc. On the other hand, the demeritorious volitions like greed, hatred, etc. are the reasons for a person's bad or harmful actions like killing, stealing, saying ill or false words, etc. The formless volition is truly neutral kind of mental state. This one is responsible for the process of finer or higher meditation. Besides the ethical aspect, the aggregate of volition contains psychological and physical aspects too. From those aspects, volitions, in general, can be considered as the psychophysical element for living beings. Being a kind of mental faculty, volition, along with other mental derivatives like love, aversion, etc., contributes to the composition of mind.

Volitions refer to a human being's urges (*cetanā*) to initiate some action. Every single urge or impulse is a complete combination of physical and psychological characteristics. As a result of that, the human being can decide her action in accordance with the urge, situation, etc. The dynamic volitions provide background for all actions. The aggregates of sensation, perception, and volition are non-sensuous in nature. For that, none of these can be grasped by any physical means. The effects of sensation and perception from the present life are stored in the mind as pre-dispositions, which influence another ignorant and sized mind to be caused in the future as a new life.

4.7: The Consciousness

The aggregate of consciousness represents the entire formation of the mind and its function. In the wider sense, the aggregate indicates consciousness in all its aspects. The entire range of it is called *mana-āyatana* i.e. total mind's field. In the description of the aggregate of consciousness (*viññāna-skandha*) Vasubandhu says, “*viññānaṃ pratibijñāptiḥ mana-āyatanam ca tat. Dhatavaḥ*

sapta ca matāḥ, ṣaḍ vijñāna-anyatho manaḥ ” (*Abhidharmakośa*, *kāriā*-16/1). Vasubandhu describes consciousness “as the relative impression on the apprehension (*upalabdhi*) of each object (*viṣayam viṣayam prati*). The *vijñānaskandha* comprises six classes of *vijñānas*: *Cakṣurvijñāna*, *Śrotravijñāna*, *Ghrāṇavijñāna*, *Jihvāvijñāna*, *Kāyavijñāna*, and *Manovijñāna*. The *vijñānaskandha* is the *mana-āyatana* consisting of seven *dhātus*: Six *vijñānas* (*vijñānakāya* = *vijñānadhātu*) and the *manodhātu* or the Mind” (Caudhuri, 1976: 79).

It is to note that among the five aggregates, apart from the aggregate of corporeality other four aggregates internally work through the mind. These are then included within the aggregate of consciousness. *Vijñāna* is considered as the synonymous of *mana* and *citta*. In this respect, it can be said that consciousness means mind. The relation of the body and the consciousness (i.e. mind) is an established and spontaneous one, though Buddhists do not consider it as primary or direct. The mind cannot function without the involvement of the mental faculties. During the function the mind and the mental faculties, both follow one common base. In fact, the mind and the mental faculties arise and cease together, right at the same time. It is to mention that *vijñāna*, *citta*, and *manas* are synonymous, though each of the terms has separate significance. *Citta* represents the moral states, *manas* represents reason and reflection, and *vijñāna* represents sensation. these three are different forms of one and the same consciousness. Moreover, according to Buddhism it is said that five sense organs are recognised as internal. These are the special functions of the mind. *Vijñāna*, in general, is described as a reaction to the object of consciousness. Consciousness is a complex mental function that causes as the result of contact between the *āśrita dhātu* i.e. sensation and *ālambana dhātu* i.e. sense organ. For example, visual consciousness (*cakṣu vijñāna*) arises by the contact between the element of form or colour (*rūpa dhātu*) and the eye element (*cakṣu dhātu*). First one is the object (*viṣaya*) of consciousness and

second one is the seat (*ādhāra*) of consciousness. In this case, the sensation plays the role of the stimulus.

Sautrāntika philosophers consider that consciousness (*viññāna*) is constituted by both physical and mental elements. The five sense organs and their respected objects are definitely physical. All of these are originated from the combination of the four great elements. At the same time, the five sense faculties are internal seats of respective sensation. The faculties rest in their corresponding sense organ inherently. Moreover, the five sense objects like colour or form, etc. are known by respective sensations and mind-consciousness (*manovijñāna*). Mind-consciousness is normally impure. Only in the case of seers, it can be pure. The object of mind-consciousness is mind-element i.e. *manodhātu*. Their respective objects more or less regularly determine the five sensations. Whereas mind-consciousness usually is indefinite. The nature of its corresponding objects may be indefinite, too. In fact, colour, sound, etc. as sensations also are counted as the objects of mind-consciousness. The objects of mind-consciousness vary. Each of the particular faculties does its respective function(s) in relation to the respective object. But the mind, in general, cognises all. During cognising, some object, the mind functions in two ways, simultaneously. One, it cognises the particular object in connection with its particular consciousness (as *viññāna*). Two, it cognises the object through the mind-function itself, as the mind-consciousness (*manovijñāna*). Among all six kinds of consciousness, while the first five consciousness of visual, etc., those are related to their corresponding sense organs, are directed to their corresponding objects of the present time, there the mind-consciousness is directed to that which is past.

Following the link, it is necessary to say something about the *manodhātu*. The mind or *manodhātu* stands for the past contents, which functions as the object (*ālambana*) or mind-

consciousness. In this connection, it can be said that the *manodhātu* or mind-potential may be taken as dealing with memory (*smṛti*) or the retained content of sensation. In the case of common people, who are the limited beings, mind potential is the determinate aspect of mind because it contains functions like reflecting, investigating, discerning, and so on. Therefore, it naturally is impure. Mind is a continuous flow. By the means of meditation the mind-potentials comes out from its previous thoughts. Mind cannot be attained (*aprāpta viṣaya*) or achieved. There is no chance of *direct* contact between the mind and physical objects. The mind potentials i.e. the past content function as the objects in relation to mind-consciousness. It is to remind that the subject and the object of consciousness are both mental. Mind, on the one hand, acts as the subject. In this mode, the mind recognised as the mind-consciousness. On the other hand, it appears before the subject as the object of cognition i.e. the mind-potential. As a subject, the mind is aware of the mind-potential(s). According to the *Abhidharmakośa*, cognition (*jñāna*) or awareness is the consequence of collective involvement and action of corporeality and mind, in the one hand, and of the mental subject and the mental object both, on the other.

4.8: Pure and Impure Dharmas

Before entering in the discussion of the aggregate of corporeality, it is good to have some ideas about the nature of aggregates in general. We should discuss this matter before the discussion of the aggregate of perception, but to maintain the flow and relevance of the discussion of this chapter, we are doing that now. In *Abhidharmakośa* it has been said that all of the five aggregates are conditioned, which means those are constituted. In Sautrāntika terminology the state of being conditioned is called as '*sāsrava*' and the state of being constituted is called as '*saṃskṛta*'. Well, here '*sāsrava*' and '*saṃskṛta*' are synonymous because both the term refers to the states of being caused or conditioned, which in turn refers to the nature of mundaneness,

temporality, being constructed, impermanence, being non-eternal, and so on. All of these terms refer to taints or impurities i.e. *āsrava*. Now, we are going to explain the terms. It is to mention here that, already we have said that *abhidharma* is essential because through the knowledge of *abhidharma* one can start walking towards the goal of ultimate cognition. Generally, ‘dharma’ refers to those things that hold only the bare particulars. The first syllable of the term ‘*Abhidharma*’ i.e. ‘*abhi*’ means the direction or approach (*abhimukha*). Therefore, the complete meaning of the term is approaching towards the ultimate cognition i.e. *dharma*²². *Abhidharmakośa* is the journey through the impure (*kliṣṭa*) *dharmas* to the ultimate *dharma*. The impurity (*kleśa*) is known, in Sautrāntika terminology, as ‘*āsrava*’ and that contains the impurities is called *sāsrava*. All of the five aggregates are impure, therefore, those are known as *sāsrava*. Again, the states of impurities are conceptually constructed. Therefore, from this aspect, those are called *saṃskṛta*.

In this context, Vasubandhu says that “*sāsravā-anāsravā dharmāḥ saṃskṛtā marga-varjitāḥ. Sāsravāḥ āsravāsteṣu yasmāt-samanuśerate (Abhidharmakośa, kārikā-4/1)*”. It means *sāsrava* or conditioned *dharmas* are those, which are conditioned. Except for the eightfold path (*mārga*), all remaining constituted *dharmas* are categorised as conditioned. These are called ‘conditioned’ because vice (*āsrava*) are attached to them. According to Yaśomitra, conditioned *dharmas* are called so because they serve as the basis or support (*ālamvana*) for the appearance of impurities like attachment (*rāga*), aversion (*dveṣa*), illusion (*moha*), wrong view (*mithyādrṣṭi*), etc. The eight-fold path cannot be conditioned because no impurity can be laid (*anuśayan*) there. On the other hand, *anāsrava dharmas* are those where there is no impurities or vice. Those *dharmas* are

²² In this chapter and other relevant places in this thesis, I will use the term ‘*dharma*’ as it is, instead of any English synonym, to maintain its real sense.

as follows: the eight-fold path, *ākāśa*, *pratisamkhyā-nirodha*, and *aprtisamkhyā-nirodha*.²³ According to Vasubandhu, ‘*ākāśa*’ refers to something that cannot cover anything (*anāvaraṇa-svabhāba*). The corporeality or physical form can go through it, but cannot cover it. *Pratisamkhyānirodh* is the annihilation of by means of discriminating wisdom. *Pratisamkhyā* means the pure kind of cognition that is the comprehension of the four kinds of noble truths. The annihilation of desire and other material passions acquired with this special kind of cognition. On the other hand, “[a]pratisamkhyānirodha is an absolute extinction of a productive cause which cannot reappear in future. This is so called because this is to be realised not by the comprehension of the truths, but by the ineffectiveness of the causes of birth (*pratyayaivaikalyāt*). Through the *aprtisamkhyānirodha*, sufficient concurrence of cause (*pratyaya-sānnidhya*) and birth (*utpatti*) become absolutely impossible” (Chaudhuri, 1976: 72).²⁴

Among the conditioned *dharmas*, apart from the eight-fold path, the remaining conditioned *dharmas* are the five aggregates of physical form, sensation, perception, pre-dispositions or volition, and consciousness. Apart from the aggregate of consciousness, remaining four aggregates together constitute the psychophysical combination called *nāmarūpa*. *Nāma* represents the aspect of mental phenomena and *rūpa* represents the aspect of the physical phenomena of existence. Ignorant human being sees the mind and mental phenomena as the ego and the corporeality and physical faculty as the personality. There are multiple causes behind the production of these phenomena. Each of the aggregates represents an organised combination of produced *dharmas*. The verb ‘*kṛ*’ not just refer to the produced (*saṃskṛta*) *dharmas* of the present but it includes the produced *dharmas* of the past and those are destined to be produced in

²³ “*Anāsravā mārgasatya trividhaṃ capyasamskṛtam.*

Ākāśaṃ dau nirodhou ca; tatra-ākāśam-anābṛtiḥ” (*Abhidharmakośa*, *kārikā*-5/1).

²⁴ “*Pratisamkhyānirodho yo biasamyogaḥ pṛthak pṛthak.*

Utpāda-atyanta-vighno-anyo nirodho-aprtisamkhyā” (*Abhidharmakośa*, *kārikā*-1/6).

future. Each of the aggregates involves and represents all of these conditioned dharmas together. That is why those are counted as conditioned or constituted. Now, following the link let us have some idea about the aggregate of corporeality i.e. *rūpaskandha*.

4.9: *Rūpaskandha*: Sautrāntika Idea of Body

In the description of the aggregate of corporeality, Vasubandhu says, “*rūpaṃ pañcendriyārthāḥ pañca-avijñāptiḥ-eva ca. Tad-viñāna-āśrayā rūpa-prasādāḥ-cakṣurādayaḥ (Abhidharmakośa, Kārikā- 9/1)*”. Vasubandhu says the aggregate of corporeality comprises the five sense organs (*indriya*), five objects (*artha*), and five *abhiññapti*. The five sense organs are the eye (*cakṣu*), the ear (*śrotra*), the nose (*ghrāṇa*), the tongue (*jihva*), and the body (*kāya*). The five objects of sense organs are visible colour or form (*rūpa*), sound (*śabda*), smell (*gandha*), taste (*rasa*), and touch (*sparśa*). In this context, it may be added that the sense organs play the role of bases (*āyatana*) of eye-consciousness, ear-consciousness, nose-consciousness, tongue-consciousness, and body-consciousness, respectively. Visible objects etc. play the role of supports (*ālamvāna*) of these consciousnesses. All of these objects may be classified again into different classes. For example, here I am mentioning about the divisions of visible objects. Visible objects may be classified into two classes of colour (*varṇa*) and figure (*saṁsthāna*). These colour and figure again have more classes and so on. This way, there are twenty kinds of visible objects. One point is to note here that, according to Sautrāntika the *figure* is not a real matter rather it is mental construction. Similarly, sound, etc. other objects also have many classifications.

In the description of the last kind of corporeality is *avijñāpti* that literally, means ‘not manifested or not expressed’. Despite being a physical constituent of corporeality, *avijñāpti* remains unmanifested and so unobservable. Vasubandhu, to define the state of *avijñāpti* says, “*vikṣipta-acittakṣya-api yo-anubandhaḥ śubha-aśubhaḥ. Mahā-bhūtānyapādāya sa ha-avijñāptiḥ uccate*

(*Abhidharmakośa*, *kārikā*-11/1).” Every mental or physical action necessarily should have some corresponding result. In most of the cases, the result or reactions are quite manifested and can be observed. But, sometimes, in some cases, the reactions do not get manifested, those remain latent or unmanifested. No sense organ can observe or grasp the unmanifested reactions, though that does not affect the existence of this kind of states. To classify this particular kind of *kṛiyā* or action Vasubandhu introduced a separate kind of category called *avijñapti*.

Following this Vasubandhu explains that the unexpressed or not manifested corporeality is one of the derivative *dharma* of the four great elements (*mahābhūta*) of earth, water, fire, and air. Like the other corporeality, this one also automatically takes its own course on the ground (*hetu*) of being dependent on the four great elements, without any reference to mind, either distracted (*vikṣipta*) or inactive (*acittaka*). Being dependent on the four fundamental elements, the unexpressed state of corporeality involves the stream of good (*śubha* or *kuśala*) and bad (*aśubha* or *akuśala*). Yaśomitra, in explanation of distracted mind (*vikṣipta-citta*), says that it is such a mental state, in which vocal and physical communicating functions are ceased. On the other hand, inactive mind (*acittaka*) represent that state of mind, in which all mental functions including the mind itself are at absolute rest. *Abijñapti* is categorised as physical corporeality because it is constituted by the support of the four fundamental elements, however, Sautrāntikas do not admit the reality (*dravyasattā*) of *avijñapti*.

The context of the aggregate of corporeality remains incomplete without the discussion of the four fundamental elements of earth, fire, water, and air. Vasubandhu calls these elements as the ultimate *dharma*s or *mahābhūta*. The great elements are also called *dhātu*-s as they retain their individual characteristics.²⁵ These are called great (*mahā*) because the elements regarded as the

²⁵ “*Bhūtāni prthivī-dhātuḥ-tejo-vāyu-dhātavaḥ.*

Dhṛtyādi-karma-saṃsiddhāḥ, khara-sneha-uṣṇṭā-iraṇaḥ” (*Abhidharmakośa*, *kārikā*- 12/1).

supporters of all derivative matters. Each of the elements has its own functions that are relative to their basic characteristic. Earth provides the function of support (*dhāraṇa*) depending on its nature of hardness (*kharatva*), water coheres (*saṁgraha*) for its nature of humidity (*snehatva*), fire ripen (*pakti*) due to its nature of heat (*uṣṇatā*), and air provides expanding (*vyūhana*) for its nature is motion (*gati*). All of these functions are important and significant for the constitution of the world and worldly objects, including a human body (*deha*). We are giving the details of the four great elements because together the elements constitute material objects. Yaśomitra explains that the great elements are not completely detached with one another. Each of the elements contains at least one atom of remaining elements. For example, the element of earth contains at least one or more atoms of water, fire, and air. But as the atoms of earth predominate here, we call it earth. Thus, though the great elements arise together in all molecules, hard, moist, hot, or mobile, for the time being, the nature of one predominates and our senses notice only the predominating one and not the others. In this manner, each and every material object is the combination of the four great elements. Even the derivative material *dharma*s of the aggregate of corporeality are caused to grow by the four great elements.

4.10: Sautrāntika View of Perception and Embodiment

After having an account of Sautrāntika theory of perception, now, the analysis can be started to see whether the account contains properties that can explain the experiences of an embodied human being, regarding the world. But before that, we need to remind that the earlier portion of this discussion that includes Dharmakīrti's view of perception, reflects the description of perception that is truly a means of cognition. On the other hand, the latter part of the discussion is about the empirical aspect of perception, which is not even called by the Sautrāntikas as *pratyakṣa* but *saṁjñā*. Despite, both of the *pratyakṣa* and *saṁjñā* produce effect (i.e. cognition)

by the contact between sense organ and the percept. The basic difference is that the object of *pratyakṣa* is bare particular, whereas the object of *saṃjñā* is the copy or stream of copies of bare particular. Secondly, the *pratyakṣa* is the indeterminate version of perception but the *saṃjñā* represents the determinate aspect of perception. Thirdly, indeterminate perception is free from conceptual construction and determinate perception involves conceptual construction. Despite the differences, in this research work, I am considering *pratyakṣa* and *saṃjñā* as the two consecutive sequences of the same process or means called perception, in which the first half produces cognition without experiencing and the latter half produces experiential cognition.

In the discussion of the empirical phase, apart from the perception I have discussed sensation, pre-disposition, consciousness, and corporeality, because all of these together constitute the psychophysical combination, more specifically speaking, the coupling of mind and body, consciousness and action. It is already been discussed that the aggregate of corporeality alone is responsible for the human being's (biological) body that is one of the derivatives of the four great elements. On the other hand, sensation, perception, and pre-disposition or volition together constitute the mind. Now, the point is according to the Buddhist view, there is no constant or real state in any human being called mind, which inherently holds all of the mental states and mental derivatives. Again, unlike Naiyāyikas they do not accept anything called self that owns the mental states and some other inner states as its quality. Therefore, from the Buddhist account, it is near to impossible to extract any subjective state that can claim the mental states like mine. In this regard, Jonardon Ganeri says, "the happenings of the mind are not owned. The mind's ontology is one of tropes, not properties. There is nothing that owns mental tropes and they don't aggregate to form subjects (it is the fundamental wrong move to think that any of the mental items, or the collective stream, is a subject)" (2012: 42). Sautrāntikas in support of imposing

mental occurrences on the body, retaining psychophysical supervenience. *Supervenience* represents a kind of connection between the mind and the body or the mental properties or physical properties. “The supervenience claim is that fixing the body’s physical state fixes its mental state....” (Ganeri, 2012: 77). Supervenience refers to the relation of dependence between the physical states and the mental states. Mental states are dependent on the physical states or the body in order to be ascribed, but not vice versa. For, the body or physical states can stay independent of mental states. For example, a deeply sleeping body, fainted body, or a dead body remains there as independent of mental ascriptions. In all of those states, it is still recognised as the body. The presence of the condition of dependence reflects through the psychophysical combination. This combination is collective property. It represents a kind of totality, though the combination. It is a collective property, but it does not stay within any of its constituents.

Following the discussion, one curiosity arises that how is it possible that nothing owns the mental states. Because in our commonsensical experience we feel various mental states like mine and in our semantic uses also by the expression ‘I’ we claim ourselves as the exclusive owner of various mental states like joy, grief, aversion, pain, pleasure, etc. Following the link, one more question arises, that what is it the mental states metaphysically dependent upon? In the reply of second question on behalf of Sautrāntikas it can be said that since ontologically mental states are nothing but trope, therefore, the question of metaphysical dependence regarding the metaphorical mind and mental states is not enough significant. The question of metaphysical dependence, indeed, refers to the issue of individuality of some matter. Now, if a concerning matter is categorically constructive and ontologically metaphorical, and does not exist in reality at all, in that case, the question of metaphysical dependence loses its significance. Therefore we are

dropping the issue right here and moving forward to find the solution of the curiosity that whether there is any owner of the mental state or not.

The basic idea of the ownership view is that “the mental states are owned by selves and dependent on bodies” (Ganeri, 2012: 38). This idea clearly mismatches with the Buddhist, especially, Sautrāntika philosophical views. Unlike the systems like Nyāya, etc., Sautrāntikas do not accept the permanent existence of self as the place (*ādhāra*) of all of the mental states, cognition, experience, etc. This constant self is considered as the owner of the mental states and so, recognised as ‘I’. Buddhists do not accept any constant faculty called self. For Sautrāntikas, it seems meaningless to ascribe the ‘I’-hood on the inner psychical state of a person because there is no so-called *inner state* or self that could be referred by it. Despite the fact, there is a tendency in the common people to ascribe the ‘I’-hood or mineness on their own personal feelings, actions, experiences, etc., as the influencing and responsible authority of all these mental derivatives. However, the use is erroneous. It erroneously imports the notion of subject or agent and imposes the notion upon one’s inner experience. The use of ‘I’, in Sautrāntika framework stands for a combination of metonymy and error theory. Therefore, in this case ‘I’ does not function as an expression of true reference. Instead, it refers to a deceptive reference. We are calling the reference as *deceptive* because it is a null-expression having a zero referent. Therefore, the imposition of ‘I’ causes a false impression. Moreover, this erroneous expression affects the language of common people and involves mistakes about semantic uses. Semantically the use of ‘I’ represents the immediate experience of a person, which is technically called the first person stance or the firsthand experience. For example, when someone says ‘I am happy’ or ‘I am in pain’ then the ‘I’ refers to the speaker as the subject or first-person, who is alone able to experience immediately the feeling of happiness or pain. According to the Sautrāntika belief, this

first-person stance is not real and following that, the inner state and the subject-hood also do not exist. All of the '*I*'-feelings and '*I*'-experiences and their related states are purely metaphorical. Therefore, according to the Sautrāntikas there is no scope for any real owner and its ownership, besides the trope of mineness and self-awareness. In this context, following Vasubandhu, Ganeri adds, "in the movement from a pre-attentive self-awareness to explicit use of '*I*', a transformation of some sort is involved, one which involves conceptual work (*vikalpa*), and that the use of '*I*' is metaphorical or metonymic. Their view is that the use of '*I*' is indeed referential, and that the use as object and the use as subject are to be understood as making reference to, on the one hand, the human being, and on the other, an inner subject of experience, this second use being derivative from the first. There is, however, no subject of experience and so the subject use of the first person is an error" (2012: 161).

4.11: Embodied Perception and Sautrāntika Thought of Perception

We started this chapter with the objective that whether the model of indirect perception that is represented through the Sautrāntika theory of perception, can become a means to explain the visual experience of an embodied human being or not. Following the discussion that we have yet, it seems that it is difficult to find out the characteristics, related to the concept of embodiment, in the Sautrāntika theory of perception. Embodiment is a concept of existential phenomenology that accepts and emphasises on the subjective aspect of a human being, apart from the physical or objective aspect. The subjective aspect refers to the conscious inner state of a person that involves desire, intention, emotion, cognition, and other subtle states of mind or mental elements. Along with that, the concept of embodiment essentially talks about subjective experience, over the simple physiological activity. It refers to the direct, conscious, and intentional involvement of a person during the process or performance of cognitive action.

The embodiment in perception refers to the direct physical presence of the perceiver in the process of perception. Along with the direct physical presence of the perceiving agent, the physical presence of the object of perception also expected, according to the notion. By ‘physical presence of the object of perception’, I mean to say that the object should be there in the environment as well as before the visual sense organ, with a particular form and structure. In fact, the object of perception is supposed to be perceived as it is, directly. Direct perception of the physical form of percept affects the act of perception. In respect of the form, shape, etc. features of the percept the body of a perceiver gets a kind of perspective that affects her perception regarding her surroundings. According to the notion of embodiment, perception is directed by the intention of the perceiver. The needs, desire, present situation, etc. of a perceiver affects the process of perception. How an object will be used that depends upon desire, needs, etc. of the perceiver. For that reason, an object is used in many ways. For example, a thirsty person X uses a glass of clean water for drinking purpose but another person Y, who is having some irritation in his eyes, uses the clean water to wash his eyes, and so on.

4.11.1: Subjective Experience

The subjective experience of the perceiver affects her perception. For that reason, two different people may perceive the same object in two different ways. As it is exemplified in the last example of water. Again, one person can treat an object in two different situations in two different manners. For example, a person at her workplace uses a chair strictly for sitting purpose. But, the same person at her home uses her chair for various purposes, other than sitting purpose. The person lives in a small apartment where there is insufficient space for furniture like the study table, bookrack, etc. Therefore, sometimes she keeps her books on the chair, sometimes uses it as writing-table, etc. In our daily life sometimes, we manipulate our subjective

experiences for using some object in an unconventional manner, in order to solve our problems. For example, none of us, under normal condition, would like to hold a steel-glass of boiling water in bare hands. But if a person has lost the sensation of her hands due to extreme cold then she will eagerly choose to hold the glass of boiling water in bare hands. In this case, the person already aware of the feeling of hotness of boiling water and she also has the subjective experience of the consequence of touching hot object. Simultaneously, the person is also aware of the fact that, in extreme cold situation, sometimes, our body needs warmth from some external source to survive. Therefore, to get back the sensation in her hands she chooses to pick up the glass of boiling water by her bare hands. In this case, she manipulates her subjective experiences and uses the object in an unusual manner. From the standpoint of Sautrāntika theory of perception, the explanation of this kind of behaviour is quite difficult to find out. Sautrāntikas do not argue on behalf of a person's subjectivity. In their account, there is no space for any explicit 'I', reflective 'I'-consciousness, or the mineness.

In fact, Sautrāntikas describe the inner state as a continually flowing stream. Common ignorant and seized people impose the 'I'-hood or mineness upon the stream and consider the 'I' and its related states as real, permanent. Due to ignorance, common people think the 'I' as the owner of the mind, mental states, and physical states, too. However, the 'I' and its ownership both are metaphorical, unreal. If just having a physical form or body, and being shaped (literally) or recognised by that form, may be considered as a meaning of 'embodiment' then the psycho-physical combination definitely represents a version of embodiment. However, this sense is not even close to the phenomenological notion of embodiment.

The phenomenological notion of embodiment necessarily includes the element of the experience. There are some shades or variations in experiences, some are crude, can be described in the

terms of physicality, and can be expressed in language. There are some other kinds of experiences, which belong to the higher level those are subtle in nature. These second kinds of experiences are inexplicable, cannot be expressed in a language other than metaphor. Experiences help a person to decide actions for the present situation and for future also. In Sautrāntika framework experiences has been accepted, though as unreal. In fact, according to their description, the aggregated form of sensational (*vedanā-udbhūta*) experience and perceptual (*saṃjñā-udbhūta*) experience together form mind, on one hand. On the other hand, these (past and lived) experiences remain stored in the stream of mind as pre-disposition or volition for future action. But the problem is that Sautrāntika accepts the experiences as well as the application of experiences as unreal, metaphorical. For, neither experiences hold the true object of perception, i.e. bare particular, nor the actions performed is influenced by the experiences help a person to have or achieve the bare particular.

Following the link of the object of perception, it is to say that nobody can register the state of perceiving bare particular (i.e. *pratyakṣa*). In fact, other than the seers, no human being is aware of the entire state as well as the processing of indeterminate perception. Therefore, for empirical purposes, people are dependent on determinate perception. The objects of determinate perception are merely conceptual construction, which is hypothetically real. Now the question is how some hypothetical object can cause some genuine experience? The experience caused by a hypothetical object should be hypothetical in nature. In fact, it is little difficult to understand how some hypothetical objects can fulfill a human being's needs, which are not hypothetical. However, according to the phenomenological notion of embodiment the object of cognition or perception should be real and tangible, in respect of what the perceiver can measure or realise her own spatial position, means whether she is in a close or far distance, whether she is so big or

small in respect of the object, and so on. This kind of realisation contributes to getting a physical perspective, depending on which the perceiver can decide, to know the percept properly where should she stand or what should she do, etc. For example, in the case of visually perceiving a house, the perceiver needs to decide her own standing position in respect of the *real* the of the house, so that she can have more visual details about that house. As the perceiver changes her positions by coming closer to the house, standing in a certain distance, or taking a tour around the house, the more information about the house becomes reveal to her. Now, if the house would not be real, but someone's conceptual construction, then it would be impossible to encounter the house physically. The owner of the hypothesis would be aware of every detail of the house beforehand because it is her own mental construction. In that case, there would be no application of such concepts of near, far, right, left, etc. because in the hypothetical realm these are nothing more than mere words without significance. However, practically no one experience such a situation. We are not aware of the bare particular; even we cannot register the contact between the eye and the bare particular. Depending on the stream of copies of the bare particular i.e. the universal form, we infer the bare particular that already has passed away. Again, on the basis of the existence of bare particular the main/root object can be inferred (only). Therefore, on this ground, it can be said that in Sautrāntika framework the process of *pratyakṣa* and *saṃjñā* both are mediated and so indirect.

Conclusion

At the beginning of conclusion, it is to mention that Sautrāntika Buddhists do not mention their theory in terms of the western theory of embodiment or have the term 'embodiment' anywhere in their theory. In fact, it is clear from the elaborated discussion that in true sense Buddhists do not accept any role of mind-body relation as it is accepted in the notion of embodiment. For the

mind, mental states, experiences everything is unreal, non-existent. Body, on the other hand, for them is nothing but a composition of atoms, caused as one of the consequences of the cycle of existence. As I have mentioned previously, in this research work I am interested in focusing on the process aspect of perception that invariably involves a person's conscious intentional activities for fulfilling her own needs in order to survive. Therefore, I took an attempt to see whether it is possible to find out any hidden aspect or approach in the Sautrāntika theory of perception, as a whole, or not, which openly or latently indicates towards the notion of embodiment. From the above mentioned discussion, it is clear that in the context of the fulfillment of the empirical purpose Sautrāntikas accept the significance of visual perception and in this context they talk about the role of psychophysical combination. However, this kind of perception is called 'perception' in figurative sense only. Determinate perception, for them is inference in disguise. For, in this case, the so-called *perception* occurs depending on the inferential process, though no perceiver is aware of it. This kind of perceptual process is similar to the Helmholtz's concept of unconscious inference (see Chapter 3). Sautrāntika theory of perception is not suitable for explanation of the visual experience of the world of an embodied human being. For the sake of debate in this research work if it is considered the figurative sense is the real sense, in that case also this theory fails to explain the mechanism behind the embodied perception. By embodied perception I want to refer to that level of perception in which no concept, language, or sign can be applied consciously. The body of the perceiver interacts with the surroundings to cope up with it, in order to survive or at least to fulfill own need(s). In this level, the perceiver as a complete conscious physical being realises and expresses her needs. At this kind of level the need of a person cannot be categorised as purely physical or mental. For, physical and mental both kinds of feelings, realisation, etc. become inseparable. The perceiver

considers percepts as desirable or rejectable, only. In this kind of action or behaviour, the present situation also has a great impact. The body as the owned property of the inner-self (not *ātmā*) of the person copes up with the surroundings in order to understand or decide whether the surrounding is useful or not, safe or not, and so on. However, this entire matter is quite difficult to describe in terms of the Sautrāntika theory of perception, because they explain all of these matters as mere conceptual construction, hence, false and unreal. For them all the subtle or crude feelings, etc. arises due to ignorance, trace of the past life, sensation, perception of the unreal hypothetical material world, etc. Therefore, naturally the achievement of the hypothetical object that a person longs for becomes meaningless, pseudo. From the entire discussion, it can be said that in the context of the thesis the Sautrāntika theory of perception is not suitable to explain the visual experience of an embodied human being.

Direct Perception as Embodied Perception: Reflections from Gibson and Nyāya

The notion of embodiment starts or comes down to us through the phenomenological tradition that obviously owes itself to Husserl and maybe before that to Brentano. But the main purpose of this thesis is to explore how the notion of embodiment as it has developed in cognitive science may have an impact on our idea of perception itself. Hence, the aim of this thesis is to reflect upon and possibly propose a picture of embodied perception.¹

“Embodiment in the field of cognitive science refers to understanding the role of an agent’s own body in its everyday, situated cognition” (Gibbs, 2005: 1). Our bodies influence our actions like thinking, speaking, and perceiving. Embodiment is a concept used in many different research areas and thus has many different, yet related meanings. The concept of embodiment considers

¹ Let me say with little diversion that as I am going to describe the notion of embodied perception in the light of embodiment in cognitive science, one may wonder whether I am considering perception as a type of cognition. My answer is that I am not aiming to merge the notion of embodied perception with the notion of embodied cognition. My plan is to use the notion of embodied experience as the bedrock on which both embodied perception and embodied cognition may be based. Perhaps, the most fundamental factor that keeps the notion of embodied perception apart from the notion of embodied cognition is the involvement of concepts. It may be said that cognition is essentially conceptual and such concepts are derived from one’s lived experience of various physical and bodily states. Such concepts may then be applied metaphorically to other cognitive states. Let me give an example, ‘when I realised that I had travelled to my destination with none other than A.P.J. Abdul Kalam, a thrill *ran down* my spine’. Notice the italicised words in this example. Their use is obviously metaphorical. But they have been most certainly derived from the passage of electric current along a wire.

On the other hand, embodied perception, which is also part and percle of embodied experience, optionally involves the use of concepts. What it necessarily involve is the embodying of generic features and usability of objects along with the present situation and the environment by the body itself. The body embodies those factors and kind of moulds them to suit its own physical form. Hence in perceiving the body, the environment, the perceptual systems, the agent’s prior experiences act as a unit in tandem. The involvement of concepts and the difference between concepts and percepts cesses to remain an issue of significance. Let me take the example of an old woman waiting in front of a kerosene oil shop in a village. The long que is intimidating and she fills tired and looks around for something to sit in and rest her tired feet. As she finds nothing other than an upturned iron bucket, she proceeds to lower her weight on it. Her perception of that bucket is not as something that carries water. But as something on which she can sit and which can bare her weight. Whether percepts or concepts or both are involved does not seem to be an important consideration here, given the fact that the body is able to both mould itself and the object of the environment in a well-tuned manner.

the body as a critical component of cognition. Embodiment is more than just physiological activities. The act of *embodying* is dependent on the repetitive and habitual occurrences of kinesthetic, proprioceptive actions that provide much of people's felt, subjective experience. In this research work, my focus is centred only on visual perception. It is true that visual perception occurs by eye and its related visual system but that is not the complete description. Apart from the role of the eye and the visual system, visual perception involves kinesthetic actions, locomotion, including the activities of the entire body. Visualisation, as an essential aspect of the perceptual process, represents subjunctive thought processes, in which objects are perceived by imagining how they may be physically manipulated. For the time being, we may understand the *subjunctive process* in terms of visualisation. This action is not possible without the involvement of embodied experience in the process of perception.

In most of the cases, it becomes possible to have or earn abstract concepts through embodied experience. The cognitive process is such a thing that neither happens completely depending on physical activities nor is it a complete outcome of brain activity. Cognitive processes are the combination of bodily movements and interactions, manipulations of objects in real-world environments, psychological or emotional involvements, and some other relative factors. Comprehensive cognitive mechanisms necessarily include the presence and influence of environmental structures. Therefore, it can be said that cognitive processes are the composition of both internal processes and bodily involvement with the external world. In the study of embodiment, irrespective of its grounds or areas, it is accepted that the body of a person appears, in perceptual interaction with the world, always as a culture-bound object, because nobody on this planet is outside of some culture. Our bodies and the felt experiences of our bodies in action are inevitable in the study of perception.

In this research work, I am trying to see the concept from the perspective of perception and perceptual process. For that reason, I am interested in that aspect of the notion of embodiment, which takes the body to be important in perception and action. One more point should be added here that in this research work I am dealing with the notion of embodiment as it is accepted in cognitive science. Following the history of cognitive science, it can be said that to understand and explain higher-order cognition and subtle experiences cognitive science involves the notion of phenomenology of embodiment. In different platforms for the study of embodiment, there are different descriptions and definitions available. But almost none of the areas of the study of embodiment disagree with Lackoff and Johnson (1999) as they provide a consistent definition of embodiment. Regarding the issue, Lackoff and Johnson have three major findings: “The mind is inherently embodied. Thought is mostly unconscious. Abstract concepts are largely metaphorical” (1999: 03). It is true that through our everyday activities or interactions with the world we learn about various things, concepts, etc., which are abstract in nature. But when we describe those abstract matters to someone else, surprisingly, in most cases, we prefer to use metaphors or use bodily gestures. That becomes possible because without the conscious registration we, or more specifically speaking, our bodies already have recorded the senses of those concepts or experiences, along with the vibes of the instant of the situation and the environment by embodying those things during perception.

The body has a great contribution to the constitution of our subjectivity. It shapes our thoughts, vision, and experiences. The subjective, felt experiences of our bodies in action provide base for language, thought, perception, and behaviour. Embodied experience is dependent upon an individual’s dynamic movement through her physical, social and cultural surroundings and upon the accession of first-hand experiences during various activities. The dynamical approach of

embodied cognition rejects the idea that representational content is the best means of describing and understanding cognition. The dynamic approach of embodiment comprises the interaction among perception, body, and environment. In fact, the study of the dynamic approach lays great emphasis on the relation between perception, action, and situatedness.

Throughout the thesis, I am dealing with the issue of embodiment as an inherent part of the study of perception. The purpose of this research is to show how one's perceptual experience of the world, in particular visual perception, can be explained only if perception is taken to be embodied. This feature of perception is present in the model of direct perception. It is for this reason that the notion of embodied perception that I uphold in this thesis is based on the model of direct perception. By direct perception, on the one hand, people know the objective aspect of the surroundings. On the other hand following own subjective experiences from the perspective of their own bodies people experience and embody various factors, which are already there in the environment but cannot be grabbed objectively, like distance, positions, meanings of the objects, etc. In this part of the research work, we are going to talk about *the shape of perception*. As a process, perception is much more than just contact or connection between the sense organ and the object of perception. During perceiving something, an individual as if owns the perception by her body. In this context, the body is not a mere physical object, barer of motor activities, or a display of emotional expressions, but it is identical with a person including her mental states, emotions, physical matters, and so on. Therefore, naturally, any of the actions, especially perception of that person is bound to be affected by her body. The aim of this chapter is to show that the body plays various significant roles by going beyond the brain in processing perception or performing perceptual actions. From the phenomenological aspect, from the concept of *action* of perception the presence and conscious involvement of the body of the perceiving agent cannot

be separated. In the chapter the discussion will be preceded following the sequence: right after this introduction, we will frame a general picture of the model of direct perception, which is the central factor of the thesis. After that, we will describe the notion of embodied perception and following the link at next two subsequent sections, we will show, respectively, that the theory of direct perceptions of Gibson and Nyāya school of Indian philosophy indeed involves the notion of embodiment intrinsically.

5.1: A General Model of Direct Visual Perception

Direct perception is such a process of cognition, in which the perceiving agent sees the object of perception directly. She directly steps in the process of the occurrence of perception. Here one may wonder that what is the significance of mentioning the phrase ‘directly steps in the process of the occurrence of perception’, separately, because only living beings are able to perceive something, and the process occurs only *in* someone. Therefore, is not it obvious that the perceiving agent is bound to participate in the process? Despite the obvious fact we are consciously using the phrase to highlight the fact that according to the notion of direct perception a person involves in the process according to her own desire, will, or intention, not because she has to. It is true that an agent cannot control or decide what will come in contact with her senses and what will not, but she definitely can desire and decide that what to see and what not to. As a conscious and intentional being the perceiver, according to her situation and need to choose the object from her surroundings for perceiving. From the start of perception to the application or use of that object, the perceiver remains involved in the process.

The process of direct perception is a real fact. The factors, which are involved in the process also are real. The presence of the perceiver, the existence of the percept, space, time, the entire

surroundings, including the situation, in which the perception occurs (in general) is completely real and objective. From the theoretical aspect, too, direct perception is considered as a real action. In this context, the term ‘real’ refers to philosophical realism or practicality. the supporters of the direct model of perception consider that the objects and the use i.e the scopes of applications of those objects potentially are already there in the environment, as independent of the presence of any perceiver or anything else. But how or when those *uses* will be perceived by someone or the object will serve someone’s purpose that is dependent on the presence of human beings (or, broadly speaking, on the living organisms). An object can be used in different ways, but all of the *ways* are bound to match the basic category of that object, in short, there is no scope for any category mistake.

One of the main conditions for perceiving directly is that the perceiver has to have immediate and direct contact with the object of perception. By this direct and immediate contact, the perceiver sees or knows the object as it is, including the features and structures of that object. Since for the occurrence of the process, the direct physical involvement of the perceiver is necessary, therefore, naturally along with the physical appearance of the perceiver her mental presence or attention also necessary. Apart from the presence of the perceiver, the situation and the environment, in which the perception occurs, also plays important roles.

According to the notion of direct perception, the information related to the percept does not enter to the perceiver’s head through her sense organs or get imposed on her; but the perceiver is supposed to move voluntarily to obtain the percept as well as the perceptual cognition. This process prioritises and pays importance to the spontaneous or deliberate desire of the perceiver for perceiving the object or expressing the desire to attain the percept. Therefore, it is needless to

say that an *empty* contact between the sense organ and the percept does not produce perception in real sense. The perceiver's awareness, desire, volition, effort, etc. together make a perception true and meaningful. That is why, a casual, purposeless scanning over the surroundings or looking at something blankly for a long while does not call perception, because no one obtains anything from these kinds of gestures.

The process of direct perception requires at first the direct connection or relation between the perceiver and the object. This relation mainly happens between the visual sense of the perceiver and the object of perception. By the term 'sense' we meant the perceptual system as a whole, not the visual sense organ eye, alone. The eye is not just a body part, positioned in front of the head. It is a whole system, which is connected with the central neuromuscular system of the body by various neuromuscular fibers. Following that link, the visual system is connected with the entire body. Due to this connection, the perceptual experiences become the experiences of the entire body as well as of the perceiver, irrespective of any particular body part.

From an empirical perspective knowing something by visual perception does not mean that it is only acquired by the eye. Consider practically that if something attracts us visually then at first we see it from a distance but later, if it is accessible then, we gradually move towards it, try to see it minutely on the all of its sides, sometimes pick it up in hand to see more closely. Now see, when we see something from the very first time, then apart from the visual sense our other senses like tactile, auditory, or olfactory senses also get involved in it. Again, along with the senses our motor systems also get involved by which we move towards the object or pick it up in hand, etc. As the result of this entire process, later, only by seeing the object even from distance we can

recognise it and can decide whether at present it is able to serve my purpose or not, and behave accordingly.

There is one more important point deserve to be mentioned here that, in the process of perception apart from the visual perceptual system of a human being her entire body gets involved, too. Moving *towards* the desired object of perception, to get it in the close range of vision and to grab that if it feels interesting. Otherwise, the perceiver moves *from* the object to some other direction, if the percept is felt as uninteresting; she keeps a distance from the object of dislike or rejects it. All of these gestures or more specifically speaking, *actions*, like movements, postures, expressions, etc. happen depending on the body of the observer. All of these actions are constituting parts of the broader action called the perception.

5.2: Embodied Visual Perception

The body of a perceiving organism is essential for the processing of her perception, whether someone agrees or disagree with it. Embodied (visual) perception is clearly a kind of continuous or live experience of the living body. Therefore, it includes a perceiver's firsthand experience. For embodied perception, four elements are essential; those are body, time, space, and relation with others. And top of it all the most essential and important element for embodied perception is the environment. It provides the surroundings, ground, backgrounds, horizon, medium, etc., which are necessary for an organism to live and survive. The space that we experience, we stand on, is real. In Gibson's term, the space is ecological in nature, not abstract geometrical. Ecological space provides positions that are there in nature, as open to be occupied. In this sense, space or position is not abstract or ideal. No two people can occupy one position at the same time. We cannot see anything called 'space' separately in the environment. Whatever we get

though the perceptual experience are some positions, which are either occupied by some living or nonliving objects at present or there is possibility to be occupied in future. But we are aware that we always stay by occupying some position, we move from one position to another, on the earth. Again, in the case of the experience of time, unlike space, it cannot be said that we feel or see the ecological time. But it is true that we see or experience the flow of time through duration, changes, or shifts in the environment. We cannot see the time as it is but we can experience the duration by seeing the house of my childhood is still there, the movements of the watch spines or pendulum, shift of the sun in the sky, change of the positions of objects, change in the growth of a plant or a child, etc.

There are two kinds of phenomena, which are invariably required for a living being, especially for a human being for perceiving and experiencing the world. Body Image and body schema are two such phenomena that we are about to talk. These two are barely two different or separate phenomena. In fact, it is quite difficult to identify or experience the difference, transitions or shifts between the two. However, conceptually there is a clear and prominent line of difference between the phenomena.

According to Shaun Gallagher (1986), body image is such a phenomenon that refers to a conscious awareness of one's own body, which is, conversely, the basis of body image itself. Irrespective of the circumstance, this conscious awareness makes a person to recognise her own body as an intentional object, as a real thing. On the other hand, body schema refers to the non-conscious performance of the body. Body image and body schema are almost run together. Mainly in the reflective states of consciousness, the body of a person behaves as an intentional object of consciousness. In some situations like in fatigue, pain, pleasure, physical or mental

sickness, stress, or in the situation of physical challenges like different sports, the body becomes an intentional object of consciousness, and the mode of body image gets switched on. As a result of that, the body, from just a physical object, gets converted into ‘my body’. Apart from these kinds of situations, in the situation of voluntary actions also the body turns into the intentional object of consciousness. The person behaves as the responsible owner of her own body and its activities. When the voluntary desire and will of the perceiver overtakes the consciousness and following that the *mineness* reflects on the body, then she perceives or experiences herself as the owner of her own body. At that moment, she sees and treats the body as conscious and intentional but (still) object. Following this kind of experience, the owner refers to her body and body parts by articulating as ‘my body’, ‘my hands’, ‘my legs’, ‘I am suffering from sore throat’, and so on.

On the other hand, the phenomenon called body schema, unlike body image, refers to the pre-reflective state of consciousness, in which the *non-conscious* performances of the body are the main concern. In the pre-reflective states when the consciousness is engaged in some task or thought and not focused about the body-object, then for that limited tenure, the body becomes free and open to be anonymously integrated into the ambiance. A person does not concentrate on her own body-object unless her mineness get reflected on the consciousness being forced by some external or internal reason like pain, discomfort, fatigue, pleasure, etc., as we saw in the case of sensationless perception (ref: see *suptamanā*). It is a notable thing that despite the sudden shift from the phase of non-conscious to conscious, even for a moment, the owner does not *see* the body as some unfamiliar alien object but it appears to her as an *owned object*, as ‘my body’. In fact, this *owned* presence makes her realise, by pointing to the fact, that *my* body is already there, prior to my awareness of it, working in the world in a non-conscious, unwonted way.

In the course of perceiving the environment, including its objects and organisms, first, we see our whole body and its parts as my owned properties like ‘my body’, etc. Then in respect of the body, we perceive the environment. it can be said that at this point the role of body image and body schema get merged quite smoothly. Being affected by that *merge*, on one hand, we as owner consider our body as the axes and, on the other hand, in respect of those axes, we measure the position of the other objects whether those are far or near, up or down, big or small, and so on. If we see these actions in a sequential manner then the former portion refers to the effect of the body image and the later portion refers to the effect of the body schema. unless having an open or broader idea regarding the surroundings and its contents’ existence, including her own body-object, at beforehand, a perceiver neither can measure the positions of her surrounding objects nor can consider her own body as axes.

Since the perception is a perspectival action and the behaviour is situated, therefore, in some situation the body of a perceiver non-consciously copes up with the environment following the available stimulus information, at the first. Immediately after that, as self-conscious intentional being the perceiver recognises the position of her body in the space i.e. the perspective of perception. Then she decides whether for her perception, the information coming from the present perspective, is sufficient or not, whether she should change her perspective i.e. position or should take a tour around the object.

In light of the discussion of the body schema and the body image now we can talk about some of the actions, namely coping and other-perception, which exclusively require the core involvement of the body. The mechanism of these kinds of actions necessarily involves the above-mentioned phenomena. This discussion will lead our work towards the embodied perception.

5.2.1: Coping: Friendship with the Surroundings

Perception itself is an action and it develops through (various) actions. The entire process involves the active and conscious participation of the perceiver's body as *owned* by herself. In this last sentence, the term 'owned' refers to that in perception, the body of an organism is not *used* merely as a tool or medium that is required only to receive data of the external world, to transmit the data to the brain, and finally to execute the command of the brain. But it works as owned by a conscious and intentional authority called the embodied 'I'. Nothing can escape the environment. Every organism including human being is naturally bound to live in some environment. Therefore, from the very early stages of life, the body of a human being, anonymously or non-anonymously, starts to cope up with the surroundings through perception. At the early stages, an infant can perceive light and motion and gradually as the range of her vision is developed she becomes able to see clearly the objects in her surrounding environment. As the infant grows up her body becomes able to locomote, to travel from here and there, and to access the objects she perceives or intends to perceive. According to the direct perceptual approach, our body has a tendency, it in its conscious state keeps exploring the environment to find out whether the environment is safe and habitable or not. At every stage of explorations, it keeps coping up as much as possible in order to survive. And once the body gets to confirm that the environment is habitable and safe, gradually the body becomes used to it and starts to develop various habits. Even in the states of performing habitual actions, the perceiver does not stop collecting information, directly. Therefore, she can register if there any change happens in the body like cut, etc. or in the environment like the displacement of the object, some change in its background, etc.

In the act of coping, the body reads the environment and present situation by which it is surrounded and tries to match those as much as possible. If it finds the surroundings as new or unknown then tries to understand whether it is habitable or is able to provide some other kind of uses or not. If it is, then the body tries to adjust to fit in it following the need of surviving conditions. On the other hand, if the body recognises the surroundings as known and familiar then behaves in the usual ways or follows its habits. The act of coping makes able a person, especially her body, to become an expert in recognising the nature of the local environment and instantaneous situation and to respond or behave accordingly. It is to note here that a person may behave differently at different moments despite the presence of the same surroundings, depending on the present situation and the condition of her present state of mind. However, the act of coping starts following the interest, desire, and need of the owner of the body and it runs along with the process of perception as one of the essential parts of its mechanism. The act of coping is natural and instant. It runs in a person's body at a very physical level; her awareness cannot reach it. At the early ages, a human body tries to match the environment, cope up with its medium, changes, and other things following trial and error method. For, at that level, the body starts from zero learning. But with growing age, as the person learns various lessons, techniques, concepts, etc. that affect her mind and body both to be mature. As a result, the chances of error reduce gradually. Sometimes the body of a mature or experienced person even in some new environment or situation, without the awareness of the owner, starts to cope up to reach a balance and to keep the owner calm and comfortable. This happens especially when a person is plunged into a deep sleep or thinking of some serious matter.

5.2.2: The Grip on Reality

Now, one may wonder that if, for a mature adult person her learning, perceptual experiences make her read the situation, cope up with the environment then what is the problem in accepting the position of indirect perceptual theories that claim the same. No, there is a problem, there is a great difference. In direct interaction with an object, especially to a person, every time we may *see* something extra. It may be a small, ignorable, or unimportant change or addition on the surface of the object or in the appearance of the person. However, this extra something cannot be grasped through mediated perception. For, first, these changes or additions are not basic features of the object or the person and second, the things keep changing depending on time, situation, and of course the mental state of the observed person. Sometimes, the mental states, moods, etc. affect the perception of the perceiver, too. Therefore, if the receptors fail to receive the data that is/are carrying *the extra thing* then during the processing of received data in the brain, memory cannot feel that gap by some stored similar data. For every change or addition is unique and situated, does not repeat itself. Therefore, if there is any data regarding some change or addition in the memory bank then there is a high chance mismatch. As a result of that, the perceiver remains unknown about that change or addition and get to see the object with the same typical features. Again, if the data related to the changes reach to the brain, in that case, for that particular moment the perceiver sees the right thing but as a *type* that data become stored in the memory bank of that person for future purpose. Therefore, the point is, crossing the barriers of her learning, memory, and processed perception, the person can see but cannot have the experience of seeing the extra thing. From the perspective of richness and clarity of the earned knowledge, the experience of these small, ignorable things matters much more than what is *given* in the general concepts or rules. Learning generally involves some concepts or rules regarding

the fact that is either based on some formula or on some experiment. But when a person encounters something or someone in a real situation, then she may perceive there some extra information that is unexpected to her, because those are not given in her learned concepts, methods, or knowledge. The *readymade* data or information for the indirect methods miss those *extra* things. If the body of an organism is considered only as a mediatory tool or device that is there to work passively following the command or instruction of the brain then it is not possible to register the extra things instantly by looking toward something or someone and behave accordingly. For example, we may consider the case of an expert doctor who is practicing for many years, so, naturally, he is quite aware of the biological and anatomical behaviour of the human body and its every part as well as about medical science and its theories. Despite the knowledge and expertise, regarding the treatment of some disease X, depending on the nature of the case, the doctor changes the *given* or the established method of treatment. For, theoretically and technically, there are some basic and particular methods of treatment, but since, every person's body is uniquely organised and oriented, therefore, some cases demand to be treated in a different way. Since the doctor has expert vision therefore, he can *see* and *register* those extra things in those special cases, in comparison with the regular cases, by direct perception of the patient's body. So, the point of this argument is that to have a grip on the reality one has to have bodily participated in the process of perception right from the beginning.

Another point regarding the argument is: to have the optimal grip on the reality the movement and locomotion of the body are necessary. The richness and clarity of the information regarding a percept's form and other details depend on the direction and distance of the percept in respect to the position of the observer. The fact is perception is a kind of perspectival action, it requires movement and locomotion of the human body in order to find out the right perspective, from

where the perceiver can have maximum information regarding that object with maximum richness and clarity.

As an example, think about a case of watching an abstract artwork by an art-interested but inexperienced person. As the person knows that the artwork she is watching now definitely has a meaning or hidden figure in it but due to lack of knowledge she is not getting it. Therefore, to understand the work she stands in front of it for a while, and then changes her position, posture for five to six times, moves her eyes, etc. to get a right *perspective* from where she can have optimal information with maximum richness and maximum clarity to understand the work. Apart from the perception of critical or complex objects like artwork, etc., even for perceiving some simple object like a house the perceiver may move her body, shift positions or possibly take a tour around the house to get optimal information. Regarding this argument, one point is to add that the body of an experienced person gains a kind of ability to calculate the optimal distance of her own (position) from the object of perception, depending on the object's size, shape, background, the present situation, etc., in respect of her own body-structure and range of vision.

Moreover, every object on the earth has some values, meaning, which make the object useable. These meaningful features are there available in the environment as independent of the perceiver. Following the needs of the people and the meanings of the objects, a kind of relation or bond develops among the objects and the people.

5.2.3: The Skill of Coping

Following the aforementioned discussion, one may ask how someone cope up with her ambience and other conditions for surviving in some environment? And how the action of coping should

be described? Coping is such a kind of action that our body does whenever we step in some environment or surrounded by some situation. For a person coping happens naturally if the environment and situation both are new, unfamiliar or any of the two are unfamiliar to the person. But sometimes in the case of known environment and familiar situation also coping happens if there any change(s) occur.

Coping, in a sense, is nothing but a kind of skill of the body. Basically, by this action, our body makes us adapted to stay and survive in some environment or situation. Right after we born our body starts its struggle to reach a balanced state and tries to maintain that. The interesting thing about the action of coping is we, the conscious owners of the body, are not aware of it; we never feel it as 'I am coping' or 'my body is coping' as we can feel and say that 'I am eating', etc. We become familiar with our surroundings by coping. By nature, this is a kind of situated action and so, it is not bound to follow always the rules given in concepts or theories in order to cope with the environment. According to the mutual condition or circumstance created by the intensity of the need of the person, available options in the environment, and of course the situation together, the perception is manipulated and behaviour follows that. That is why the chair, which conventionally is an object to be sitting in, sometimes perceived as a substitute of a ladder or a place for keeping books. This kind of behaviour refers to the strong relationship between the process of perception and the act of coping, which in turn indicates to the bond of perception and action.

As we said previously that a human body from its very early age stars trying to fit in its local environment, it tries to cope up with all odds and evens. In the beginning, we can see a child go through trial and error method almost at her every step because at those periods she belongs to

the stage of zero learning and skill. At these stages, every success, as well as every failure, teach the person some lesson about the way of living or skills to grab objects and provides some more information about her surroundings.

At these stages, the person directly perceives objects and moves toward those without knowing the name or the use of those objects. For example, an infant tries to hold everything from toy to a crawling ant and puts it in the mouth to know it, follows the focus of a torch and tries to hold it in her fist, etc. After a certain age, the child does not repeat the same behaviour. This way at her adult age she becomes accustomed to the surroundings and all of her knowledge and experiences help her to move forward in her life to step into a new ambiance, new situation and to explore it. The act of coping becomes possible due to the direct perception of the available information in the environment. Moreover, when a person goes through the phase of success or failure at that time also she perceives the change/s in the environment that happened as the effect of her action and collects information from that *affected* environment. In the case of successful perception, the perceiver's body (metaphorically) notes down the steps that made it the success that in future in the same situation or in alike situation it can apply the steps. On the other hand, in the case of unsuccessful perception, the body notes down the steps not to repeat those in the future. Sometimes this kind of survey-based perception happens without her awareness and sometimes the perceiver with full attention minutely investigates those states. Through these kinds of intense perception, the involvement of the body, and gradual but balanced learning the perceiver earns various skills to cope up with the environment and to have a *grip* on the situation. The skillfull coping leads someone's body as well as herself to get an optimal grip on the situation. In this context, it is to add that in the case of embodied perception, in reality, every situation is real and concrete instead of vacuous, constructed, or hypothetical. There is no scope to infer the

perception or to extrapolate the behaviour. In fact, in real and concrete situation someone's behaviour is operated and decided by her instantaneous need for the object, interest towards that, current mental state, physical condition. Top of it all her awareness of the capability and grip over the skills of her own (body) to reach that object, which varies according to the type of environment, situation, and of course, the person. Our knowledge or learning and skills make us so equipped that we can perform an action in the appropriate time in the appropriate way.

Everyday skillfull action and everyday perception gradually make one gain mastery over some field, provide her *practical* and *pragmatic* wisdom, (which is much more than theories) which makes someone able to see beyond the boundary of *givenness* by breaking the barrier of the *establishment*. The practical wisdom of someone changes her worldview; in fact, she finds her own original vision that in future changes (in most of the cases) her perceptions of different situations. As a result, the person becomes able to see the offers or options available in the environment (i.e. affordances) that she can use freely to serve own purposes.

Following Hurbert L. Dreyfus (1978), on behalf of embodied perception, we can argue that no mediatory process, computer, or virtual technology can replace the role of the human body completely, because these things cannot do coping with reality. This difference appears more prominently regarding the cases of perceiving other persons. No machine can explore or read eye movements, head motion, gesture, posture, etc. of a person. In most of the cases, these movements or gestures carry a kind of silent language that only understandable to other human beings instead of a machine. Sometimes the intensity of some emotions like the pain of a broken heart or a mother's pleasure by seeing her child is doing well cannot be expressed through verbal language. Sometimes it is hard to find the exact word to express our inner state because the

expansion of our felt states is so wide that no uttered word can cover those states to describe. That is why sometimes we use such words which are meant to be express some other thing. The cases of synesthesia would be the right examples of this kind of situations. In these situations, only a sensible, mature human being can understand the state of mind or inner state of another human being who is *in* or *going through* any of these states by reading her gestures, facial expression, or the language of her eye. Therefore, a human body works during interaction with other persons in a much richer way. In a holistic sense, the embodied perceptual interaction is essential for human encounters, in general.

5.3: Perception of Other's

Until now we were talking about the role of the body in perceiving objects, mainly inert objects. Now in this section, we are going to have a discussion about the significant role of the body in perceiving another human being. It is such an important aspect without which the entire discussion of embodied perception will remain incomplete.

Perception of the living object i.e. the other, is more complicated than the perception of the non-living object. For in the former kind of perception the perceiver and the percept, both are living intentional beings. both of them hold desire, will, independent individuality. Therefore, in this case, the perceiver is not free to move towards the object of her desire, take a tour around it, see it from her own desired perspective, or to pick it up in her own hand to see it closely. Knowing a living percept, like another human being, is not so simple, because it involves the direct participation of both the perceiver as well as the percept.

In the perceptual process of other, the perceiver and the percept appear as a couple or pair. The intention, attention, and action of both almost equally matter here. Therefore, unlike the perception of an object, in this case, the external structure of the percept is considered as less significant. The essence of the perception of other is hidden in a special kind of phenomenon, called the Intercorporeality (Merleau-Ponty, 1964), which is also known as the intersubjectivity. The notion of Intercorporeality refers to the fact of understanding other mind, the behavioral mutuality of two individuals who are interacting with each other. The phenomenon of intercorporeality is not mediated by any representation or oriented by any established theory, but it works depending on the embodied perception of other's actions and understanding her intentions behind those actions. Apparently, it seems impossible to achieve by direct perception because there is a *belief* that the internal state of someone is private to that person and only she can access it. Merleau-Ponty describes the belief as mere myth. According to him, the relation between two person's bodies illuminates the intersubjectivity in an alternative way. Before to start a conversation or interaction with an *other* the perceiver tries to understand her state of mind, her nature, etc. by directly noticing her facial expression, gesture, manifested behaviour towards something or someone else, etc. This is a one-sided action, in which the perceiver only plays a role without her percept's awareness. On the other hand, during an interaction between the perceiver and her percept both of them read each other's facial expressions, etc. to understand each other's subjective state and to behave accordingly. At this point, one may wonder how the notion of intercorporeality is significant in the context of embodied perception because the notion typically refers to the problem of understanding other mind. To clarify that person's curiosity we can say that the connection of one person with other person depends on perception. Following Merleau-Ponty, we can say that during the process of perceiving an other

the perceiver reads the actions of the other through her own body. In order to perceive that other the perceiver from a distance personalises all of the expressions, gestures, or utterances of other that she perceives directly. The perceiver lives the intentions behind all of that expression or gesture of the other in her own body as her own intentions. At the next step as she is connected with the other's body, she sees all of her personalised and lived experiences, feelings, and intentions to become embodied in that other. Due to this reciprocal connection both of the persons can access each other's subjective states like thoughts, merits, demerits, likes, dislikes, etc., which in turn makes the perceiver as well as the other to see whether her interacting partner is usefull, harmful, or avoidable. Therefore, it is true that the notion of intercorporeality i.e. the reciprocal connection is intrinsically related to the fact of embodied visual perception.

Now let us enter the main discussion of perceiving other. From the perspective of an object, including nonliving and living both categories, the environment is called as surroundings. A person in her local environment i.e. her surroundings perceives everything from her own point of view. She deals with all kinds of objects following her own desire, learning, culture, and need, though practically she has the awareness that the nature and behaviour of living objects are hugely different from nonliving objects. Therefore, after a primary stage, the perceptual process regarding a living being becomes subtle and more complicated. At the primary stage, the perceiver observes the structural details of the percept's body, but then if she feels the need or some kind of compulsion for moving towards that living percept then she steps into the advanced stage(s) of the perceptual process. In the case of perceiving a living percept, the perceiver should necessarily consider the remaining living object in her surroundings, besides her and her percept. And most importantly she is supposed to see the environment as a society, instead of surroundings only. Therefore, in the case of perceiving a living being, like a human being, the

perceiver perceives something more than just the external appearance of that human being in respect of present situation, which is hidden behind the observable body. The mechanism of this kind of perception is not possible to explain by the established methods of reasoning, unconscious inference, or information processing. In this case, the perceiver through the direct perception of the another person's facial expressions, gestures, postures, in short, the expressions of the percept's body and by the interpretation of the spoken and unspoken language as well as meaning, collects information in order to have a vision of her subjective aspect. The perceiver needs to see and understand the subjective aspect of the other in order to match it with her own subjective aspect and to find out what kind of *uses* (i.e. affordances) that other affords. The other usually affords social relationships, help, assistance, supports, etc.

As we mentioned previously that in the perception of other, the perceiver becomes connected like a couple or pair. Again, in some purpose, if more than two people are interacts or have a face-to-face conversation in that case also all of the people are connected together in order to understand *other* behind their visible external aspect. The urge to understanding each other's inner aspect makes the perceiver or the self to be connected with the other.

To explain this matter more clearly we can mention about the notion of intercorporeality that Merleau-Ponty proposed in the book named *Signs* (1964). Intercorporeality refers to the intersubjectivity. According to Merleau-Ponty, it is possible to perceive someone's inner or subjective aspect by someone other, other than the *owner* of that aspect. Reciprocity is one of the essential parts of the mechanism of other perception as well as intercorporeality. Only in a reciprocal way, the perceiver can see and realise other's inner states. Simultaneously the perceiver can realise that though during the period of an interaction she and her percept share the

same perception-action loop but practically they are two independent individuals. She identifies her own existence as the *self* and her percept's as the *other*.

In order to perceive other and to find out the space for living freely, to express desires, etc. in the social surroundings, people try to build a bond with other inhabitants in different ways. For example, we can talk about simulation. In the case of toddlers or kids, we can see that they simulate different gestures or other activities of their parents or elders. In some other cases of the children we can see that the actions of others prompt their act in the same way. For example, if someone playfully opens her mouth as if she wants to bite a child's hand simultaneously we can notice that the child following that person opens her own mouth. Sometimes the same thing happens in the cases of adults. For example, let us consider the case of a diabetic person in a party, who craves for sweets but cannot have any due to doctor's restriction and strict watch of her wife. In this situation when he sees a person to have those sweets standing in front of him then unconsciously, he simulates that person's actions of eating sweets. His mouth gets open, his jaws move in chewing movements, and he swallows also, as if, instead of that person standing in front of him, he is eating those sweets. In this case, the actions of sweet-eating person prompt the action of the sweet-craving person. In this case, the body of that sweet-craving person becomes connected with the body of that sweet-eating person. By direct perception of the actions of sweet-eating person the sweet-craving person feels the inner subjective states of that sweet-eating person, like his intention, pleasure, satisfaction behind those actions as those he is having all of those states and as a result following the prompt of that sweet-eating person's body the sweet-craving person's body simulates those actions. The act of prompting or simulation works depending on the intersubjective connection between the two persons. In these cases, the reciprocation happens between the bodies without the awareness of the owners of those bodies.

Again, apart from the simulation, the reciprocal behaviour between self and other's body leads to the interpersonal communication process, which is potentially operated by intercorporeality. For interpersonal communication, the perception-action loop between the two (or more) bodies tries to match their behaviour with one another or they choose to synchronise their behaviour at the level of interaction with one another. Empathy is the most prominent example of behaviour matching. Apart from that, mirror reactions could be another prominent example of interpersonal communication through behaviour matching. Mirror reaction occurs by a visual encounter of two people during a face-to-face interaction. Yawning, head propping, crossing the legs, reflexive crying, etc. are some of the most felt examples of mirror reaction. If someone is truly involved in some serious job and has no time to be enticed by anything in that situation if the person sees someone yawning repeatedly then within a few seconds she also starts to yawn. It happens reflexively, no one can control it. Again, in the case of reflexive crying in a situation if we see someone to cry, unconsciously to match her behaviour reflexively we start to cry or at least feeling like crying. It happens even if that crying character belongs to some novel or television play. To be connected with the situation in which the crying character is in and to understand or understand the feeling of that character our body puts effort to match own behaviour with the portrayed character's behaviour. In the cases of behaviour matching, the people, who are involved in the same action, converge emotionally.

On the other hand, during interactional synchrony, a kind of connection is created between the action and reaction of the bodies of self and other, though this kind of reciprocation maintains a rhythmic order. To maintain the rhythm of reciprocation i.e. the interaction, it is important for both the self and the other to understand each other's intention of action or behaviour. And for that, both of them are supposed to be connected with the flow of each other's nonverbal (and

sometimes verbal) behaviours. This attitude helps both of the self and the other to keep continuous the communication. The act of being connected and coped up with one another's behaviour is significant and necessary for the synchronised and meaningful reciprocation. The force of this meaningful reciprocation makes us behave or respond in a certain way in reply to a certain kind of action. Once we behave differently during some interaction the bond or pair between the self and the other becomes broken or separated. The perception of other makes a person fit in a society, to earn the ability to understand different aspects of society, which passively contributes to developing her sense of perspective.

5.4: Embodied Perception in Gibsonian Framework

James Jerome Gibson's theory of visual perception is one of the clear examples that represent the image of embodied perception. Though he does not claim that his theory represents a model of embodied perception, still, the clear presence of the features of the embodiment as well as the embodiment perception are available all over his theory, arguments, and descriptions. Gibson describes the theory of ecological approach in the process of perception in such a manner that reflects the inseparable presence of the notions of embodiment and first-person stance of experience in the process of perception or perceptual cognition. Gibson proposes the model of direct perception in his theory that we already have seen in the first chapter. With the link of that discussion, in this section, following the context, I will highlight the role of the body of the perceiver in the act of perception in order to fit the theory within the frame of the embodied perception.

One of the main features of the notion of embodied perception is that through direct perception the perceiver senses the nature of her surroundings, verifies whether the place and the

environment is inhabitable or not by interacting with it. This feature gets properly evaluated in the Gibsonian theory when he counts the environment, objects, information, and light as the elements of the key concept to build up the entire thesis of the direct perceptual process from the ecological perspective. Direct perception is such a process that necessarily requires perceivers *bodily* participation for picking up information, processing perception, and behaving accordingly. One thing is to note here that I just have used the term ‘bodily’ instead of ‘physical’ when both refer to the same meaning. Despite the synonymy, in the context of the perceptual process, the application of the terms refers to the different matters. For, the information processing theories in general, also accept the presence of the perceiver’s body during perception but not as a part of the perceptual process. According to those theories, the material body of the perceiver is subject to be considered merely as a medium for the execution of the outcome(s) of the processed information. The theories consider the body as a passive tool where objective data or information is received and transferred to the brain for the processing. They describe the role of the body from a physicalistic perspective, as a machine that works according to the command of the brain by the force of sensory-motor action. On the other hand, in the context of the direct perception as well as the embodiment, *the body* is considered as an aware, intentional object of consciousness. According to the notion of direct perception and embodiment, the body is a tangible, opaque, space-occupying, movable object. As I already have mentioned in the first chapter that for Gibson, the brain is just a central system of the body that is connected with the entire body and get affected by each and every activity of the body. But beyond the brain, the body itself plays so many roles quite actively. In the previous section, I have discussed that aspect enough elaborately so without repeating the same thing let me come back to the context of the embodied approach in the Gibsonian theory of perception. Apart from the ecological

approach, Gibson's theory of perception also has a somatological approach that indeed highlights the embodied perspective of the theory. From a very general point of view, 'somatology' refers to the study of the physical nature of human beings. However, in the study of phenomenology, along with that meaning, the term refers to the phenomenology of the body. It refers to a human body as a mutual form of the appearing body and the intersubjective body (Owen, 2006: 120). The phrase 'appearing body' refers to the body as interacting with the environment and its material objects, including the other organisms' body-object during perceiving those directly. On the other hand, the phrase 'intersubjective body' refers to the body of a perceiver as interacting with other persons as other human beings (not objects) having mental states, emotions, etc. like her. These two areas have been covered in Gibson's theory with plenty of arguments and explanations.

There are some true reasons for counting Gibson's version of perception as a model of embodied perception. Let me begin with the argument that for the processing of perception Gibson considers, lived experience of an individual and her sense of situatedness (or being situated in some environment, time, and situation) are two most important ingredients. Without counting the body as an intentional object, the lived experience of someone is difficult to explain or understand. Living some experience means going through, personally, each of the steps and moments for having the experience. Living some experience means not just having some feelings or touches of those moments or steps of occurrences on the skin of the body but baring those feelings as those are inseparable with the self-hood; it means personalising those moments, etc. and other peripheral stuff of those moments in respect of the shape of own body. Lived experiences make a person more mature to recognise the environment that is enriched with

various meaningful things and values and to learn the skills to explore those meanings and values to living life.

The body of the perceiver is inseparable from her selfhood. They always go together. The perceiver is the owner of her own body. The body is not a mere extension, but it, following the nature of objects in general, occupies some space in the ecology at a time to afford the owner a *position*² on the earth. According to Gibson, the body of a human being is the *place* of all of her felt sensations, lived experiences that she earns from a first-person standpoint. Apart from the experiences and sensations, the body also is the place for a human being's mental states, emotions, motor systems, neural system, etc. Perception is such a kind of action that occurs as a mutual or combined performance of all of the systems, and the outcome of which is executed to the world as the behaviour of that individual.

Gibson considers perception as a kind of continuous process of experiencing. In the process, a person is supposed to experience each step of the actions. At this point, it is necessary to mention that this act of experiencing is not captured entirely by the aware states of the person's consciousness. Some steps remain outside of the range of registration. However, those uncaptured or unregistered steps get grabbed and lived (experienced) by the body of the person. The process of experiencing or perceiving is unique for every individual.

As I have mentioned previously that Gibson considers that, the body of the perceiver is not separate from the self of her. The conscious authority or the embodied 'I' including its intention, desire, etc. all are inseparably merged with the body. The body, in Merleau-Ponty's (1945/2012) language, *anchors* the person, the owner, or the self with the real material world. In every

² According to Gibson, position refers to real space on the earth that can be physically occupied by an organism.

situation, as someone steps into some environment, the body of the perceiver (in most of the cases), without her aware registration, starts to read and understand the ambiance in order to cope up with it.

The action of coping, practically, ties the bond between the environment and the perceiver or more specifically speaking, the body of an individual. Through this action, a person chooses her habitat, a place for living. The body of an individual detects the surroundings of its owner even when the owner is mentally involved somewhere else and unaware of the environment. It detects whether the facilities that its environment is providing are suitable for her surviving or not. This detection is done by direct pick up of information for perceiving and moving here and there around the environment. From his theory, it seems that Gibson is a hardcore realist. According to him, objects and other perceivable stuff are there in the environment, as independent of the presence of perceiver. If someone intends to see something or needs to have something she is free and open to dip down into the environment and get the stuff of her need on her own. 'Going', 'moving', 'dipping', 'picking', etc. all these continuous forms of verbs refer to the voluntary or intentional bodily activeness, which in turn refers to the inseparable and mutual effort of the body and its owner. Though Gibson does not mention about erroneous perception in his theory, still, we can imply from his theory that the error in perception can be avoided if the perceiver does not make any mistake in picking up information. Now, in this context, our point is that someone can pick up information properly if she is aware of her environment; if she is well coped with the environment.

Gibson's arguments and description regarding the theory of affordance provide food for our claim that Gibson's theory of perception represents a model of embodied perception. According

to the theory, the environment affords us various facilities or usabilities that we are supposed to see, recognise, and pick up by ourselves for fulfilling our purposes. Now, the question is how is it possible for someone to see the *usability* or *affordance* of some object or surface, and so on? Why outside the convention, can some object fulfill someone's unconventional purpose? For example, how a cellphone can be used as a paperweight or page marker when it has been made to be used for phoning and related purpose. For perceiving affordances, the perceiver is supposed to *embody* the (exact or possible) usabilities and accessibilities of the object of perception. Unless, by seeing a broken abandoned concrete piece that is laid at a place of some roadside, a person cannot see or embody the affordance of *sit-on-ability*, depending on the information like it is enough strong to bear her body weight, its surface is enough wide and even for sitting on, it is placed on a flat surficial part of the ground, etc. then despite having desire and need for sitting and having a little rest the person will not be able to sit on that piece of concrete. It is a generic nature of all organisms that they find some facility or usability as *affordance* in respect of her body. Following the structure, shape, size, flexibility, and top of it all attainability of own body, a person embodies the affordances. Therefore, a 'chair' is considered as an object used for sitting, but a cat does not find the chair that way, rather it may find the chair for sleeping on its seat. Apart from that, a human being who is not accustomed to the use of chair, who is isolated from the human-culture from her childhood (someone like Mogli from the story of *The Jungle Book*), she definitely will not be able to see the affordance of a chair. Again, it may be think of someone who is civilised with modern culture and quite familiar with the use of a chair. This person also may not choose the chairs of some particular place like a pub, for sitting, because her height is short and so those chairs are not accessible to the height of her body. Instead of those chairs, she prefers a couch or sofa for sitting because the seats of those sitting objects are near to the ground

and so accessible to her. Therefore, here we can see that usually a person selects some object in respect of her body. Therefore, we can see a variety of behaviour in our surroundings. The body provides a person her own perspective that is unique for her. Depending on this *perspective*, a person can find her own subjective domain of mineness. All of her perception, actions, and achievements happen from the perspective of *mineness* or embodied 'I'-hood. According to Gibson, people are quite aware of their own bodies. As the outer world, they can directly see their own body externally and internally, by direct pick up of information. Everyone sees her own body as *mine*. People are aware that their own bodies own a particular form and the contour or outline of the body-form envelopes all of the body parts, from the head to toe, inside.

At the end of this section it is to mention that one may find the discussion of this section is quite close or similar to the discussion of the section 5.2 and may get confused by considering this section as mere repetition of the section 5.2. To avoid that confusion I would like to say that Gibson's ecological theory of visual perception truly involves such features that are so similar to the features of the notion of embodiment as well as the embodied perception. Therefore, in this section 5.4, as I attempt to fit the Gibsonian view in the framework of the embodied perception, naturally the similarity came out. Highlighting the similarities is not my intention in this research work. Therefore, the unintentional confusion is quite unfortunate.

5.5: Considering the Nyāya Theory of Perception as a Model of Embodied Perception

In this part, I am going to find out, whether the Nyāya theory of (direct) perception fits in the frame of the embodied perception or not. Before proceeding it is to remind that the approach of the Nyāya system towards perception is completely different from the approach of Gibson or the concept of embodiment. These two genres are two poles in terms of time, thought, logic, and

explanation. Despite the distance and differences, the Nyāya theory and the embodiment theory (including Gibson's theory), as distinct from each other, contains some thoughts and arguments that made us think that whether this two distinct genre can be brought together. One more thing is there to remind in this context that I am trying to bring the theories together not to compare them with each other or to find out similarities and dissimilarities between them. The aim of this research work is to study the problem of perception regarding the issue of the mechanism or process, depending on what an embodied human being perceives the world around her. In the second chapter of this thesis, I already have discussed quite elaborately about the presence of the notion of embodiment in the Nyāya theory of perception. Now, following the context of this chapter, in this section, I am trying to see whether the theory fits in the frame of the idea of embodied perception that has been discussed in section 5.2.

In the discussion of the second chapter, I have shown that the Nyāya term '*jīvātmā*' can be interpreted as embodied being. *Ātma* or the self is free and ubiquitous when it is free but as the self gets departed (*paricchinna*) by the physical form or body of an organism (*jīva*), it becomes bound and limited (*baddha*). In this situation, the self of that organism becomes the place of qualities like knowledge, experiences, mental states, emotions, etc. It becomes conjoined with its limiting body. In fact, the self *owns* all of these qualities including the body. The self earns all of the knowledge, experiences being in contact with the body. Even it enjoys (*bhoga*) all the pain and pleasure only in association with that particular body.

The self as an individual owner earns experiences through the different activities of the body. Later the experiences leave impression or trace on the self, from which in some future situation desire pops up. In the case of visual perception of some object, like a table, by the direct relation

between sense organ and the table, perception or perceptual experience of the table occurs. The trace of the perceptual experience of that table remains in the self of the perceiver. Later at some moment, if the person encounters a table (or table-like object), her trace of the table becomes alive. In this situation, if she truly needs that table for some purpose, then following the desire and longing (volition) her body moves to achieve that table. Now, the noticeable point is, the entire operation is happened by the mutual participation of the self and the body of the perceiver. The self plays its role as the *embodied* self. On the other hand, the body plays its role as a *conscious intentional* object, though both the qualities (consciousness and intention) belong to the self, with which it is conjoined. Although, metaphysically the Nyāya theory accepts the separate existence of the self and the body but phenomenologically, from the aspect of perception or other empirical activities, the body and the self seem as inseparable from each other. From this perspective, the ‘I’ or the ‘I’-hood of the person may be recognised as the embodied ‘I’.

The Nyāya theory of perception holds a realist position and accepts the existence of the external world and physical objects. It also accepts that those objects can be perceived quite directly by the physical sense organ(s) as they are. It means that the Nyāya theory talks about the direct presence or involvement of the perceiver by her own, during the occurrence of perception. Again, the action i.e. the consequence of the perception also happens in the embodied presence of the perceiver.

According to the notion of the embodied perception, the act of perception makes someone to interact with the environment, with her niche. The environment is an obvious and natural factor for perception. Therefore, although there is no specific reference to the environment or its role in

the discussion of the Nyāya theory of perception, we can assume that in the Nyāya context the environment and its significance are considered as a natural element or condition for perception.

According to the Nyāya context, desires for having something or doing something starts depending on the recall of the traces of prior experiences. More experiences help a person to make or commit less error. Through the process of earning experiences, the person comes closer to the environment in order to know, adjust, and cope up with the environment. The coupling between the environment and the embodied being is dynamic in nature. The dynamicity works during the performance of the voluntary action.

According to Nyāya, perception is intentional. At some space, time, and situation how an object will be perceived that is determined according to the perceiver's need, desire, and of course experience. In the case of voluntary action, the *knowledge* and *subjective experience* of a person influence or affect her perception and so the action. In fact, *perception* is shaped by these two factors. Here, I am specifically mentioning 'subjective experience' because when some adult person encounters some object, being a part of some event or situation, then she responds or behaves towards that object in respect of that situation, space, time, and top of it all, her instantaneous state of mind and interest.³ If the object of perception is familiar to the perceiver and if she can identify the use of that object just by seeing it, then the person, following her experience of pain or pleasure regarding that object, in the present situation decides her action. In this process, her body contributes to taking the decision.

Moreover, when someone tests some object from the perspective of mineness and introspects that whether the object of her interest is accessible by her or not, whether it will be possible for

³ See the example of choosing poison as desirable object by a normal person and its related explanation in chapter 2, p.30.

her to attain that object, etc., then as an owner she verifies the object from the perspective of her own body. In this case, she compares the size, shape, etc. of the object of perception in respect of her own body's size, shape, etc. After that, if she feels satisfied or confident only then she moves towards the object to achieve it.

The Nyāya system talks about the graspability of sense organs. Among the cluttered arrangement of objects in the environment, it is difficult to find and pick up the right one that matches the need and interest of the perceiver. For this kind of activity, the perceiver, as well as her body, is supposed to know the environment quite closely. Otherwise, despite the presence of the object of need in the front someone may miss identifying that. A person as an embodied agent knows her surroundings or its objects including their meanings and values, by going close to the environment, by coping with it.

According to Nyāya perception caused action and at the stage of the effort, the action is executed. The body moves to have or leave the object of perception. Therefore, we can see that being realist the Nyāya school not just accepts that the objects are there in the environment, outside our body, we can see or reach those as they are in real. And if we need any of them we can grab that object, with its real features; can feel its physical touch by the skin of the body. At the end of this part, it can be said that despite the theoretical and other differences the Nyāya theory of perception fits in the frame of the embodied perception.

5.6: Conclusion

From what has been discussed so far, it seems that the notion of embodied perception refers to a aspect of the perceptual process, which is essentially expects the complete involvement of a

person as a conscious, aware, and intentional being. The phrase ‘complete involvement’ refers to the participation and contribution of a person’s entire body along with her mental states, subjective experiences, feelings, etc. When a person grows up in a certain social and cultural community then her body, mind, consciousness, etc. everything is shaped and progressively becomes mature under the shadow of the culture, practices of that community. This *earned* maturity affects quite deeply the thought, taste, action, and behaviour of that person. These thought, etc., in turn, affect the perception of that person. It brings a kind of uniqueness in the perception. In effect of that how an object will be perceived that is determined by that persons psycho-physical orientation, learning, and training, apart from her present needs.

From the discussion of embodied perception, two more points become clear that one, perception is necessarily direct and two, through the process of perception, external objects are perceived directly, as they are. The argument regarding these two points is: a person sees an object as it is by her own visual system. She can find a perspective of perception in respect of the shape and position of her own body and the position of the body of the object of perception, i.e. its external structure. Due to this perspective, the perceiver can see some of such aspects and features (or uses) of the object that is not normal or usual for that object. As example, the case of the man who sleeps on the hood of his taxi can be remembered here (see Chapter 3, p. 55).

Gibson’s theory of perception and the Nyāya theory of perception include the notion of embodied perception. Gibson describes his theory of perception in such a manner that the elements of embodied perception already can be seen there in his theory. Since he describes the matter of visual perception from the aspect of ecology, therefore, the issue of the position of a perceiver and objects of perception in the environment, and some other related issues come quite naturally in his theory as important and significant matters. For that reason, Gibson’s theory of

perception easily can be fitted in the frame of the notion of embodied perception. On the other hand, the perceptual theory of the Nyāya system also involves the notion of embodied perception, but latently. Although the Nyāya system does not talk about the environment and its importance in the process of perception overtly at all but it can be understood from the theory that Naiyāyikas consider the issue(s) as one of the presupposed factor regarding the process of perception. From a realistic point of view, Naiyāyikas describe the process of the causation of perceptual cognition as well as the application of the cognition so nicely that it reflects the role of the presence the perceiving agent. Simultaneously it reflects the perceiving agent's behaviour towards the object of perception and the surroundings following the present desire, needs, etc., mental states, physical abilities of that person.

At the end of the chapter, it can be noticed that the notion of embodied perception provides an enough strong ground to build the tripod of Gibson's model of perception, Nyāya model of perception, and the concept of embodiment in order to conceptualise the visual experience of human being. One may ask that despite having a general notion of embodied perception, what is the necessity of accepting the three different views as elements of embodied perceptual notion separately? At the beginning of the thesis, in the introductory part, I made a plan to build a triad including the Gibsonian theory of perception, the Nyāya theory of perception, and the concept of embodiment, which will help justify the title i.e. "Reconceptualising the Visual World of the Embodied Human Being: A Philosophical Study of the Problem of Visual Perception". Well, here one thing I should clear that the aim of my work is not to *Reconceptualising* the world that is visible to someone or that is the object of someone's perception, which is difficult or may be impossible to do. Instead, I am interested in giving a different concept regarding the visual or perceptual experience of an embodied human being. Moreover, human beings are naturally

embodied. Despite the fact, I have repeatedly emphasised on the expression ‘embodied human being’. For, unlike the establishment or traditional view of perception, the element-theories of the (proposed) triad consider every perceiver as an independent individual who is conscious, has the awareness of own physical existence or the body, along with the awareness of the self-hood. It makes a perceiver realise as the owner of all of those things that are related to her including her own body. These theories also accept the role of the perceiver as an embodied individual; unlike traditionalists, they do not consider the body of the perceiver as a mere mechanical device. To highlight the individuality of the perceiver and the role of her body beyond the control of the brain, I have repeatedly emphasised on the term ‘embodied’.

Conclusion

At the beginning of my conclusion, let me give an overview of the matter presented in the five main chapters including the 'Introduction'. The Introduction contains the work plan of my thesis along with the central research problem and the hypothesis. This is the general outline of that chapter. For this research work, I have selected a little unusual area among the various problems of perception. Considering 'perception' as a kind of action, I have chosen to work on the process aspect of the act of perceiving. How perception occurs, how cognition arises through the process, and how that cognition leads a person to perform further activities—these are the basic issues, which I have dealt with throughout the thesis. The central research question of this thesis is: how to define or explain the process of the visual experience of the world of an embodied human being. In order to solve the problem, I have taken a hypothesis that: the process of direct visual perception is the best way to explain the experience of an embodied human being. For, the concept of the process of direct visual perception and the concept of embodiment in perception or embodied visual experience are intrinsically related to each other. To establish this hypothesis, I have made use of J.J. Gibson's theory of visual perception, the Nyāya theory of perception, R.L. Gregory's constructivism, the Buddhist theory of perception following Nyāyabindu and Abhidharmakośa. These four theories of perception have been discussed in the four consecutive chapters of the thesis. In the fifth chapter, I have presented a separate notion of perception, which coherently combines Gibson's theory of perception, the Nyāya theory of perception, and the notion of embodiment to present a new way of looking at the phenomenon of human visual perception. I have claimed that this view may be named 'the notion of embodied perception'. In

the chapter, I have described the nature of embodied visual experience and the connection between the process of direct perception and the notion of embodiment.

Some Important Conclusive Observations

After having a long enough discussion on the issue of experiencing the world around us through the direct perceptual process, let me conclude the thesis here. An embodied human being truly experiences the world through direct visual perception – this claim that I made at the beginning, can be seen as supported by this research work. An embodied human being perceives her surrounding environment i.e. her habitat too, directly without being mediated by anything. In this case, a person perceives objects as well as the surrounding environment, as they are. In fact, the perceiver can grasp the object that she desires to have, directly. Let me remind at this point once again that in this context our concern is only visual perception. On one hand, the word ‘perception’ refers to an action that occurs by the contact between the visual sense organ and the object of perception. On the other hand, the word, in a broad sense, refers to an entire process that includes the process of perception, perceiver’s behaviour, along with her intention, interest, feeling, realisations, interpretation, etc.

Through the discussion presented in the five chapters, it becomes clear that the issue of experiencing the world around, i.e. our habitat, serving different purposes for fulfilling the needs of living, lends itself to only one reasonable choice, that is, to admit that the process of perception occurs directly. Following the path of indirect perception, it seems difficult to explain these everyday issues about visual perception. For, according to indirect theories of perception the only way to know the world and its objects is by mental construction or inference. Again, it is difficult to explain the mechanism of constructing some physical object mentally, inside the

brain or inferring it depending on some abstract data, while the object indeed exists there in the external physical world. Once again, let me remind that the supporters of indirect perception believe that external objects cannot be perceived as they are. The sense data enters directly through the door of the visual sense organ and then following the nervous pathway travels across the brain and there gets processed for producing perception. The perception is processed in the brain following a method of ampliative reasoning. Depending on the freshly entered sense data and already stored memory, the brain constructs hypotheses. According to indirect theory, like perception, the behaviour towards the object of perception and the use of that object, is also inferred or produced depending on those hypotheses.

The environment around us and the objects in it are real in nature. They are independent of the presence of some organism. Therefore, it is obvious that in order to know or enjoy the utility of the real objects or the real environment one is supposed to accept their existence as real, instead of considering them as mere inferences. Otherwise, the account of the mental construction of the material world may bring in some kind of category mistake. In that case, the existence of the real world has to be admitted as imagination (not fiction), which in turn will refer to the imaginary existence of the use or utility of the material objects and the behaviour of human beings towards them. If that is true then the conception of experiencing may appear as quite confusing. On the contrary, the solutions to all these problems are there in the account of direct perception.

Moreover, from a commonsensical point of view, it can be considered that the human mechanisms or the bodily mechanisms have been built following a kind of consistency with the world around us, to give us knowledge of the world. If we take evolution seriously and if we have to explain the survival of the fittest then definitely human perceptual mechanisms must also aid in survival. It must also support survival. Now, if this process takes us away from the actual

object then it cannot help us in survival. Rather survival can be enhanced only when the object is perceived as it actually is out there in the world. Therefore, on this ground, if one considers the indirect approach of perception as anti-survival then that would not be very wrong.

Again, on the issue of 'category mistake', I would like to add some more lines in support of my arguments. I want to show that the objection of category mistake is not the result of my rootless imagination. In the article, 'Pursuit of truth through doubt and belief' (1996), one of the renowned realist philosophers, Rasvihary Das, also has argued in this regard. Although he has not mentioned the phrase 'category mistake' in his writing or has not mentioned directly any such kind of a mistake, from the approach of his arguments it seems that the arguments indeed are quite compatible to support the objection of category mistake.

Being a realist his primary argument is it becomes possible for a person to understand the fact of illusion or construe the case of perception of some illusory object because that person can think of a real object. A real object provides the base or ground to the illusions to be imposed on. Otherwise, the explanation of the notion, as well as cases of illusion, will be illogical or meaningless. In that case, the explanation of erroneous perception will represent such a thing that does not exist indeed.

According to Das, direct perception is the most primary source or way of knowing the world around us. Being a realist, he disagrees to accept the role of sense data as well as the process of mental construction, in the context of perception and perceptual process. He describes the entity of sense data as 'backless superficies' (1996: 17).

From the perspective of the issue of experience, Das argues that the entity called sense data is not the object of experience. He adds that for knowing or perceiving objects, the notion of sense data

is not sufficient. An object, apart from the sensible qualities, contains different kinds of intelligible qualities also. A person in respect of her body-perspective earns those. As my research, work shows that both the approaches of direct realism and direct perception complement each other and consider the embodied presence of the perceiver as an independent individual. In Das's words, "I regard myself as one with my body" (ibid: 17). An agent knows some object as it is, as real in the respect of her own body, from the perspective of the very body. He adds that the objects outside that we feel as inevitable for fulfilling our need(s) are perceived by us in respect of our bodies. The fact of enjoying or using of the objects is impossible without the real, physical body of the perceiver as well as the object.

Throughout the discussions in the five chapters of this thesis, it became clear that as a whole the process of perception necessarily expects the bodily presence of the observer. The process also expects some actions like the perceiving agent's body movement, locomotion, interest, intention, experiences, etc. Apart from the presence or interest of a perceiver, the environment, in which the person and the object of her perception belong to are also considered as important matters in the pursuance of the direct perceptual process. Time or situation of occurrence of the perceptual process, from the perspective of a perceiver, affects the process of perception and its following behaviour.

The process of perception necessarily involves a perceiver's physical movements (including both voluntary and involuntary) that are technically considered as motor activities. These activities are operated by the person's conscious and intentional decision or by the force of reflexive action. Intention that is an internal or subjective factor for a human being has a great significance in the process of perception and behaviour.

Internal or subjective factors like desire, volition, intention, etc. significantly affect a human being's actions. Some objective factors like space, time, situation, etc. also contribute to the same. These two kinds of factors mutually influence the actions that are related to perception and behaviour. According to the notion of direct perception, during the contact between a sense organ and an object, a person can directly perceive the abilities of an object, i.e. affordances, and following that, she can decide whether to use that object and how to do so. These abilities remain there in the environment independently. Sometimes people manipulate the abilities of an object in order to solve their purpose. If they cannot find a proper object for serving some purpose, then in that situation people are often seen to use such an object in such a manner, which conventionally is not its proper or expected use. For example, sometimes I use my pencil for stirring the instant coffee powder in a mug of hot water. A pencil is not meant to be used for the coffee stirring purpose. But when I do not find a teaspoon i.e. the conventional object for coffee stirring, I use my pencil. At that moment, I see the affordance of stirring-ability in the pencil. If to explain the matter of experiencing the world by visual perception one follows the view(s) of indirect perception, then she has to deny the real presence of the affordances in the environment, objectively. Following the link, she also has to deny or reject the account of graspability of objects. For that also appears before her merely as mental construction.

According to the notion of indirect perception, the role of a perceiver is passive in the perceptual process. The perceiver cannot apply her desire, intention, emotions, etc. independently. For according to that notion, the role of an agent is passive, only her brain rules the act of processing perception. Therefore, the agent cannot apply her experience, sense of realisation, or interpretation during the processing of perception. On the other hand, according to the account of direct perception, the experience, etc. of a person helps her to recognise and interpret affordances

directly from the objects in the environment. It has already been discussed that depending on the requirement of the present situation and the perceiver's own need she can manipulate the affordances. The experience, etc. also affect the behaviour of the perceiver. Let me remind that the perception of affordances is closely related to the size, shape, and structure of the body of a perceiver. Therefore, it can be seen that the perceiver's awareness of her own existence, body structure, and surroundings are also required for perceiving and behaving accordingly. The account of indirect perception is unable to explain this.

In the case of a human being, the contribution of the faculty of experience for processing perception and organising relevant behaviour is quite significant. Experience is a phenomenal factor. It is something that a person is supposed to earn through different activities, in different moments and situations. The more a person adapts to the environment, the more experience she gains. The action of adapting to the environment refers to the act of having an optimum grip on the environment. As the body of a person copes with the surrounding environment and its elements, atmosphere, etc. the person starts to have control over her movements, postures, attitudes, skills, which are related to the act of perceiving and behaving. Therefore, in most cases, the success of perception depends on the richness of the experience of a person. For, it helps her to understand or read the situation, recognise the object of perception, and to interpret the entire frame following the person's present need(s). Now the noticeable thing is, the environment, objects, affordances, values, situations, experiencing, etc. all the things are real, not mere mental construction or imagination. Therefore, following the account of indirect perception, it is quite difficult to explain how an embodied human being experiences the world visually.

Following the link of experience, I would like to add that the context of the role of the perceiver's body in the perceptual process cannot be ignored. In the process of perception, apart

from the inert or inanimate objects, living or animate objects also appear before a perceiver, as the objects of perception. During perceiving some object, whether it is animate or inanimate, the perceiver experiences the existence of her own body also. It is to be noted that our perception happens in accordance with our body structure. Our body provides us perspectives. Due to the body-perspective it becomes possible for a person to perceive distance, size, shape, etc.

In the thesis, I have addressed the matter of perceiving animate objects, especially human beings, as the case of 'other perception'. The mechanism of perception works in two manners during other perception. On one hand, the perceiver perceives the other merely as an object in the environment like a chair, etc. On the other hand, the other is perceived as a human being other than the perceiver, who can speak, desire, shift or move, who also has body, mind, emotions, etc. and other internal factors, who, like the perceiver, perceives, behaves, and responds to the environment's stimuli. In this kind of perception, apart from the regular kind of perceptual activities, one more kind of activity adds on to the perceptual process, called intercorporeality. Through this method, the perceiver tries to understand the other as well as her internal states by interpreting the other's body language, facial expression, different gestures, voice tone, etc. This kind of perception helps the perceiver to understand whether the other person is good or bad, deserves to be talking or not, etc.

Now the point is if the account of indirect perception is accepted or followed, then the issues like the existence of external objects, their uses, perception of affordances and their manipulation for serving someone's purposes, etc., will not be possible to explain logically. For, in that case, it has to be accepted that everything in this world is mental construction or mere inference, whose real existence may be put to question. In this situation, though it is possible to explain the repetitive perception of an old or known object by the account of mental construction or inference by

stored memories, but the same account does not provide enough support for explaining the perception of some new or unknown object, situation, or environment. For, the supporters of indirect perception do not give sufficient explanation for how to construct mentally the act of coping up with the environment or to fight against the odds of survival. On the other hand, the issue of other perception will become impossible. For, according to the idea of indirect perception, it has to be agreed that the other as an external object, her body's structure, shape, size, etc. all are the matters of inference. Again, the internal factors like intention, emotion, etc. will be accepted as mental construction. However, the roles of these matters are undeniable. Therefore, for the sake of providing a comprehensive and coherent account of perception I place my support on the account of direct perception.

SENSE-OBJECT CONTACT

Including two more essential and exclusive contacts between sense and *manas*, *manas* and the self (*ātmā*), respectively, along with some inseparable associating factors like Light (*āloka*/ combination of Physical Optic and Ambient Optic), Environment (i.e. the Ecological Ambience including its animate-inanimate objects, grounds, surfaces, patterns of lights and shades, etc.), Heterogeneous structure in ambient, optic array, Affordances, relevant information (visual and non-visual both) and their sub-factors

PERCEPTION/ PERCEPTUAL PROCESS

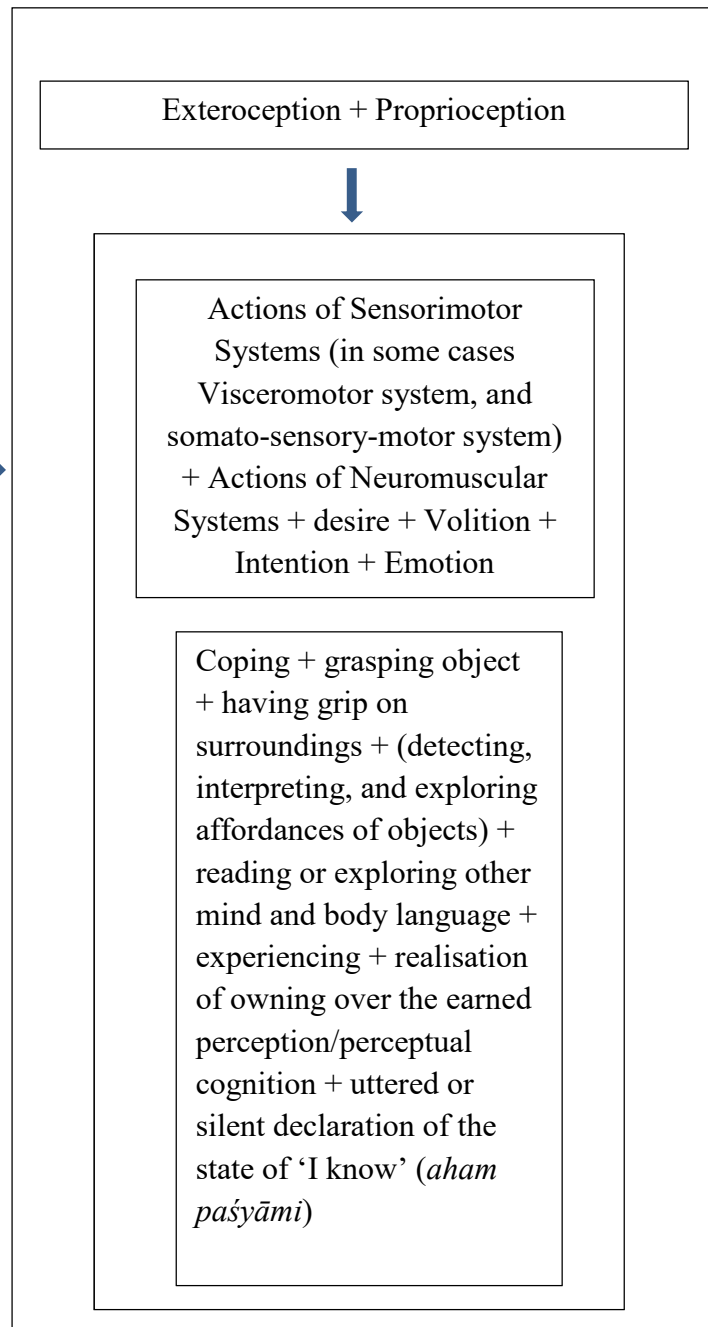


Figure: 15

Diagram of the proposed model of Embodied Perception

At this stage of the conclusion, let me talk about what remains to be done. I would like to confess that for the sake of the continuity of the main discussion of the thesis, I have consciously dropped some matters, instead of highlighting them. The most obvious thing that I missed, or I can say, left behind, is the issue of phenomenology. In the thesis, I have talked about the notion of embodiment that is one of the pillars of my thesis but I have not discussed the issue elaborately, its history, or its root in the phenomenological tradition of Continental philosophy. This is partly due to the fact that the thesis of embodiment is now well established outside the continental tradition and is a well-documented part of the framework of Cognitive Science.

Secondly, since the notion of embodiment is one of the essential parts of my research work, therefore, it is quite expected that I would spend some space by discussing Merleau-Ponty's view on the embodiment. I have consciously kept the issue aside because that would take the flow of the main discussion to a different direction. Besides, I have talked about cognitive embodiment that had been included in the mainstream of the third generation cognitive science in order to get explanations of those stages of actions and experiences. It is quite difficult to reach those stages following the sole notion of physicalism. In Addition, I have overlooked the discussion of the history of the third-generation cognitive science, the matter of cognitive embodiment, and its related issues. Again, I did it consciously, because these matters demand a separate dissertation altogether and hence may only form the starting points of my thesis. Apart from that, that discussion would not contribute directly to the central problem of my thesis, which is direct perception. I have these issues at the back of mind for my future post-doctoral research to explore their further implications.

The third most obvious issue that could be there in the thesis and probably could be fitted according to the relevance, but which I have kept aside too is the problem of other minds. Let me

describe the matter a little more bit. The environment, by which we are surrounded, can be described as a well-organised presentation of nature. It is constituted by the living objects i.e. organisms and non-living objects i.e. inert and unmovable objects that are there in the very part of that environment. Therefore, when someone looks at the environment she sees objects, surfaces, etc. Now, when the person sees some other human being, i.e. a living object, she perceives it in two simultaneous manners. Initially, she observes the other human being as a mere object in the environment. Later, as she recognises the object as a living being and it is categorically similar to her, but from the perspective of existence, it is 'other' (and the perceiver herself is the 'self'), then the perceiver sees the object called 'other' differently. The perceiver tries to understand that other's nature by reading her mind, attitudes, gestures, etc. In this case, the self-mind tries to get connected with the other-mind through direct perception. This is no doubt an important and relevant issue. However, I have left it too, because its analysis and deep research definitely would deviate the direction of the focus of the thesis and would require an entirely separate research work to do proper justice to it.

Before ending this chapter, let me be a little self-critical. At this point, I can preempt two questions. Here is the first one: After reading my thesis, one may doubt whether the chosen topic is philosophical at all or can ask what is philosophical about the matter in the first place? People generally take philosophy to be something, which is different from science. Now, in order to establish that this is a philosophical thesis, at first I can say that the typical conception of philosophy is wrong or incomplete, where it is considered that philosophy and science are opposite, contradictory, or (at least) different from each other. Rather, in naturalism, which is also a philosophical tradition, philosophy and science are considered as two continuous streams of inquiry. It is quite difficult to separate the two from each other in some definite manner

because the difference is not as prominent as the difference between black and white. This is one way of answering. However, one may not be satisfied with this answer. They may say that they do not accept naturalism as the best philosophical choice at all and may deny that philosophy and science are continuous. Now the question is what can a researcher like me say in reply? I want to say in answer that the issues covered in the thesis are highly philosophical. For example, the question about perception itself is a philosophical question. The question about how perception constitutes the embodied existence of human beings is highly philosophical. How the embodied life, embodied existence, or embodied experiences can be constituted—this is also a core philosophical question and this question may be raised across the traditions of continental and analytical philosophy. Although the issue of embodiment is naturally established in the phenomenological tradition, but at this point of time in the history of western philosophy, the traditions seem to be merging. Hardcore epistemological and metaphysical issues are involved in this debate, though subtly, if not obviously or conspicuously. The very issue of perception or building a model of perception is a deeply epistemological issue. To show how metaphysics also underlies this discussion, let me take the example of the issue of realism.

Realism claims that there is a discrete objective reality of every entity in this world. The phrase ‘objective reality’ refers to the ontological existence of an entity, i.e. object, whether independently or within the context of concepts, schemes, linguistic practices, names etc. A hardcore position of realism considers abstract concepts and universals, along with the concrete objects, under the category of entities that are not just ontologically real but independent of being perceived or cognised anyway. Following the interpretation of the realists, realism is divided into two types: direct realism and indirect realism. Direct realists go for the most stringent form of realism. They argue regarding the issue of our awareness of the external world that sensory

experiences constitute direct awareness of the external world. There is no medium like sense data, representation, or anything else. On the other hand, the proponents of indirect form of realism, argue for the inferential or constructed existence or reality of entities that in turn represent the objects as ontologically dependent on the human mind. Sensory experiences, for them, are nothing but mental constructions that are mediated by the sense data or representation instead of the objects indeed.

It is a fact that the nature of perception is intrinsically related to the question of realism. Russell is an obvious example. Russell accepts the notion of knowledge by acquaintance. It means he accepts perceptual knowledge but does not think that direct perception occurs at all. In matters of ontology as well, Russell is an indirect realist. It means the issues that are involved in this debate are indeed philosophical issues and come under the domain of core philosophy. For in the field of metaphysics, realism is one of the core concerns. And ‘what is perception?’ is one of the greatest issues within the domain of epistemology. Moreover, it is connected deeply with the philosophy of mind.

Here, I can preempt another question or objection from the side of an indirect realist. Is it at all possible for a human being to perceive objects as it is there in the environment? What does the expression ‘as it is’ refer to? For, the matter of ‘as it is’ cannot be experienced by anybody. It is nothing but an ideal and in a practical situation, it is not possible to know some ideal completely. In the case of visually perceiving some object quite naturally, some of its portion/s always remains out of sight. During perceiving something, a perceiver receives some information regarding the object of perception as it is given to the senses. On the other hand, apart from this kind of information, to know some object the support of imaginative interpretation i.e. mental construction is essential. This is an undeniable fact. Therefore, the question to the direct realists

is: if they strictly deny mental construction as a whole, then how can they explain the instances of their own perceptual experiences?

On behalf of direct realism, it can be said that the idea contained in the phrase ‘as it is’ refers to an ideal that in turn refers to the perfect and the best perception of an object. Seeing something as it is means seeing an object completely with its natural form and every single detail, with which it has been created or is existing in the environment. However, practically no human being can see an object at once completely, with its all aspects and every single detail because that is a limitation of the senses. A human being (or any organism), from one observation point, sees only as much as it comes to the field of her vision. In order to see an object from all of its aspects, the perceiver is supposed to take a tour around the object, shift from one observation point to another to come closer to the object, or to occupy such a point from where the maximum portions or parts of the object are visible. In that case, also, from every observation point, the perceiver will perceive only that much part(s) of the object that comes in her field of vision in respect of that observation point. And the remaining part will still be out of her sight. This matter already has been discussed in the main body of the thesis. The indirect realists argue that in real situations a direct realist also perceives objects or the world around her depending on the visual sense organ, sensible qualities of the object that are given to the senses and mental construction. Mental construction or imaginative interpretation provides support to the given sensible qualities for constructing perceptual knowledge.

In this case, on behalf of direct realism, I can answer this way: The claim of indirect realism regarding the basic mechanism is not completely wrong. A direct realist also has imaginative interpretation during the processing of perception that supports the sensible qualities that are given to her senses. But for a direct realist, the reference and significance of imaginative

interpretation are totally different, it is not some random or mechanical construction. It clearly refers to the probability of what it can afford to the observer or user. By direct perception, at first, a person recognises the genre of the object and interprets its significance, value, etc. following her present need, capability (*kṛitisādhyatā*), surroundings, and situation, of course. Later, following these factors, she imagines the probable ways, in which the object can be used to solve different purposes. Therefore, it would be better if the meaning of the term ‘imagine’ is understood in terms of ‘visualisation’. A direct realist justifiably accepts the real and independent existence of material objects in the environment. She can verify the truth of sensible qualities like colour, etc. by direct perception of the object. Therefore, it can be said that there remains almost zero scopes for the blind leap that may lead to a category mistake. Both veridical perception and illusory perception begin with the direct relationship between the sense organ and the object of perception of a human being. Moreover, the illusion is removed too by that same process of the direct contact between the visual sense organ and the true object of perception, on which some illusory feature got imposed.

One can object against direct realism’s distinction between fact and belief and question the claimed factuality of objects in the world in the following way. One may argue that the factual existence or real existence of an object is all about the belief/s of a person or group of persons. That is, when the direct realist says that an object exists in fact, what she means is that she believes that the object exists in fact. It is quite possible to question the direct realist by saying that the alleged existence of the object is a mere belief. Therefore, there is an open scope for all to doubt the existence of the object itself as well as the knowledge of that object. Well, the direct realist has already answered this question in the form of their explanation of imaginative interpretation of an object in the form of concurrence of the senses. That is to say, the perception

of an object is a matter not merely of a fleeting sensation. It is a matter of establishing and reestablishing that object by means of one or more senses in operation and is a prolonged process that may also involve past perceptions and felt experiences. Hence, one can safely say in favour of direct realism that beliefs cannot be said to be devoid of factuality. Indeed, beliefs must mostly be factual in order to explain the dynamic process of survival of the human organism. It is meant to be a belief about something; it must have some object and that object is mostly a factual entity. Further one can say that the very notion of 'belief' will not make sense if direct realism is not admitted because it is the very nature of a belief to point towards something. The nexus of belief, body and world is best explained by embodied direct perception, which is founded upon direct realism.

Secondly, to explain the successful functioning of the above-mentioned nexus, one must admit that objects of belief are something more than mere mental construction. Otherwise, the matter of use or utilities, in short, the issue of affordances is left unexplained. If, for the sake of debate, it is accepted that the factuality of an object cannot be explained in words or shown like material things, there is yet no way to deny the felt experience(s) of a person (at least to her own self) who uses or has used that object to solve her need using some particular object. Moreover, the utilities or uses, which the object affords, which are directly perceivable by a person in respect of her need(s), present situation, etc. are truly such matters that cannot be kept aside by calling them mere beliefs, unless one wishes to take the risk of falling into the trap of idealism (which is to me, the natural conclusion of any indirect realist view). On behalf of direct realism I want to know is it possible at all to call the sense of need, feelings of being attracted towards the affordances, realisation of satisfaction, and other associated awareness, experiences, etc. as

mental construction, instead of facts? If yes, then there is no option but to say that the notion of indirect realism at its extreme gets merged with the idea of pure idealism.

Plans for Future Research

In this section of the chapter, let me talk a little about my plans for future research. I have already mentioned that to keep unshaken, the contextuality and flow of the thesis, I have kept aside some important issues and moved on. I wish to explore those areas or topics that I have bracketed or at best, looked at cursorily, in greater detail and depth during my postdoctoral research. At present, I can see two important and relevant issues that I would like to start to work on immediately after submission of this thesis. The first one is the issue of the relationship between direct realism and direct perception. In this thesis through the discussion of direct and indirect approaches to perception, I have felt a strong impact of metaphysical topics like direct and indirect realism. In this work, it has been shown that according to theories of direct perception, it is direct realism that naturally connects epistemology to metaphysics. A perceiver can perceive an object in the external world directly as it is. On the other hand, according to the indirect approach, an object is there in the external world but it is not possible to perceive it directly as it is. Objects are perceptible only through some inferential reconstruction or through mediation of sense-data or some such. This is the most fundamental debate between the direct and indirect perception theories. In my future research, I want to investigate these issues by connecting Epistemology to Metaphysics. However, to keep matters focused, I intend to consider these issues through a phenomenological lens, particularly because I have construed direct perception to be embodied. The role of the subject and issues on subjectivity may well seep into this debate. In this research work I have concentrated all my attention in upholding the direct approach in the context of perception mainly because of its experiential appeal and logical

parsimony. As a result of that the nature of the direct-realism and indirect-realism debate emerged but remained out of focus. After completion of this thesis, I therefore, intend to shift my focus to that all-important issue in the context of Phenomenology and if necessary, other important philosophical systems like Kant's Epistemology.

The second issue that I want to work on is also very interesting. It is about the relation between our knowledge of other minds and the direct perception approach designed by Gibson. It has already been discussed in the thesis that when a human being notices or meets another human being, on one hand, she recognises that second human being merely as her 'object' of perception. On the other, she perceives that very 'object' as a living human being who also owns a body structure, senses, emotions and all importantly, a perspective. Despite the similarities, the perceiver without any mistake identifies the second human entity, i.e. her object of perception, as 'other' and her ownself as 'self'. In the process of perceiving other as living-object the perceiver tries to read or understand the other directly by decoding that other's perceivable bodily expressions. The action of other-perception, along with all of its constituting processes or actions, involves what Gibson calls, the mechanism of intercorporeality, which is a notion found in Merleau-Ponty. In contemporary literature on the problem of other minds (known variously in various traditions), there is a theory known by the name of 'Mental Simulation', which may be considered in this context. Let me try to reconstruct the Gibsonian issue of other-perception in these lines, which I may develop in more detail for my post-doctoral research.

In the project of reconstructing Gibsonian issues of other-perception my research will be concentrated on four inter-connected matters. Those are mental simulation, embodied simulation, intercorporeality, and perspective taking. These matters are constituent parts of the action of other-perception. Although Gibson has not clearly mentioned any of the matters, except

intercorporeality, in his writing, yet his account of other-perception can be analysed in terms of mental simulation, embodied simulation, and perspective-taking, along with the notion of intercorporeality. Let me talk a little about the four issues in brief.

Mental Simulation:

The idea of Mental Simulation can be best approached through the idea of ‘imagination’. In this context the term ‘imagination’ definitely does not refer to fiction but anticipation or prediction. It can also be understood in terms of the act of empathising the mental state of other people. In this act a person typically tries to understand some other person by adopting that person’s point of view or, more specifically, perspective. Perspective is one of the important things for understanding the notion of simulation. Every human being has her own unique perspective(s) that emerges in respect of her own body and is shaped by her ecology, environment, and all kinds of socio-cultural influences through which she has grown up. Mental simulation is a distinctive ability of human beings. The process of mental simulation can be understood as a process of self-projection of an individual into some hypothetical entities in hypothetical environments (some alternate temporal, spatial, social grounds or aspects).

Embodied simulation:

Embodied simulation is a process that quite significantly works behind social interactions and communication. It necessarily involves embodied cognition as the ruling element of the action of simulating. Embodied cognition in turn refers to the essential role of the body of the simulating agent as well as target. In the process a perceiver efforts to understand some other person mainly on the basis of her own lived experiences in consistency with the present situation. In this kind of process of simulation the factors of body image and body schema play significant roles. These two factors are contributed in the process from the aspect of the perceiving agent. In order to

establish social interaction with other people, the perceiver is supposed to go through the kind of action that we have called mental simulation but with more body-engagement and body imagery.

Intercorporeality:

There is no scope to deny that intercorporeality plays the pivotal role in processing other-perception and social interaction. The notion of intercorporeality is proposed by Merleau-Ponty (1964). The unique feature of the notion is that it bypasses the problem of mind-body dualism and represents the oneness of the two through the notion of embodiment (or the embodied mind). According to Merleau-Ponty it is completely unnecessary to think that the mind of a person is only accessible to her own self; it cannot be seen from outside by some other person. There is a reciprocal relation between the body of the self and that of the other, from the social perspective. It helps the self to grasp another's intention behind her actions and to take up those actions potentially. In this case the perceiver (or the self) can incorporate her own subjective states and lived experiences on the other, following that other's behaviour, body language, etc., in order to live the other's present subjective state(s) or in other words to read the other. In terms of intercorporeality the fact of situatedness in the context of embodied perception as well as embodied simulation can be explained and understood more easily apart from seeing resemblance in behaviour of the other and its theory-laden explanation. The terms also can explain the issue of manipulation of directly picked up information in order to detect proper affordances. In detecting affordances of a living-object the lived experiences of the self helps her to cope with the present ambience and situation in order to survive in the present moment and of course to live the related experiences as a whole.

Perspective taking:

Again, in the context of social interaction the matter of the ability of perspective taking deserves to be mentioned as an important one. As we already have known from the Gibsonian account that the body of a person provides her perspectives with relevance to the person's present environment, situation, etc. associating factors. Usually, the matter of perspective taking is defined as the ability to assume another's perspective. This ability is indeed a kind of multidimensional construct, composed of three different components: cognitive, visual, and affective or emotional. The ability allows a person to infer or predict the thoughts, emotions, and perceptions of others that drive their behaviours in order to get a sense of the surrounding world. other people's thoughts, motivations, intentions, etc. are inferred by the skill of cognitive perspective taking. The inference of how an object is seen from different positions in a (ecological) space is the subject of the ability of visual perspective taking. The ability of affective or emotional perspective taking is all about understanding the emotional states of other people. It provides a foundation for empathy. It seems, there is a proportional relation between perspective taking and social behaviour. A person whose skill of perspective taking is sharper in comparison with other random people, she possesses a great competence in social interaction, especially in interpreting other people's behaviour.

I am quite hopeful that in my future research work my effort for reconstructing Gibson's theory of other perception will be possible, involving the above mentioned factors.

References and Bibliography

- Acharya Vasubandhu, *Abhidharmakośa* and Bhasya with Sphutartha Commentary of Acharya Yasomitra. Bauddha Bharati Series- 5,6,7,9. Bauddha Bharati: Varanasi, 1987.
- Acharya Vasubandhu, *Abhidharmakośa*, Acharya Narendra Deva. Hindustani Academy, Uttar Pradesh, Allahabad, 1958.
- Annambhata, *Tarkasaṃgraha* with commentary Adhyapanā by Srinarayan Chandra Goswami, Sanskrit Pustak Bhandar, Kolkata.
- Bhattyacharyya, Sibajiban, *Gaṅgeśa's Theory of Indeterminate Perception: Nirvikalpakavāda* (Part 1), Indian Council of Philosophical Research, New Delhi, 1996.
- Bhattacharyya, Sibajiban, *Gaṅgeśa's Theory of Indeterminate Perception: Nirvikalpakavāda* (Part 2), Indian Council of Philosophical Research, New Delhi, 1996.
- Bhattacharyya, Sibajiban. "Some Indian Theories of the Body." In *Freedom, Transcendence and Identity: Essay in Memory of Kalidas Bhattacharyya*, edited by Pradip Kumar Sengupta, 176-212, Delhi: ICPR, 1988.
- Bhattacharya, Pandit Visvabandhu, "Valid Cognition (Pramā) and the Truth (Satya) of Its Object". In *Concept of Knowledge: East and West*, The Ramakrishna Mission Institute of Culture, Gol Park, Kolkata-700029.
- Biśvanātha Nyāyapañcānan Bhattacharya, *Bhāṣāparicchedaḥ*. Āgamānusandhāsamiti (ed.), Kolkata, Sri Pañcānan Śāstritarkatīrtha, 1354.
- Boring, Edwin G. and Lindzey, Gardner (eds.). "James J. Gibson". In *A History of Psychology in Autobiography*, Vol.- 5. Appleton-Century-Crofts, Division of Meredith Publishing Company. Newyork, 1967. pp. 125-143.
- Carello, Claudia and Turvey, M.T. "The Ecological Approach to Perception". University of Connecticut.
<https://pdfs.semanticscholar.org/c507/c30be7607b65d1e789fef16ff6fc336ce0c5.pdf> [Accessed 10 July 2014]
- Clark, Andy, "Dynamics". In *Mindware: An Introduction to the Philosophy of Cognitive Science*, Oxford University Press, Newyork, 2001, pp. 120-139.
- Chattopadhyay, Madhumita. *Walking Along the Path of Buddhist Epistemology*. D.K. Printworld (P) Ltd.: New Delhi, 2007.

Chattopadhyaya, Debiprasad and Mrinalkanti Gangopadhyaya. *Nyāya Philosophy: Literal Translation of Gautama's Nyāya-sūtra and Vātsyāyana's Bhāṣya* (part 1). Calcutta: Indian Studies Past and Present, 1975.

Chaudhuri, Sukomal. 'Analytical Study of the Abhidharmakośa' in *Calcutta Sanskrit College Research Series* No.CXIV. Sanskrit College: Calcutta, 1976.

Chemero, Anthony, *Radical Embodied Cognitive Science*, a Bradford book, Massachusetts: MIT press, 2009.

Cowart, Monica, 'Embodied Cognition', source: <http://www.iep.utm.edu/embodcog/> , 10 July 2015, at-10.34am.

Dreyfus, Hurbert L. *What Computers Can't Do: A Critique of Artificial Reason*. USA: Harper & Row, Publishers, 1972

Durvek Misra, *Dharmottarapradīpa*, sub-commentary on Dharmottara's Nyāyabinduṭīkā, commentary on Darmakīrti's Nyāyabindu. Pandit Dalsukhbhai Malvania (edt.). Kashi Prasad jayaswal Research Institute: Patna, 1971.

Fantz, Robert L. "The Origin of Form Perception" in *Scientific American*, Vol. 204, Issue: 5, p. 66-73, 1961. Nature Publishing Group.

Fodor, Jerry A. and Pylyshyn, Zenon W. "How Direct Is Visual Perception?: Some Reflections on Gibson's "Ecological Approach"", in Alva Noë and Evan Thompson (eds.), *Vision and Mind: Selected Readings in the Philosophy of Perception*. Massachusetts, The MIT Press, 2002, pp. 167-227.

Francis, George K. "The Impossible Tribar" in *A Topological Picturebook: With 87 Illustrations*. Springer Science + Business Media New York, 1987/2007.

Gallagher, Shaun. "Body Image and Body schema: A Conceptual Clarification". *The Journal of Mind and Behavior* Vol. 7, No. 4 (Autumn 1986): 541-554. Accessed: 27-05-2019 18:44 UTC

Ganeri, Jonardon. *The Self: Naturalism, Consciousness, and the First-Person Stance*. Oxford: Oxford University Press, 2012.

Gibbs, Raymond W., Jr. *Embodiment and Cognitive Science*. Cambridge: Cambridge University Press, 2005.

Gibson, James Jerome, "A Theory of Direct Visual Perception", in Alva Noë and Evan Thompson (eds.), *Vision and Mind: Selected Readings In the Philosophy of Perception*, Massachusetts, The MIT Press, 2002, pp.77-89.

Gibson, James Jerome, *The Ecological Approach to the Visual Perception*, Massachusetts, MIT press, 1986.

Gibson, James Jerome. *Senses Considered as Perceptual Systems*. George Allen and Unwin Ltd.: London, 1968.

- Gibson, J. J. "Ecological Optics" in *Vision Res.* Vol. 1. pp. 253-262. Pergamon Press 1961. Printed in Great Britain.
- Gibson, Eleanor J., Walk, Richard D. "The "Visual Cliff"" in *Scientific American*, Vol. 202, Issue: 4, p. 64-71. 1960. Nature Publishing Group.
- Goldstein, Bruce E. (ed.). "A "visual" explanation of facial vision", in *Encyclopedia of Perception*. Sage Publications, Los Angeles, 1941.
- Gregory, Richard L., Wallace, Jean G. Recovery from Early Blindness: A Case Study. Reproduced in *Experimental Psychology Society*, Monograph No. 2, March 2001, 1963.
- Gregory, Richard L. "Distortion of Visual Space as Inappropriate Constancy Scaling" in *Nature*, Vol. 199, Issue: 4894, p. 678-680. 17 August 1963. Nature Publishing Group.
- Gregory, Richard L. "Seeing in Depth" in *Nature*, Vol. 207, Issue: 4992, p. 16-19. 3 July 1965. Nature Publishing Group.
- Gregory, Richard L. "Perceptual illusions and brain models" in *Proceedings Biological Sciences*, Vol. 171, Issue: 1024, p. 279-296. 13 December 1968. Royal Society, UK.
- Gregory, Richard L. "Seeing as thinking: An Active Theory of Perception" in *Times Literary Supplement*. 23 June 1972.
- Gregory, Richard L. *Eye and Brain: The psychology of seeing*. World University Library, McGraw-Hill Book Company. New York. 1978.
- Gregory, Richard L. "Putting Illusions in their Place" in *Perception*, Vol. 20, Issue: 1, p. 1. February 1991. Pion Ltd.
- Gregory, Richard L. "Knowledge in Perception and Illusion" in *Philosophical Transactions Biological Sciences*, Vol. 352, Issue: 1358, p. 1121-1127, August, 1997, Royal Society, UK.
- Gregory, Richard L. "Snapshots From the Decade of the Brain: Brainy Mind" in *British Medical Journal*, vol. 317, Issue: 7174, p. 1693-1695. 19 December 1998. British Medical Journal Publishing Group.
- Gregory, Richard L. "Perceptions as hypotheses", in Alva Noë and Evan Thompson (eds.), *Vision and Mind: Selected Readings in the Philosophy of Perception*, Massachusetts, The MIT Press, 2002, pp. 111-134.
- Halder, Aruna. *Some Psychological Aspects of Early Buddhist Philosophy Based on Abhidharmakośa of Vasubandhu*. The Asiatic Society: Kolkata, 2001.
- Hochberg, Jullian, *James Jerome Gibson 1904-1979: Biographical Memoir*, Washington D.C., National Academy of Sciences, 1994.
- Jayantabhatta. *Nyāyamanjarī*, edited by Sanjit Kumar Sadhukhan, Sadesh, Kolkata, 2015.

Kanizsa, Gaetano. "Subjective Contours" in *Scientific American*, Volume 234, Issue 4, p. 48-52, 1976, Nature Publishing Group.

Lakoff, George and Johnson, Mark. *Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought*. New York: Basic Books, A Member of the Perseus Books Group, 1999.

Landes, Donald A. *The Merleau-Ponty Dictionary*. London: Bloomsbury, 2013

Lilakas, Linda, Ono, Hiroshi, Ujike, Hiroyasu, Wade, Nicholas. "On the Definition of Motion Parallax" in *Vision*, vol. 16, no.2, p. 83-92, January 2004

Matilal, Bimal Krishna. *Perception: An Essay on Classical Indian Theories of Knowledge*. Oxford: Clarendon Press, 1986.

Merleau Ponty, Maurice. *Phenomenology of Perception*. Translated by Donald A. Landes. London: Routledge, 2012

Merleau Ponty, Maurice. *Phenomenology of Perception*, translated by Donald A. Landes. London and New York: Routledge, 2012.

Merleau Ponty, Maurice. *Signs*. Translated by Richard C. McCleary. USA: Northwestern University Press, 1964

Noë, Alva and Evan Thompson. "Introduction", in Alva Noë and Evan Thompson (eds.), *Vision and Mind: Selected Readings in the Philosophy of Perception*, Massachusetts, The MIT Press, 2002, pp. 1-14.

Ono, Fay, and Terbell. 'A "Visual" Explanation of Facial Vision' in *Psychological Research*, August 1986, Volume 48, Issue 2, pp. 57-62.

Owen, Ian Rory. *Psychotherapy and Phenomenology: On Freud, Husserl and Heidegger*. New York: iUniverse, Inc., 2006.

Phanibhusan Tarkavagish (trans., ed.), *Nyāyadarśana (Gautamasūtra), Vātsāyanabhāṣya*, Vol.1, Paschimbanga Rajya Pustak Parsad, Kolkata, 2003.

Phanibhusan Tarkavagish (trans., ed.), *Nyāyadarśana (Gautamasūtra), Vātsāyanabhāṣya*, Vol.3, Paschimbanga Rajya Pustak Parsad, Kolkata, 2000.

Phanibhusan Tarkavagish (trans., ed.), *Nyāyadarśana (Gautamasūtra), Vātsāyanabhāṣya*, Vol.5, Paschimbanga Rajya Pustak Parsad, Kolkata, 2015.

Potter, Karl. "Does Indian Epistemology Concern Justified True Belief?" in *The Philosophy of J. N. Mohanty*, edited by Daya Krishna and K. L. Sharma, 121-142. New Delhi: Indian Council of Philosophical Research, 1991.

Praśastapāda, *Praśastapādabhāṣyam*, Vol.1, Śrī Śyāmāpada Nyāyatarkatīrthaḥ (trans. and pub.), Dāmodar Āśram.

Refraction and the Ray Model of Light - Lesson 1 - Refraction at a Boundary. Refraction and Sight <http://www.physicsclassroom.com/class/refrn/Lesson-1/Refraction-and-Sight> [18 July 2018, 09.52am]

Rock, Irvin. *Indirect Perception*. MIT press: Massachusetts, 1997.

Sanders, John T. 'Merleau-Ponty, Gibson, and the materiality of meaning' in *Man and World*. Issue: 26, p. 287-302. Kluwer Academic Publishers: Netherlands, 1993.

Sarkar, Proyash, "What Happened to the Naiyāyikas' Attempt of Understanding Perception in Causal Terms?" in *Rabindra Bharati Journal of Philosophy*, Vol.IX, 2003,(pp.17-33).

Silananda Brahmachari. *An Introduction to Abhidhamma: Buddhist Philosophy and Psychology*. M/s. Barua Chowdhuri & Co.: Calcutta, 1990.

Shapiro, Lawrence, *Embodied Cognition*, Routledge, London, 2011.

Southall, James P. C. (ed.) *Helmholtz's Treatise on Physiological Optics*, Vol. 2. Translated The Optical Society of America, 1924.

Southall, James P. C. (ed.) *Helmholtz's Treatise on Physiological Optics*, Vol. 3. Translated The Optical Society of America, 1925.

Srimohan Bhattacharya and Dinesh Chandra Bhattacharya. *Bhāratīya Darśan Kośa*, Vol.1. Sanskrit College, Calcutta. 1383.

Svāmī Yogīndrānanda (ed.). *Nyāyabhūṣaṇam* (Śrīmadācārya Bhasarvajña Praṇītasya Nyāyasārasya Svopanja Vyakhyanam). Śaddarśan Prakāśan Pratiṣṭhān. Vārāṇasī. 1968.

Tanaka, Shogo. "The Notion of Intercorporeality and Its Psychology" in *Bulletin of Liberal Arts Education Center, Liberal Arts Education Center, Tokai University*, Vol. 33 (2013)

Tsakiris, Manos, Simon Schütz-Bosbach, Shaun Gallagher. "On agency and body-ownership: Phenomenological and neurocognitive reflections" in *Consciousness and Cognition*, Vol.16, 645-660. 2007.



Recovery from Early Blindness A Case Study

by

Richard Langton Gregory, M.A., F.R.M.S.

Fellow of Corpus Christie College and Lecturer in Experimental Psychology
in the University of Cambridge

and

Jean G. Wallace, B.Com.Edin.

Lately Research Assistant, Cambridge Psychological Laboratory

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*Photograph: Tobias cures his father's blindness - Bernardo Strozzi 1581–1644
[The Metropolitan Museum of Art, Purchase 1957
Mary Wetmore Shively Bequest, in memory of her husband, Henry L. Shively]*

Foreword

Although it is nearly 300 years since Molyneux posed his celebrated query, interest in the problem of recovery of vision after early and long-standing blindness is of comparatively recent origin. In 1932, Dr. M. von Senden carefully reviewed the literature on the perception of space and shape in the congenitally blind before and after operation and arrived at some important conclusions. In particular, he stressed the slow, laborious and imperfect way in which the perception of form is acquired by these patients and their liability to emotional "crises" as they come to discover the true extent of their disability as sighted persons. Unfortunately, Dr. von Senden's monograph remained little known to psychologists, at all events in this country, and it was not until 1949, when Dr. Donald Hebb published his fascinating book on *The Organisation of Behavior*, that its significance came to be at all widely appreciated. As every psychologist knows, Dr. Hebb placed considerable weight on Herr von Senden's evidence and believed it to throw important light on the nature of visual perception and its development in infancy. Although there is disagreement regarding the interpretation of this evidence, there can be no doubt as to the fresh and stimulating influence which Dr. Hebb's ideas have had upon contemporary psychological thought.

One of the main obstacles to informed discussion of Dr. Hebb's theories has been the inaccessibility of the clinical evidence. This, it is true, has been remedied to some extent by the publication, in 1960, of an English translation of Dr. von Senden's monograph but even so the position is far from satisfactory. It was never the author's intention to assemble detailed case reports and it is not always easy to distinguish between the facts as recorded by others and the interpretation which Dr. von Senden has placed upon them. If for only this reason, the addition of a fresh and well-studied case to the widely dispersed literature will be warmly welcomed.

The authors of this monograph have provided a full description of the history and progress of a man, effectively blind almost from birth, who underwent two operations for corneal grafting at the age of 52, as a result of which he recovered appreciable sight. As they relate, their attention was first drawn to the case by a newspaper report and it is to their great credit that they followed the matter up. With characteristic enterprise, Mr. Richard Gregory made an approach to the Ophthalmic Surgeon in charge of the case, A. Hirstenstein, Esq., F.R.C.S., of the Wolverhampton and Midland Counties Eye Infirmary, who responded with warm friendliness and generosity. Indeed it is entirely due to his kind permission to study the case and to his encouragement throughout that the work reported in this monograph could be undertaken.

This case study will be of interest to many. To the psychologist, perhaps the most arresting finding is the extent of "transfer" of information from touch to vision which the authors have been able to demonstrate. They point out, too, that much of their patient's difficulty in visual learning can be ascribed to his long-standing reliance on touch and the whole complex of well-engrained habits to which it had given rise. This leads them, in my view rightly, to suggest that great caution should be exercised in drawing parallels between the recovery of vision after operation in adults and the normal development of perception in young children.

The authors would be the last to claim any particular expertise in clinical inquiry. Nevertheless, readers will be impressed by their resourcefulness and determination to proceed wherever possible by the method of experiment. In spite of limited experience, they carried their study through in a manner entitled to warm admiration and respect. Although it is always risky to generalise from a single case, their work undoubtedly serves to throw light on important issues in the development of perception and the cross-modal "transfer" of information. They have presented their case with modesty, skill and warm humanity.

O. L. ZANGWILL.

Contents

Foreword	2
Contents	3
Preface.....	4
1. Introduction.....	5
2. The Case of S.B.....	7
(1) First Considerations.....	7
(2) Amount of Pre-Operative Vision.....	8
A. The Testimony of S.B.	8
B. The Testimony of S.B.'s Elder Sister	9
C. The Medical and School Reports of the Birmingham Royal School for the Blind.....	10
D. Expert Opinion on the Immediately Pre-Operative Condition of the Eyes	14
(3) Assessment of the Evidence for Early Blindness.....	14
3. Observations at the Wolverhampton and Midland Counties Eye Infirmary (January 1959).....	16
(1) Introduction to the Case.....	16
(2) First Visual Experiences after Operation.....	18
(3) Perceptual Tests.....	19
Test 1. Hering Illusion.....	19
Test 2. The Zolner Illusion.....	20
Test 3. The Poggendorf Illusion.....	20
Test 4. Ambiguous Depth Illusions (reversing figures)	20
Test 5. The Müller—Lyer Illusion	21
Test 6. Perspective Size Changes	21
Test 7. Figure and Ground.....	22
Test 8. The Ames Distorting Room.....	23
Test 9. After-Effects of Movement	23
Test 10. Rorschach Ink Blots	24
Test 11. Kodachrome Projections of Scenery	24
Test 12. The Ishihara Colour Vision Test	24
(4) The Patient's First Drawings	25
(5) Discussion on S.B.'s Drawings	28
(6) Addendum: Later Drawings	28
4. Observations Made Immediately After Discharge from Hospital	30
(1) Visit to the Science Museum, South Kensington.....	30
(2) Visit to the Zoo, Regent's Park.....	31
(3) Visual Skill—A Game of Darts.....	32
5. Observations Made Six Months After Operation	33
6. The End of the Case	34
7. Relevance to the Theory of Perception	36
Appendix.....	39
Correspondence on the Case	39

Preface

We would like particularly to thank Mr. A. Hirtenstein, F.R.C.S., the ophthalmic surgeon under whose care the patient was admitted to the Wolverhampton and Midland Counties Eye Infirmary, for his kind permission to study and investigate the case and for his most helpful advice and criticism. Without his co-operation and help this study would not have been undertaken. The staff of the hospital were most helpful, in particular the Matron, Miss Mary Jones.

Through the generosity of the *Daily Express*, we were able to study the patient for several days immediately after his discharge from hospital. Mr. Merrick Winn, the writer, was most helpful with his insightful comments and suggestions.

We would like to thank the patient's wife for her help and comments on many aspects of her husband's life before and after the operation. His sister also provided vital evidence as to his early vision. The Birmingham Royal Institution for the Blind have kindly given permission to publish the case records covering the period the patient attended the Institution.

We are sincerely grateful to Mr. Hirtenstein and Herr M. von Senden for their kind permission to publish correspondence bearing on this case.

Professor D. O. Hebb kindly read the manuscript in draft and we are grateful to him for many valuable comments. It should be said, however, that we alone are responsible for the interpretation placed upon the case. Since completing our study, we have gained much from discussion with Dr. B. R. Gomulicki.

We would especially like to thank Miss Kathleen Watts for her help in preparing the manuscript for the press.

Professor O. L. Zangwill gave most helpful advice and encouragement during the investigation and in the writing of this monograph. We are much indebted to him.

The patient was studied by us jointly, much of the detailed testing being carried out by the junior author. We were both present on all occasions, so that all the observations reported in this monograph have been confirmed by at least two witnesses. The actual writing from our combined notes, is the responsibility of the senior author. One of us (J.G.W.) was supported by a grant from the Medical Research Council, who also kindly provided a small grant for expenses. We gladly acknowledge their assistance.

We wish to thank the publishers, D. van Nostrand Company, Inc., for permission to reproduce Figure 8 from Beardslee and Wertheimer's *Readings in Perception*, Copyright 1958, D. Van Nostrand Company, Inc., Princeton, N.J.

R.L.G.

J.G.W.

1. Introduction

This is the case history of a man born in 1906 who lost effective sight in both eyes at about ten months of age, and after fifty years as a blind person received corneal grafts to restore his sight. Such cases are rare, and few have been investigated in any detail, or have available pre-operative records giving their early history. Since cases of recovery from congenital or early blindness have been discussed by philosophers for over three hundred years, and have more recently attracted the interest of experimental psychologists, we feel justified in presenting in full everything which might be regarded as relevant to the case.

René Descartes (1596—1650) in a famous passage in his *Dioptrics* (1637), considers how a blind man might build up a perceptual world by tapping objects round him with a stick. He first considers a sighted person using a stick in darkness, and says "... without long practice this kind of sensation is rather confused and dim; but if you take men born blind, who have made use of such sensations all their life, you will find they feel things with perfect exactness that one might almost say that they see with their hands ..." Descartes goes on to argue that normal vision resembles a blind man exploring and building up his sense world by successive probes with his stick.

John Locke (1632—1704) once received a letter from Molyneux in which was posed the now celebrated question: "Suppose a man born blind, and now adult, and taught by his touch to distinguish between a cube and a sphere of the same metal. Suppose then the cube and sphere were placed on a table, and the blind man made to see: query, whether by his sight, before he touched them, could he distinguish and tell which was the globe and which the cube? The acute and judicious proposer answers: not. For though he has obtained the experience of how the globe, how the cube, affects his touch, yet he has not yet attained the experience that what affects his touch so or so, must affect his sight, so or so. . . ." In the *Essay Concerning Human Understanding*, 1690, (Book 11, Chapt. 9, Sect. 8) Locke comments as follows:—"I agree with this thinking gentleman, whom I am proud to call my friend, in his answer to this his problem; and am of the opinion that the blind man, at first, would not be able with certainty to say which was the globe, which the cube. . . ."

Bishop George Berkeley, (1685—1753) in his *A New Theory of Vision* (1709) distinguished carefully between sight and touch as ways of perceiving and knowing, and took the hypothetical case of recovery from blindness in the following way:—"In order to disentangle our minds from whatever prejudices we may entertain with the relation to the subject in hand nothing is more apposite than the taking into our thoughts the case of one born blind, and afterwards, when grown up, made to see. And though perhaps it may not be an easy task to divest ourselves entirely of the experience received from sight so as to be able to put our thoughts exactly in the posture as such a one's: we must nevertheless, as far as possible, endeavour to frame true conceptions of what might reasonably be supposed to pass in his mind" (*op. cit.* Sect. XCII). Berkeley goes on to say that we should expect such a man not to know whether anything was "high or low, erect or inverted.. . for the objects to which he had hitherto used to apply the terms up and down, high and low, were such only as affected or were some way perceived by his touch; but the proper objects of vision make a new set of ideas, perfectly distinct and different from the former, and which can in no sort make themselves perceived by touch" (*op. cit.* XCV). He goes on to say that it would take some time to learn to associate the two.

In 1728 Cheselden presented the celebrated case of a boy of thirteen who gained his sight after removal of the lenses rendered opaque by cataract from birth, but this was not by any means the first successful operation of its kind: the earliest reported dates from A.D. 1020, of a man of thirty operated upon in Arabia. Other cases were reported in: 1668, 1695, 1704 and 1709.¹ After the Cheselden case of 1728, we find some fifty cases up to the present day, one of the most recent being that of Latta, 1904.²

The evidence provided by the famous Cheselden case was discussed by Julien Offray de la Mettrie (1709—1851) in his *Natural History of the Soul* (1746)³. De la Mettrie argues that only education

¹ For a summary review of these cases, see von Senden, *Space and Sight* (1960) pp. 326—35.

² R. Latta: Notes on a Case of Successful Operation for Congenital Cataract in an Adult. *British Journal of Psychology*, Vol. i, 1904, pp. 135—50.

³ A description of de la Mettrie's comparatively little known but remarkable work is to be found in *The History of Materialism* by F. A. Lange; Transl. Kegan Paul, Trench Trubner and Co. (1925).

received through the senses makes man man, and gives him what we call the soul, while no development of the mind outwards ever takes place.

The published cases have been collected and described by Herr M. von Senden in his book: *Raum- und Gestaltauffassung bei operierten Blindgeborenen* (1932), which was virtually unobtainable in this country before the recent and most welcome translation, arranged by Miss Sylvia Schweppe and undertaken by Mr. Peter Heath, entitled: *Space and Sight* (Methuen, 1960).

The importance of these cases has been stressed by many classical writers, including Hume and Helmholtz, and most recently by the psychologist D. O. Hebb, in his influential book *The Organisation of Behavior* (1949). Hebb cites the von Senden collection of cases, and makes a great deal of use of them in developing a theory of the development of perception. We shall later consider Hebb's arguments and conclusions.

Operable cases of blindness—strictly *near-blindness* for the retina must be functional and eye tissues are never entirely opaque—are of two kinds: cataract of the lenses and opacity of the corneas. The former was treated from early times by slitting the eye ball and removing the lens; treatment of corneal opacity is recent and involves highly skilled grafting of a donated cornea. All the earlier cases are therefore cases of cataract, while some of the more recent—including the one to be described here—were rendered blind, or nearly blind, by opacity of the corneas.

With improvement in operative technique, and also a more ready supply of corneas, it has become extremely rare to find a case of very early blindness which remains untreated after the first few years of life. The case to be described—that of S.B.—is exceptional because he was regarded for many years as inoperable, until finally an attempt, and a successful attempt, was made when he was fifty-two years of age. We can hardly expect such a case to recur in the near future, and so it is unfortunate that no experimental psychologist was informed of the case until after the corneal grafting took place. If another such case should occur, we hope that it may be possible for an investigation to be initiated some time before the operation is undertaken. A later investigator may be able to learn something from our evident mistakes.

It is unfortunate that very few of the published accounts of recovery from early blindness describe any detailed observations or tests made on the patients. It is also far from clear how much residual vision they had prior to the operation. At the time we undertook the enquiry, we had but the most sketchy knowledge of the literature. We knew of von Senden's work from summaries and accounts, but had not seen the original, which was not then readily available in this country. We did, however, set out to try some reasonably objective tests, though these we had to prepare with only a few days' notice as we were anxious to see the patient as soon as possible.

2. The Case of S.B.

(1) First Considerations

S.B. was born in 1906, of poor parents, and was one of a family of seven, there being three brothers and three sisters. He spent his youth as a resident pupil of the Birmingham Blind School, being admitted in 1915 and leaving in 1923, with a training in boot repairing sufficient for his livelihood and a fair general education.

It is important to note that S.B. received far more education prior to operation than in the previously published cases, with the possible exception of one described by Latta (1904). There is reason to believe that this may be important in evaluating the case. At the time of the corneal grafting—most of the previous cases were for removal of the lens—he was aged 52. We saw him in hospital shortly after the graft operation on the second eye. It is unfortunate that we did not see him earlier, but we did not hear of the case until it was reported in a daily newspaper after the first operation. We were, however, able to get first-hand reports from the hospital staff, who were generous with their time and help, and the surgeon, Mr. Hirtenstein gave us a first-hand report of his observations.

It was from the first clearly of the utmost importance to establish the amount of vision present before the operation, and back to as early an age as possible. The label “congenital cataract” should not be taken to mean that there has been virtually no visual experience preceding operation, or that vision was as limited in the first months or years of life as it was later, when perhaps fuller tests were carried out. A cataract may well increase in opacity during the first months or years, and whether this has happened can hardly be established. There is in fact remarkably little evidence about the extent of early vision in the previously published cases, but it is noteworthy that many of the patients cited by von Senden clearly had appreciable visual capacity immediately prior to operation, and yet still made slow progress in the use of vision after operation.

S.B. was admitted to the blind school not technically as “blind” but as “partially sighted”. The word “blind” signifies to the ophthalmologist “insensitive to light”, though its lay use is rather an absence of *useful* vision. Cases of strict blindness are inoperable, the retina being non-functional, and so we should expect any case such as this to be technically “partially sighted”. The question—a difficult one—is whether S.B. had *useful* vision, or more vision than the earlier cases described by von Senden.

It is most important to be clear that where blindness is literally complete surgery is always out of the question. The retina must be functional, and since the tissues and media of the eyes are never opaque, some effective retinal stimulation must always be expected. This point cannot be over-stressed. The word “blindness” may in normal usage cover cases with sensitivity to light, providing appreciation of form is too poor to be of significant use, but to the ophthalmic surgeon (as became clear to us during discussions) “blindness” is used to denote *total insensitivity to light*. In this sense there are *no cases of recovery from blindness*. This should be borne in mind when these cases are compared with the findings of experiments in which animals are reared in darkness, for then, and then alone, visual experience has been truly absent.

The most that should be claimed for any of these human cases is that vision has been dramatically improved upon operation, but as anyone can verify by practising “seeing” with the eyes closed, under some conditions—particularly bright sunlight—quite a lot of visual experience is possible under conditions similar to the worst lens cataract or corneal opacity. The direction of bright lights can be seen, as can the movement across the eyes of shadows. It could well be that this minimal vision, which we must suppose even the “best” cases to have had, makes them very different from the strictly blind—those whose retinas are dead—and we know nothing of what would happen if *they* could be made to see.

In order to test for retinal function in cases of cataract or corneal opacity, use is made of what are called entoptic phenomena. The entoptic perception of the retinal blood vessels can be readily produced in normal subjects by holding a small light source, such as the naked lamp of an ophthalmoscope, in contact with the closed lid near to one corner of the orbit, and moving it rapidly back and forth with a quite small movement, the eye being dark-adapted. The retinal vessels will be seen as a livid red tree-like pattern, which will fade as soon as the agitation of the light is stopped. They appear because the light entering the side of the eye, through the choroid coat, reaches the light sensitive cells (the rods and cones) *after* travelling through the layers of vessels and nerve fibres, which lie to the *front* of the retina. Under normal conditions they are not seen because they form an image—a shadow image—upon the sensory cells which moves precisely with them as the eyes move, and selective adaptation cancels out the non-uniformities of intensity. Similarly, an optically stabilised image fades out and becomes invisible within a few seconds. The shadow images do shift across the retina with movement of the light source, however,

and this stimulates fresh receptors, and so the image is made visible so long as the light source is kept moving. This technique is used in testing the retinas in order to establish whether an operation is worth attempting. An operation is not attempted unless the patient is able to give satisfactory reports on his entoptically observed retinal vessels.

A study of these entoptic phenomena in cases of congenital “blindness” could prove rewarding, for the study should reveal perception of form where there has been the least possible previous visual experience. Should it be technically possible, it might be of interest to stimulate the central visual system of a totally blind person. We know from the work of Penfield¹ that visual experience can be elicited by electrical stimulation of the occipital cortex, in the course of certain brain operations’. Would it be possible to stimulate the visual mechanisms of the totally blind? The effect of hallucinogenic drugs might also be of interest in this connection, for they may stimulate directly the central components of the visual system, and in the case of the totally blind this might perhaps be accomplished for the first time in the individual’s life.

(2) Amount of Pre-Operative Vision

It will be appreciated that on admission to the blind school, S.B. would have seemed no exceptional case, since his vision at that time was evidently insufficient to be of use to him. As we shall see, we find no reference to useful vision anywhere in the school reports.

Since the matter of degree of sight is now so important to us, we shall give all the evidence at length, and try to assess it. It falls into four classes.

- (A) The testimony of S.B. with particular regard to his visual memories.
- (B) The testimony of S.B.’s older and surviving sister.
- (C) The medical and school reports of the blind school he attended as a boy.
- (D) The expert opinion of the surgeon, based on the observed state of the eyes at the time of operation.

The available evidence will be given under these headings, and an attempt will then be made to assess it.

A. The Testimony of S.B.

We questioned him on his early visual experience on several occasions, but particularly at our first interview, (on 26th January, 1959) while he was still a patient in hospital. We asked him to describe just how much vision he had before the first operation. He told us, *firstly*, that he believed he became blind at the age of ten months – the age given in the records of the blind school – and, *secondly*, that the only visual memories he had before the operation were of three colours – red, white and black. He claimed, then, and later, that he remembered no other visual phenomena.

We ascertained that he was able to name these three colours immediately after the operation, but that he tended to be confused over other colours. It is possible that he would have had experience of these three colours as an adult suffering from undoubtedly extremely severe corneal opacity, for some awareness of light and dark would be expected and very brilliant red is, as described above, seen entoptically during the standard ophthalmological examinations. No doubt the ophthalmologists would tend to use the word “red” in trying to communicate under these conditions. This does not, of course, diminish the probability that he also experienced these colours as a small child, as he thinks he did, but this might be overlaid by later experience.

How far can we trust S.B.’s testimony? It may be appropriate to say here a word or two on his character as it appeared to his teachers, and much later, to us.

The school character reports indicate that S.B. was bright and intelligent, if sometimes lazy. There are criticisms of his sense of the truth; thus for: Midsummer 1920: “Unreliable and unstable in character. Sometimes works v. hard (mainly to please!) and then has slack periods. Plausible manner and a clever excuser... has no fixed purpose, and seems bent on doing things with a minimum amount of work attached”. By Xmas 1920: “Has improved in conduct and school work. Character more stable”. July

¹ W. Penfield and T. Rasmussen: *The Cerebral Cortex of Man* (1950), London, Macmillan.

1921: "... Appears to be trying to overcome unstability but has a crooked streak which 'wangles' out of things". And finally: *Xmas 1921*: "... Has worked hard for is anxious to get into the shops. Strong, sturdy, and pleasant. Plausible and not thoroughly trustworthy".

We do not know what correlation there may be between school reports of "untrustworthiness" and the ability to tell the truth over important matters in later life. Any estimate we may make for normal children and adults might well be misplaced for the specially handicapped.

So far as we could judge, when talking with S.B. or when giving him the various perceptual tests to be described, he was trustworthy. He made his perceptual judgements with unusual care, and was perfectly co-operative in every way. Our tests were performed in the hospital which had just given him sight: he appeared to identify us to some extent with that hospital and the people who had helped him. He seemed to us to be remarkably stable and balanced in his opinions, in his attitude to his experience, and in the interest that was being taken in him. On no occasion did we find that he had told us an untruth (except by omission on one personal matter of no importance to our enquiry) and his remarks or reports seemed not to be biased towards or against what he might have thought we desired from him. Such judgements are bound to be subjective but we state them for what they may be worth. We believe him to be entirely honest in stating that he had no visual memory of form.

B. The Testimony of S.B.'s Elder Sister

We did not for some months know that any friend or relation who might be able to provide evidence on S.B.'s vision as a small child was still living. Finally, S.B. informed us that he had an elder sister, but that as she wished to avoid the publicity the case was attracting in the Press, he had not told us about her. (It might be added that he probably did not realise the importance we attached to finding such witnesses, and it became quite clear that the sister did in fact wish to avoid publicity for a personal reason). It must suffice that S.B.'s sister is some four years older than S.B., that she is married and has a considerably higher standard of living than he had, and that she seemed to us a sensible forthright and honest person. We could see no motive for any deception or exaggeration especially as she was anxious to remain anonymous. We spent an evening at her home, during which she gave us the following details: –

She remembered him clearly as a small child. She used to take him weekly to the clinic, to have his eyes washed. She emphasised that his eyes were in a shocking state, and that there was a severe running discharge. She remembers his head covered by a large bandage, under which the discharge used to seep. Apparently he wore a bandage more or less continuously as a small child.

The family used in effect to test S.B.'s vision, when the bandages were removed, as a game. Her recollection is that as a small child he could "point roughly to large white objects". She thinks that his vision was limited to appreciation of fairly bright large surfaces, apparently without any appreciation of colour. She is confident that his vision was too rudimentary to be useful when the bandages were removed, and he was blind-folded throughout his young childhood, so that what vision he had was generally not available. There seems no doubt, from her statements, but that he led the life of a blind child. This story of the bandages is born out by the report of the Matron of the Blind School for Xmas 1915, which reads: –

"Admitted this year – eyes in shocking state of discharge. With care and treatment they soon begin to appear quite normal. The condition of his eyes gets much worse during the holiday, and on his return make one feel sick to look at him...."

And also her report for July 1916: "... Eyes always look exceedingly bad after a holiday". This is strong language for a Matron of an institution devoted to diseases of the eyes; discharge from the keratitis must have been unusually severe. It is worth adding that the testimony of S.B.'s sister is independent of the medical report, since she had not access to it. On the cause of S.B.'s blindness, she thought that he went blind at the age of ten months as the result of an infection following vaccination. This was also the belief given in the two medical reports (almost certainly not independent) at admission, but the cause is not known with certainty. According to the Medical officer's report for 1st June 1915, the mother had poor sight, and this was confirmed by S.B.'s sister. It is possible that there was some hereditary factor, but we have no further evidence on the matter.

C. The Medical and School Reports of the Birmingham Royal School for the Blind

We are very fortunate in having full medical and school records, in the original handwriting, for the period 1915 – 1923, when S.B. was at the Birmingham Blind School as a full time student. We now quote from the Progress Book of the Birmingham Royal Institution for the Blind, by kind permission of the Superintendent.

Date of Birth:	30.5.06.
Date of Admission:	2.6.15.
Condition of Blindness (partial or total)	Partial
Cause of blindness as certified by the Institution's Ophthalmic Surgeon	Keratitis
Position in school on admission	placed in lowest class.
Estimate of attainments on admission	has never attended school before; knows practically nothing
Mental condition	Appears to be a bright intelligent lad.
Physical condition	Normal but for sight.

Medical Officer's Reports

Admitted 1st June, 1915.

Family History:	Parents living and healthy; father, good sight. Mother, not good. 3 brothers in Army. 3 sisters healthy.
Personal History:	Measles and chickenpox. Eyes bad since 10 months old.
On examination:	Heart and lungs negative. Submaxillary glands enlarged. Skin rough.

Feb. 1918

Complains of pain over front of chest. Heart – *irregular* (tachycardia). No history of rheumatism. No cardiac murmur.

26th Feb., 1918

Two days ago went out with friends – had more exercise – was followed by an attack of pain in precordia for 36 hours. There is now a definite mitral systolic bruit – increased when lying down. Slight irregularity, but tachycardia better.

8th March 1918

Again complained of pain over heart – now no tachycardia, but heart irregular.

Restrictions during this period:

Feb. 1918. Gym and drill suspended. Walking outside school boundary suspended.

March 1918. Piano exercises stopped also.

May 1918. Allowed walking in moderation, and renewal of piano exercises.

1st July, 1918

Influenza – 8th July, convalescent. 20th July. General health much better.

3rd Sept., 1918

Returned looking well – eyes much clearer and cleaner.

6th Sept., 1918

To have drill included now, and to be carefully watched for symptoms of previous attacks. Headmistress informed.

Ophthalmic Surgeon's Reports... taken from the Progress Book.

(Late Mr. Jameson-Evans).

3rd June, 1915:	Keratitis. Eyes bad since 10 months old. ? after vaccination. O/E: Diffuse dense nebulae each eye. Some vascularisation and epithelial xerosis. Conjunctivitis with slight discharging. Dacryocystitis. Some scarring of upper tarsus.
16th June, 1915.	Vision: fingers at one metre.
2nd Sept., 1915:	Eczema of face and forehead. Ectropion of lids. Keratitis.

27th Jan., 1916:	Left cornea vascularised and fleshy.
18th Sept., 1916:	Vision 3/60. Eyes much cleaner and quieter.
22nd Jan., 1917:	Rt. and Lt. vascular keratitis. No regurgitation from lac. sacs.
11th Oct., 1917:	Left mucopurulent discharge from lac. sac.
22nd Oct., 1919:	Keratitis and xerosis I.S.Q. Regurgitation from lac. sacs.
14th Oct., 1923:	Eyes quieter and cleaner; no regurg. from lac. sacs. Vision: 2/60. Illiterate.
13th Feb., 1923:	Eyes quiet. Xerosis conj. Vision 2/60?
19th Feb., 1923:	Xerosis I.S.Q. Vision: fingers at 9 inches.

From these reports it seems that at that time he had some ("finger") vision when his eyes were free from discharge which, it appears from the sister's testimony and the Matron's report quoted above, was not generally the case at home. We may gain further information from the reports of his school progress, which will also be given in full.

School Reports:

July 1915

Elementary education: has only been in school a few weeks, so no report is possible at this stage. Conduct: good.
Signed: S. Robinson.

Xmas 1915

Reading, BRAILLE: Failed to learn anything for some time, but is making some progress now.
Writing: Too careless to obtain any result.
Arithmetic: Working of sums, slow; but very quick at mental arithmetic.
Composition: Fair.
Literature and recitation: Very good progress made.
History, geography, nature, etc.: This boy is very interested in his work and answers well
Handwork: Works well and has shown great improvement.
Conduct: Very good.

Signed: J. I. Falconer.

July 1916

BRAILLE: Making satisfactory progress in infant reader. Writes Grade 1. Has mastered the signs and can now write them perfectly.
Has done excellent work this term, and now sets his sums down nicely too, in the Taylor Frame.
Composition: Has done excellent work.
History, geography, nature: Answers splendidly and does good work. He takes a keen interest in these subjects.
Handwork: A good little handworker – a careful boy.
Conduct: This boy has gained the class prize this year. A most polite well-mannered boy, and an excellent worker.
Height: 4 ft. 2¾ins.
Weight: 4 st. 8¾ lbs.

Signed: J. I. Falconer.

19th December, 1916

BRAILLE. Reading: Making satisfactory progress—sometimes gets somewhat "mixed".
Writing: Writes Grade 2 to the 6th line.
Arithmetic: Tables to 12 times. Pence tables. Long measures reduction.
Composition: Tells a story well.
Recitation: A most marked improvement to this subject. Enunciation and pronunciation specially improved.
History, geography, nature: Answers well—tries very hard.
Handwork: A good worker.
Cane-seating: Careless—little progress.
Conduct: This pupil's conduct continues to be excellent.
Height: 4 ft. 3½ ins.
Weight: 4 st. 9½ lbs.

Signed: J. I. Falconer.

25th July, 1917

BRAILLE. Reading: Prep. Temple Reader; could do better, but sometimes careless. Out of class two mornings for music.
Writing: Fairly good.

Arithmetic: Has not mastered Long Division; finds a difficulty in "setting down". Two sums right, out of four, in exam.

Composition (Oral): Tells a story well, also retells his lessons well.

Recitation: Excellent.

History, geography and nature: Answers well in all oral lessons. History not so good as other subjects.

Handwork: Cane seating; started double frame. Carpentry: good.

Conduct: This boy still is very little trouble. A good little boy.

Height: 4 ft. 4½ ins.

Weight: 4 st. 10¾ lbs.

Signed J. I. Falconer.

Xmas 1917

BRAILLE. Reading: "Guy of Warwick". S. has improved much this term.

Writing: A marked improvement shown.

Arithmetic: Seems to have more idea of "setting down" now. Factors and their uses learnt. Multiple of £.s.d. factors.

Composition (Oral): Still very good.

Recitation: Excellent.

History, geography and nature: Answers intelligently and thoughtfully.

Handwork: Satisfactory progress shown.

Conduct: A good boy in school, but he sometimes has to be checked for talking too much.

Signed: J. I. Falconer.

July 1918

BRAILLE. Reading: Reads nicely—just a little inclined to guess sometimes.

Writing: Quite good. Grade ii, with a few abbreviations.

Arithmetic: Has done v. good work; all four rules and reduction of money.

Handwork: V. Good. A steady worker. Chain-seating: 6th row patt. Knitting: plain and purl on fine needles; has also made sev. bags and small purses.

Conduct: A useful boy with plenty of "esprit de corps". Works well. Has not been v. strong this Term (see med. report). Rather disobedient over small rules, otherwise a good boy.

Signed: J. I. Falconer and L. H. Best.

Xmas 1918

BRAILLE. Reading: Oxford Reader 4. Has done very satisfactory work.

Writing: Writes Grade 2 with fair amount of accuracy; more contractions used.

Arithmetic: Has done excellent work. Difficult examples with four rules in money, length and weight.

English subjects: Shows much thought and interest in these subjects; has a good fund of information regarding present day affairs. Greatly interested in machinery.

Handwork: Does v. good work in knitting and chair-seating when care is taken; needs to be checked occasionally for hurrying too much.

General: A very helpful and smart boy.

Signed: J. Falconer and L. H. Best.

July 1919

BRAILLE. Reading: Shows slight improvement, but is still far from being good.

Writing: Fair; improving. Composition: plenty of ideas, but cannot express them. Spelling weak.

Arithmetic: Mental, fair; has made some progress with fractions, practice and areas.

English subjects: Interested in these subjects, and satisfactory progress has been made. Literature: inclined to be lazy, and not sufficiently interested.

Handwork: Plasticine, V. good. Cane work, good. Chair-seating, V. good.

General: Good. A smart lad in appearance, and v. anxious to help.

Signed: J. Falconer and G. W. Bloomfield.

Midsummer 1920

Reading: Not much progress; touch poor.

Writing: Revising all braille rules, as written work is v. poor.

Composition: Mainly oral. Anxious to give a good impression—usually shallow.

Arithmetic: Good work done. Improved in fractions. Fairly strong in Unitary Method.

Literature: Has shown interest. Recitation has made more effort.; nice voice.

History and Geography: At times v. good. Lack sustained effort. Sometimes unusually thoughtful.

Xmas 1920

Reading: A weak subject, but touch slowly improving.
 Writing: Has revised all contractions in braille to abbreviated words.
 Composition: Memory much improved.
 Arithmetic: Very pleasing progress. Fractions, percentages, etc.

*Midsummer 1920**General Comments:*

Boot-repairing: good work for a beginner.
 V. active at all sport—a good footballer.
 Unreliable and unstable in character. Sometimes works v. hard, (mainly to please!) and then has slack periods.
 Plausible manner and a clever excuser.
 Nice mannered boy, and affectionate but has no fixed purpose, and seems bent on doing things with a minimum amount of work attached.

Signed J. Falconer.

Xmas 1920

Medium progress—should do well, if more attention were expended.
 Still v. keen over games—v. active and alert.
 Has improved in conduct and school work. Character more stable.
 Is improved in general behaviour and has made decided effort in class work.

Signed: J. Falconer.

July 1921

BRAILLE: Continues to improve, but slow touch. Not yet fully contracted, but still works steadily. Spelling fair. Mental and practical arithmetic fair. Has shown a fair grip of decimals.
 Other subjects: Has developed a keen interest in books, but must read more for himself. Concentration improved, but not much activity in class work.
 Boot-repairing and making: Work is developing in quality and speed.
 A thorough boy where games and mischief are concerned. Rather too talkative and self-opinionated. Appears to be trying to overcome instability but has a crooked streak which “wangles” out of things. Helpful, obliging, observant. Upright in physique.

Signed: J. Falconer.

Xmas 1921

BRAILLE. Reading: Good—deliberate. Writing: Improving; spelling fair. Composition: Needs developing.
 Arithmetic: V. good—quick and accurate.
 Other subjects: Pays attention, and is anxious to show that he has understood a lesson. Science: Good.
 Boot-repairing and making: V. good progress.
 Rather aggressive in manner, but has worked well.
 Less noisy but still self-opinionated. Has worked hard for he is anxious to get into the shops. Strong, sturdy, and pleasant. Plausible and not thoroughly trustworthy.

Signed: J. Falconer.

It may be noted that there is no mention of any useful vision. It is only braille reading which is mentioned, and his aptitude for manual skills does not suggest the help of residual vision. This is confirmed by technical training reports for the final year at the blind school when he was taught boot repairing and making as a trade by which to make a living.

Technical Training: (Full Time—resident pupil)*July 1923**Boot-repairing and Boot-making:*

Started full-time training in January, 1922. Training proceeding satisfactorily, and may be completed by Xmas 1923.

Quality: $\frac{3}{4}$

Speed: $\frac{1}{2}$

Independence: 4.

Assessment: 14/— per week (rate of an average sighted worker £2.10.)).

Conduct: Fairly satisfactory. Rather boisterous at times, and over assertive.

Signed: J. Falconer.

Xmas 1923

Boot-making and repairing

Training now completed. To become a home-worker under our auspices, at Burton-on-Trent. Shed and equipment to be provided.

Quality: 7/8

Speed:

Independence: 7/8.

Character: Noisy. Self-opinionated. Active. Showy in appearance—loves finery, Difficult to convince, and will rarely make the “amende honorable”. Likes to be first, but has not sufficient self-control or balance to be a good leader.

Signed: J. Falconer.

The assessment of 14/— per week against the rate of £2 10s. for an average sighted worker is evidence that his vision was not of an order to be useful even in this comparatively simple trade. This is a point which may be made with some confidence when it is remembered that he was undoubtedly an intelligent boy, and certainly as an adult he has always taken great pride in making things with his hands, as was very clear to us when we visited his workshop and his garden.

D. Expert Opinion on the Immediately Pre-Operative Condition of the Eyes

We now quote from a letter written to us by Mr. Hirstenstein dated 24th November 1959.

“When I first examined him in November 1957 both cornea were completely opaque with heavy superficial and deep vascularisation; in addition there was bilateral band-shaped keratinisation in the interpalpebral areas. He had thickened lid margins, with poliosis; the eye movements were full. There was no nystagmus (either before or after the operations.) The iris and pupil could not be visualised on slit-lamp examination nor could the depth of the anterior chamber be estimated. Trans-scleral retinal stimulation produced a normal pattern of retinal vessels in the left eye and this was the main reason I decided to try the operation. The vision in the right eye was reduced to hand movements in front of the eye. The left eye had accurate projection of light only.”

(3) Assessment of the Evidence for Early Blindness.

It is clear that S.B. as a child was not blind in the strict sense of being entirely insensitive to light, and this we should expect, given that a successful operation was possible. There is strong evidence to suggest that he wore bandages entirely covering his eyes during most, and possibly virtually all, of his childhood. There is evidence that his vision was not sufficiently good to be of any material use to him for orientation or recognition of objects. He appears from all accounts to have led the life of a blind person throughout his life.

Can we conclude that the case of S.B. may be taken as an example of “recovery from blindness” in the sense used by von Senden or Hebb? It cannot be claimed that this is equivalent to a previous life of total lack of retinal stimulation, as in the case of Riesen’s chimpanzees, but was S.B.’s vision at all times after about the tenth month too rudimentary to be his dominant sense, and too rudimentary to aid him appreciably in any task or skill?

We want to know how S.B.’s early vision compared with that of the previously reported patients, but this is difficult to discover as the earlier case reports tend to be exceedingly sketchy and often virtually non-existent, and little trouble seems to have been taken to form any estimate using more indirect evidence. There are plenty of indications that in some cases there was considerable residual vision immediately prior to the operation, and yet progress in using vision was often slow. In his chapter “The Significance of Residual Vision in Cataract Patients for their Consciousness of Space” von Senden (1960, pp. 71—86) refers to patients having prior to operation awareness of (1) brightness; (2) brightness and colours; (3) brightness, colour and shape. He says: (pp. 71—72) “Unfortunately the details as to the vision of the patients before and after operation are extremely fragmentary. . .” and considers that there are only four cases which can definitely be classed as having only brightness vision prior to operation. (These are: Wardrop II (1826): Nunneley (1858): Ahlström (1895): Latta (1904).) Thus von Senden thinks that only four out of nearly seventy cases can be said to have had only brightness vision before operations, (and at least one of these (Latta, 1904) developed useful vision comparatively fast, being comparable with the case of S.B.).

There are several cases in which pre-operative vision was clearly superior to S.B.’s and yet vision was extremely slow to develop after operation. Von Senden attributes this to “their intelligence and will to live

. . . since they were accustomed to make use of everything and had thereby already acquired extensive schematic notions of space, they also made use of their visual capacity and tried experiments on their own account. . . . This may indeed have been partly a game at first, as with Ware and Home; but the important thing was that they thought about impressions gathered from this game, and did not merely enjoy them as qualitative stimuli and accept them as such" (*op. cit.* p. 85, considerably condensed). We see nothing to disagree with in von Senden's view of the matter (though we might not wish to follow his arguments concerning the essential difference between tactual and visual space, with which he is concerned in this section of his book) and we feel that too little weight has been given to the probable importance for visual development of making *effective* use of the information available through the impaired visual channel. To disagree with this, one would have to argue that visual learning is very different from the other kinds of learning we know something about; where progress depends upon use, reward, and relating things—building up, in Bartlett's word, schemata.¹ This involves active processes of selecting and relating and depends largely upon intelligent interest. It is a tragic fact that blind people (particularly before there were good schools for the blind), tend to be generally lacking in intelligent interest. To take a striking illustrative example, the case of a seven year old boy²:—"The boy appears initially to be devoid of all concepts relating to knowledge of objects, mathematical figures, etc. He cannot even tell by feeling whether a thing is round, square or triangular; here too it is primarily a deficiency in his mental upbringing." (Uththoff, 1890, quoted by von Senden *op. cit.* p. 112).

We consider that although S.B. was once reported as having finger vision in early boyhood, his residual vision was certainly less than in the cases described by von Senden, including many which took months to gain useful vision. Our main reason for this conclusion is that although S.B. was of at least average intelligence and education he did not, according to the available records, get any assistance from residual vision. This we believe for two reasons: (1) The absence of any comment in the school report of any help from vision in reading, crafts or other skills, combined with the rather low final assessment; (2) The fact that throughout his life he lived the life of a blind man, and developed the special skills, such as orienting himself by echoes, which are necessary to those who lack effective sight if they are to live active lives. S.B.'s residual vision was apparently insufficient, even for a man of his intelligence and training, to serve him in any simple or complex task, and so we conclude that the case of S.B. may be considered with the classical cases.

The following differences from most of von Senden's cases should be noted.

(1) The operation was for opacity of the cornea and not for cataract of the lens, as in most of the earlier cases.

(2) So far as we know, S.B.'s vision was entirely normal up to the age of ten months.³

(3) S.B. had the advantage over almost all the previously reported patients in that he received specialised and careful education, including the reading and writing of braille.

(4) So far as we can judge, S.B.'s general level of intelligence, and also his sense of curiosity were above average.

(5) A most unusual feature was absence of nystagmus, both before and after operation. No reason is advanced for this, unless it be his visual experience as a baby, though this seems unlikely. Nystagmus is an almost invariable feature in these patients, though occasionally it is absent.

We shall now describe our observations on the case.

¹ F. C. Bartlett, (1932) *Remembering*. Cambridge University Press.

² Uththoff, W. (1890) *Helmholtz-Festschrift z. 70 Geburtstag*. (Special edition, Hamburg, 1891)

³ This may not be very different from the earlier cases, for the state of the eyes in infancy has not previously been recorded. We should expect opacity in lens or cornea to increase in infancy, and it is unlikely that vision is ever absent in the early weeks or months in operable cases of blindness.

3. Observations at the Wolverhampton and Midland Counties Eye Infirmary (January 1959)

(1) Introduction to the Case

We first heard of the case of S.B. through a short report in a daily paper, which stated that a man blind from birth, had upon operation immediately recovered his sight. Having read something of earlier cases of recovery from congenital blindness, and being impressed by their significance for contemporary perceptual theory (in particular Hebb's writing on the subject) we determined to try to investigate this case. We wrote immediately to the Hospital Secretary (the name of the surgeon was not given in the press) and received the following picture of the case, and invitation to investigate it, from the surgeon, Mr. A. Hirtenstein, F.R.C.S.

16th January 1959

Dear Mr. Gregory,

Thank you for the letter regarding a patient of mine, who, as you know, underwent a corneal graft operation a month ago.

I have myself been very interested to note how quickly he readjusted himself to the vision he gained after operation. Prior to the operation he only had light perception in the first operated eye; in the other eye he could perceive vague hand movements close to his face. He lost his sight at the age of ten months after smallpox vaccination, and was trained as a blind person from the age of seven to eighteen years, at the Birmingham Blind Institute. I am contacting the Secretary of the Institute to find what records they have of his early years.

After the operation he seemed to have absolutely no difficulty with spatial perception, and he could recognise faces and ordinary objects (i.e. chairs, bed, table, etc.) immediately. He learned the names of colours very quickly, and seemed to have no difficulty in recognising cars, windows, doors, etc. His explanation is that, though he could not see any of these things before, he had a definite and accurate mental image of all things he was able to touch; in the case of a car, for instance, he used to wash his brother-in-law's car, and thus he had a good idea of its shape. He was working as a boiler-scraper, and although he hasn't yet seen a boiler, he assures me that he would be able to recognise one immediately, as his mental picture of its shape is very accurate.

As you know I operated on his second eye a fortnight ago, and I hope the visual result will be equally satisfactory for him. His present vision is, of course, not very good yet, but I hope it will improve after further operations, as the first ones were only preparatory ones.

He will probably be staying another week or so in the Wolverhampton Eye Infirmary, and if you would like to see him yourself, and carry out any tests you might wish to do, you would be more than welcome. Do let me know if you are able to come up, as I would very much like to meet you if possible. Thank you very much for enclosing the two interesting articles of yours. I look forward to discussing Mr. B.'s case with you.

Yours sincerely,

Signed: A. Hirtenstein (F.R.C.S.)

We are most grateful to Mr. Hirtenstein, and the Matron and staff of the *Wolverhampton and Midland Counties Eye Infirmary*, who gave us all the facilities we requested, and helped in every way possible. We were given the use of a quiet and well lighted room for our investigations, and were left entirely undisturbed.

It is unfortunate that this case was not examined earlier from the psychological point of view, but it is understandable that it seemed to be of no very special interest to those who were involved in eye operations every working day of their lives. Special investigations take time, and time is obviously a precious commodity in a busy hospital geared to treatment rather than to research. We saw S.B. while still in the hospital, and interviewed members of the staff to obtain details about what had happened before we saw him. These were trained and careful people, and indeed had far more experience in dealing with, and observing, blind people than we had.

S.B. received a corneal graft on his left eye on 9th December, 1958, and on the right eye on 1st January, 1959. We first examined him on 26th January—48 days after the first operation. The first

examination was carried out in a quiet private room in the hospital, lit by winter daylight, and lasted about 3½ hours.

We first saw S.B. walking confidently along a corridor. He guided himself through a door without the use of touch, and he struck us immediately as a cheerful, rather extravert and confident, middle-aged individual. At first impression he seemed like a normally sighted person, though differences soon became obvious. When he sat down he would not look round or scan the room with his eyes; indeed he would generally pay no attention to visual objects unless his attention were called to them, when he would peer at whatever it was with extreme concentration and care, finally making some almost oracular comment. He never said anything silly or hysterical, and answered every question with unusual care. He never evaded a question, and showed an intelligence and sense of curiosity very much higher than a sighted man of his trade would be expected to show. He displayed an unusual dislike of being surprised by anything. He had a matter-of-fact attitude to his situation and his experience, and disliked not knowing things known as a matter of course to sighted people. At no time did he dramatise his situation, or exaggerate his lack of knowledge, as one might have expected if he were trying to impress us with his past blindness. He was proud of his independence as a blind man, and indeed he was unusual in his independence. He would go for long cycle rides, holding the shoulder of a friend, and he was fond of gardening, and making things in his garden shed, provided by the blind school for his trade as a cobbler.

He had no nystagmus. Searching eye movements were minimal, and when they did move over a large amplitude, they did so in larger than normal saccadic jerks which were plainly visible. No records were taken of his eye movements.

It was very soon apparent that his vision was far from rudimentary: he could name almost any object in the room. Much to our surprise, he could even tell the time by means of a large clock on the wall. We were so surprised at this that we did not at first believe that he could have been in any sense blind before the operation. However he proceeded to show us a large hunter watch with no glass, and he demonstrated his ability to tell the time very quickly and accurately by touching the hands. It appears that he always used this method of telling the time before the operation.

We were even more surprised when he named correctly a magazine we had with us. It was in fact *Everybody's* (for January 17th, 1959), and had a large picture of two musicians dressed in striped pullovers. Although he named the magazine correctly, he could make nothing of the picture. We at once asked him how he knew which magazine it was, and he said that although he could not read the name, he could recognize the first two letters, though not the rest, and he guessed that the *Ev* belonged to *Everybody's*. Further questioning revealed that he could recognise any letter in upper case, though not in lower case, and it so happens that the title of the magazine was written with only the first two letters in upper case, thus:



He then told us that he had learned capital letters by touch, these being inscribed on blocks and taught at the blind school. Lower case letters were not taught.¹ This was particularly interesting, for it suggested direct transfer from touch experience. It also showed how he could guess correctly from comparatively little evidence. We were, after this early experience, continuously on our guard for intelligent guessing covering up perceptual abnormality.

His colour naming was not at that time by any means perfect. He told us that his only visual memories were of red, white and black. He could name these correctly, and apparently could do so very shortly after the operation. When we saw him he was uncertain about yellow, complaining of the large number of kinds of yellow. Latta's patient responded with great displeasure to yellow. S.B. did not show *dislike* for any colour, but seemed to prefer greens and blues, for example when seen in kodachrome projections, even when he could not name the objects. He liked bright colours, and later often expressed disappointment when things were "dingy".

¹ The upper case letters were taught since they often occur embossed on name plates, and they are useful to the blind, whereas lower case letters are seldom used in embossed form and so were not taught.

When we established that he could distinguish upper case letters, cars from lorries as seen in the distance through the window, and name such objects as trees and tables, we realised that more sophisticated tests were called for. Fortunately we had brought everything we could think of in the time available, including the tests to be described.

(2) First Visual Experiences after Operation

S.B.'s first visual experience, when the bandages were removed, was of the surgeon's face. He described the experience as follows:— He heard a voice coming from in front of him and to one side: he turned to the source of the sound, and saw a "blur". He realised that this must be a face. Upon careful questioning, he seemed to think that he would not have known that this was a face if he had not previously heard the voice and known that voices came from faces.

At the time we first saw him, he did not find faces "easy" objects. He did not look at a speaker's face, and made nothing of facial expressions. On the other hand, he very rapidly (apparently within a couple of days) distinguished between passing lorries and cars, and would get up at six each morning to look at them some way off. He "collected" different types of lorry, and took much pleasure recognising vans, articulated lorries, and so on. His particular interest in cars and lorries may have been in part that they made familiar sounds, which helped in identification; that they could only be driven by sighted people, and so held out particular promise to him. He had spent many hours trying to visualise the shape of cars while washing them, particularly his brother-in-law's car, which he frequently washed down.

He told us that he did not suffer particularly from giddiness when he first opened his eyes.

As in previous cases (Latta, 1904), he experienced marked scale distortion when looking down from a high window. In the famous Cheselden case, objects were at first reported to be touching the eye¹; this was not true for S.B. but he found that when looking down from a high window (about 30—40 feet above the ground) he thought he could safely lower himself down by his hands. When later he saw the same window from outside, he realised that this would be impossible.

On the whole, his early estimates of the size of objects seem to have been quite accurate providing they were objects already familiar to him by touch. Thus buses seemed to him to be too high but the right length. This may well have been because he was used to walking their length but not feeling their height, adding the separate tactile sensations of the height of each step and adding enough above the stair-case would be a comparatively difficult and unfamiliar task. In drawings of buses, to be given later, he emphasised the features familiar to touch but ignored the bonnet, which would not normally have been touched by him.

He may well have made many mistakes of identification of objects which we did not hear about, but from the beginning he was proud of his ability to name objects correctly, and took no pleasure in allowing others to find out that he made mistakes.

It was very soon obvious (as we had to some extent anticipated) that merely to ask questions about what he saw would not give us much information about his visual capacity. In fact the only example of a curious and interesting mistake was described to us by the Matron, who said that about three days after the operation he saw the moon for the first time. At first he thought it a reflection in the window, but when he realised, or was told, it was the moon, he expressed surprise at its crescent shape, expecting a "quarter moon" to look like a quarter piece of cake! It is noteworthy that this is the only clear instance of an expression of surprise, or of a clear error of this sort. That it should occur with an object he could not have touched is perhaps significant. It also shows—when it is remembered that the full moon only subtends 0.5°—that his visual acuity must have been reasonably good at that time, a few days after the first operation.

It is also worth noting that reflections fascinated him and continued to do so for at least a year after the operation.

¹ Although this is often quoted at its face value, it is worth remembering that normally a strong light, particularly if painful, is not regarded so much as "out there" as in the eye itself. The same is true for intense (and unusual?) stimuli in any sense modality. E.g. a very loud sound is a sensation *in the ear*.

(3) Perceptual Tests

One of the difficulties about trying to discover the perceptual world of the blind is that they use the normal words of the sighted, even though they cannot always have the meanings we attach to them. Thus a blind man will say, "I saw in the paper to-day. . .when he reads it by touch in braille. When S.B. named an object correctly (say a chair or a vase of flowers) we could not discover what special features he used to decide what object it was. It was obvious that facial expressions meant nothing to him, and that he could not recognise people by their faces, though he could immediately do so by their voices, but we could learn little more.

We tried to get some insight into his previous world by getting him to say what surprised him when vision returned. The attempt failed almost completely, as he seldom admitted to any surprises.

We would have liked to obtain accurate measures of such things beloved by the experimental psychologist as the visual Constancies, but this was not practicable, for he tired easily, and we were anxious not to upset either him or the hospital staff. We decided to get him to look at various well-known visual illusions, about which a great deal is known for normal observers, even though explanations for many of them are lacking. The lack of explanation of these illusions did not worry us greatly, for with more knowledge, which is bound to come with further research in perception, they will surely be explained, and then any findings should be relatable to general perceptual issues¹. It seemed to us that this would be the best way of getting some reasonably objective information as to his perceptual capacities and peculiarities.

The first three tests to be described here were given on the morning of 26th January 1959, and the remainder on the same afternoon when the first three were repeated.

Test 1. Hering Illusion

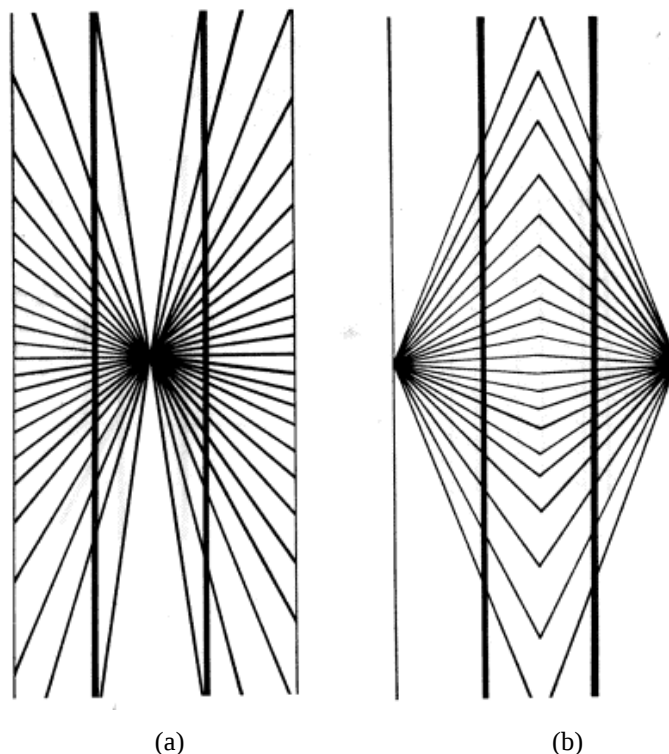


Fig. 1. The Hering Illusion. (a) First form. (b) Second form.

¹ Since undertaking this investigation, we have made an intensive investigation of the geometrical illusions, and have come to the conclusion that they arise from discrepancy between estimated distance and degree of constancy evoked by such perceptual features as perspective lines. The illusion figures presented here seem to produce distortion of visual space by evoking constancy which is inappropriate to the flat plane (visible as a textured surface) on which the figures lie. On this view, we might say that the anomalous results obtained for S.B. show that these figures did not serve to evoke constancy scaling for him, and thus the illusions were absent.

This is shown in Fig. 1a, in which it will be seen that although the heavy vertical lines are in fact straight and parallel, they appear to diverge in the middle. This figure was presented to S.B. printed in heavy black lines on a white card of size 10½" x 4". He held it close to his eye, and studied very carefully in silence.

Result. First he said the lines were straight. He then became doubtful, and thought that they might be further apart at the top and middle. When shown the figures again, in the afternoon, he first said: "One goes out in the middle" and ended by saying that both were straight. We may conclude that the illusion was, if present, considerably less marked than in normal observers. Fig. 1b. gave a similar result.

Test 2. The Zolner Illusion

Normally, the verticals look non-parallel and may fluctuate in their positions (Fig. 2).

Result. He reported the verticals, after careful study, as all parallel, and after questioning about variation [jazzing] he said it was "all calm".

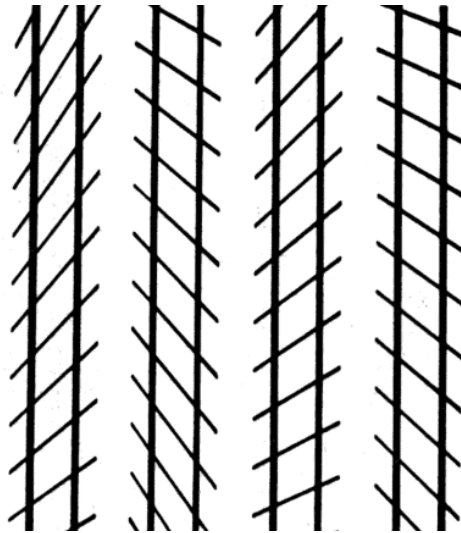


Fig. 2. The Zolner Illusion.

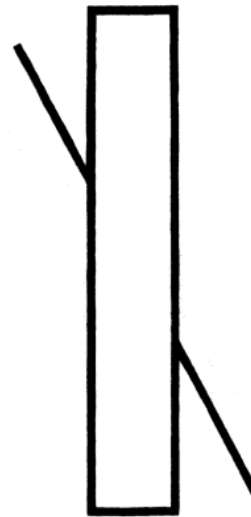


Fig. 3. The Poggendorf Illusion.

Test 3. The Poggendorf Illusion

Normally, the right-hand section of the slanting line appears to lie below the continuation of the left hand section. (Fig. g).

Result. S.B. reported it as: "all one line".

Test 4. Ambiguous Depth Illusions (reversing figures)

(a) *The Necker Cube.* This also is a very well-known illusion: it was shown as presented in Fig. 4a. It was displayed on a card 10 cm. x 15 cm. the figures being 5.2 cm x 8.0 cm. Normally, this figure is seen to reverse at intervals, the side representing the front being ambiguous.

Result. This gave a most unusual, possibly unique, result. The figure was evidently *not seen in depth* and it *did not reverse*.

"We took the greatest possible care to ensure that he understood what we meant by "depth" and "reversal," after he asked us "What is depth?" We did this by showing him (after first obtaining negative answers to our question as to whether it reversed or was seen in depth), a child's wooden brick we had brought along, and pointed out that it receded from him by pointing out the depth with a finger, and getting him to touch it while looking at it. When he looked again at the picture cube he said that he could

not see depth, and that, “it looks quite different [from the brick].” He tried, rather unsuccessfully, to draw a cube, but unfortunately this drawing is lost.

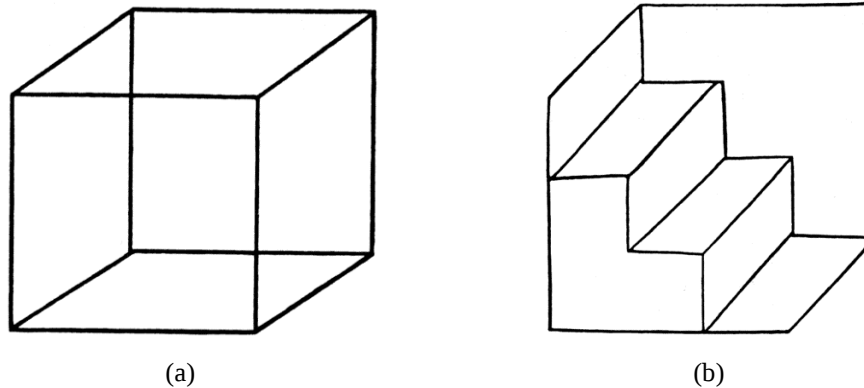


Fig. 4. Ambiguous Depth Illusions. (a) Necker Cube. (b) Staircase Illusion.

(b) *The Staircase Illusion*. This is similar ‘to the Necker cube in that it also is a figure reversible in depth. It was presented on a card. (Fig. 4b).

Result. The result was the same; evidently no depth, and no ambiguity was observed.

Test 5. The Müller—Lyer Illusion

This famous illusion is shown in Fig. 5. When the shafts of the arrows are in fact of equal length, the arrow with diverging fins is seen as longer than that having converging fins. This was presented to S.B. as two arrows end to end, and was so arranged that it could be varied, and continuously adjusted by the observer, who holds the device in his hand. The length of the fixed arrow was 74 cm., and the movable arrow is normally observed to be *shorter* than this. S.B. adjusted the arrow for apparent equality of length four times, each time with great care.



Fig. 5. Müller—Lyer Illusion.

Result. His estimate of length on the four successive readings were as follows:

1. 10.0
2. 16.5
3. 17.0
4. 16.0

These figures meaning the *under-estimation of length* from the standard of 74 cm. His average illusion is thus 14.12 cm, in the normal direction. This may be compared with the mean obtained on ten normal observers on the same apparatus of 20 cm. The extent of the illusion as measured for S.B. is unusually small, though some “normal” observers can be found with a similar degree of illusion.

Test 6. Perspective Size Changes

Figure 6 shows four men, all actually the same size, but normally appearing of increasing size as the apparent distance, due to perspective, increases.

Result. S.B. reported: “They don’t look far away, it’s just as though the men were standing underneath (? the buildings). The first man looks smaller, but the last three look the same.” It should be made clear that these comments were in answer to a request for a description of the relative sizes of the men, and we

had to state that the objects depicted *were* men. As will be seen later he was hardly able to identify drawings of such objects as men.



Fig. 6. Perspective Size Illusion.

Test 7. Figure and Ground

One of the classical problems in the study of perception is how “figure” is distinguished from “ground” and whether the distinction is innate or learned. Normally objects stand out against a hardly perceived background, for example the objects in a room against the walls, even when highly decorated, but this can be perceptually ambiguous, as when at dusk the sky is sometimes seen as “object,” with the black roofline as unimportant “background”. Similarly, looking at a map, the land or the sea can be seen as “object” or “background”.

The only example given to S.B. was Fig. 7.



Fig. 7. Figure and Ground Effect.

Result. S.B. made little of it; after some time he said, of the black curved part:

“Is it the case of a fan—a turbine fan?” He meant by this, as questioning elicited, part of the boiler equipment on which he worked. This is particularly interesting, for he had not at that time seen this equipment; he was however certain that he knew what it would look like, from his experience with touch plus his recent visual experience. He gave no response indicating figure—ground fluctuation, and could make nothing of the white part, even when the face” was pointed out in detail.

Test 8. The Ames Distorting Room



Fig. 8. Apparent Size of Objects in Ames Distorting Room

The Ames distorting rooms are of importance for studies on “visual framework”. They emphasise that many judgements of size, shape or distance which may seem to be absolute are relative in the sense that they depend on other features in the visual field.

The rooms are non-rectangular, but are so made that they give, from a chosen viewing position, a retinal image corresponding to a rectangular room. Clearly they *must* appear rectangular from the chosen position, since no information is available to indicate otherwise, but they become interesting when objects are introduced into the rooms, for objects in fact at different distances may appear to be the same distance from the observer. When this is so, objects of the same size and the same *apparent* distance will give different sized retinal images. To the normal observer the objects will appear of different sizes even when this is quite contrary to all their past experience. For example, a child can be made to look larger than an adult, as in Fig. 8, which is taken in an Ames room. It would seem that, at least in a Western culture, where most rooms are rectangular, the walls serve as a reference frame for deciding the ever-present perceptual question: is it a large object far away or a small near object giving this size of retinal image?

We should expect S.B. to see an Ames room as rectangular—or at any rate he should not find its shape surprising—but it was an open question what he would see when identical objects were placed in such a room at actually different distances though at apparently the same distance.

To test S.B.’s reactions to this special situation, we used a small model Ames room, into which he looked, using one eye.

Result. He reported the room to be rectangular (in fact the rear wall receded from him to the right), and this result in no way surprised us since the resulting retinal image would be the same as for a truly rectangular room, or box. We then held a half-penny in each of the two windows in the back wall, one window being in fact further from the observer than the other, this distance not being apparent. S.B. reported that the right hand coin looked smaller than the left. When the right hand coin was replaced by a penny piece, and this compared with a half-penny in the left window, he reported that they were of the same size. This response is quite normal for observers using the particular model Ames room we used for this test. We were, rightly or wrongly, considerably surprised by the result.

Test 9. After-Effects of Movement

The well-known after-effect of perceived movement, often called the “waterfall effect” is a marked apparent movement of stationary objects viewed immediately after exposure of the retina to moving stimuli. A familiar example is the apparent movement of the bank of a river when seen after the moving water has been fixated for half a minute or so. The effect may most readily be observed by fixating the centre of a gramophone record while it is rotating, and then stopping the turntable. It will be seen to rotate in the opposite direction, the effect lasting for up to at least twenty seconds.

We tested S.B. for this effect using in place of a simple rotating display, a large spiral mounted on a turntable. Normally after this is viewed rotating slowly, a marked after-expansion or contraction is seen. This is a particularly good display to use because the effect cannot be due to eye movements, since the after-effect is symmetrical round the centre of rotation of the spiral.

Result. First we switched on the motor and asked S.B. to tell us what he saw. He was unable to say, and we discovered that he did not understand or appear to know the words “contract” or “expand”. After several exploratory trials we got him to watch carefully for 30 seconds, and to tell us what he saw when the disc was stopped. He reported: “stationary”. He appeared to get no after-effect under conditions when a normal observer would experience an expansion lasting 15—20 seconds. This was probably not due to lack of acuity, for he did appear to see real movement of the spiral. Language was, however, inadequate for this bizarre situation, and we may have been mistaken in thinking that he obtained no after-effect of any kind, though this appeared to be the case.

Test 10. Rorschach Ink Blots

We showed S.B. cards I and X of the Rorschach test. Our purpose was not to test his personality, but rather to see whether vague and quite unfamiliar shapes would evoke any interesting response.

Result

Card I (no colour). He said: “It is just a design—I can’t see what.” We asked him: “Does part of it show something?” He answered: “I haven’t the slightest idea.” Even after the most leading questions he was quite unable to make anything of it.

Card X (coloured). This time he said. “Is this a wallpaper design, or a cushion cover? It looks like a design for something. I can see colours but not what they are—there aren’t any flowers are there? I thought it was something of a plant, but there are no flowers, so I thought it was a design.” This response is interesting in being one of the few cases where he is evidently thinking aloud. Colour always stimulated him: his greater interest in the coloured card is typical.

Test 11. Kodachrome Projections of Scenery

We showed S.B. several kodachrome transparencies of objects and scenes familiar to sighted people but never seen by him. They were shown by projection.

Slide 1. The Interior of a Cathedral (Hereford). He said: “Is it a building with lights in it? What’s all that gold, is it the sun?” (The lighting was in fact rather gold-coloured sunlight). He took a stained glass window to be a door in a church. (This might have been from the common gothic carving to be found in Victorian churches and school doors.) He was rather puzzled by what he thought was a door, and asked: “Why should it have lines down it?”

Slide 2. The Cambridge “Backs” showing River and King’s Bridge. He made nothing of this. He did not realize that the scene was of a river, and did not recognise water or bridge. We named the water and the bridge to him, pointing them out.

Slide 3. Evening Scene of Malvern Hills. “This is a landscape is it? I can only tell fields by the colour. What’s this gold colour?” He liked the green, but could name nothing on the picture.

Slide 4. The Cambridge “Backs” showing Trinity Bridge. This time he immediately, though with a trace of uncertainty, identified the water as water, and pointing to the double arched bridge said: “Are those bridges again?”

So far as we could tell S.B. had no idea which objects lay in front of or behind other objects in any of the colour pictures. He showed pleasure at green foliage, but could make very little of buildings or other objects. We formed the impression that he saw little more than patches of colour.

Test 12. The Ishihara Colour Vision Test

We gave S.B. the whole of the standard Ishihara Colour Vision Test. That we had brought it along with us turned out to be peculiarly fortunate, for the result was remarkable.

Result. We presented the book of test cards in the normal order, and asked him to try to make out any numbers or letters among the coloured dots. To our extreme surprise he read *every single number correctly, as for normal colour vision*. That his colour vision would thus appear nearly normal is of secondary importance here, what amazed us was that he was able to make out figures without the aid of any high-contrast outlines. He made only one correction from a 1 to a 7, which is normally found rather difficult to distinguish.

He also succeeded, quite easily, in tracing out the “mazes” on the final test cards, after we showed him what was required using the small paint brush provided as a pointer which does not harm the cards.

It seems very difficult to avoid the inference that he used earlier tactile experience of number shapes. He had never had this or any similar test administered, as we established from the hospital staff.

The fact that he succeeded in reading these numbers is of particular interest as they have no contours, in the ordinary sense, but consist of dots coloured slightly differently from other dots which are of various colours. It would seem impossible for him to have followed outlines with his eyes, since he could not know which colour was relevant until *after* he had recognised each figure. We noted that he did not attempt to follow the figures with his finger, or make any related movements with his hands or fingers. He read the numbers out quite confidently and quickly, without apparent unusual mental effort. This seems to us the most interesting observation which we made in the study of S.B.

This observation that he was able to read the characters even though masked in the coloured dots of the Ishihara test displays, seems to provide very strong evidence for transfer from earlier tactile experience. This is surprising in view of Riesen's findings that trans-modal transfer does not seem to occur in chimpanzees kept while young in the dark.

(4) The Patient's First Drawings

We asked S.B., on the same day that the visual tests already described were administered, whether he would try to draw for us. He said that he had not so far tried to draw, though he had tried to write, and indeed he produced a laboured but just legible version of his own name, which he produced with great pride. (His wife had recently given him a ball point pen—his first writing instrument—and he had written his name to show to Mr. Hirtenstein.)

(A) *A Hammer* (Fig. 9) was a subject of his own choosing—a *cobbler's chipping hammer*. This seems to be the first drawing that he ever made. He was most doubtful of his ability to draw, but once started, he enjoyed it, and attacked it with great concentration. He placed his head very close to the paper, using only his preferred (right) eye, and checking the results from time to time holding the paper further away.

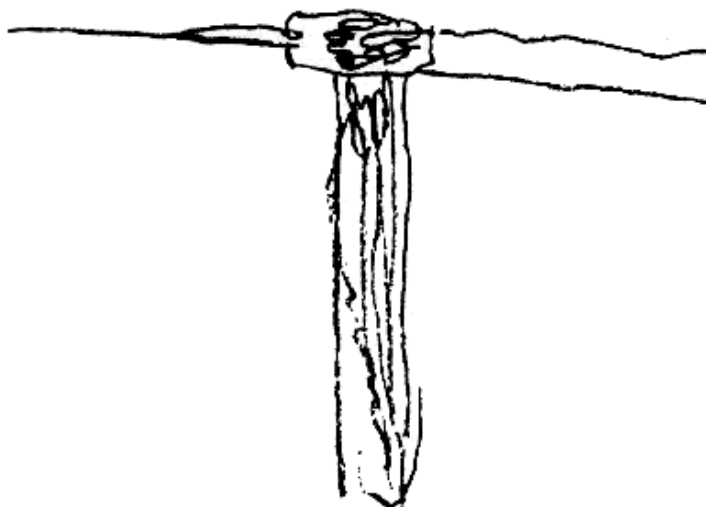
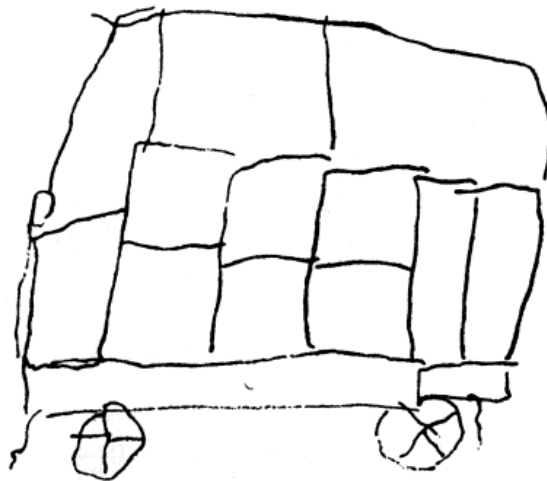


Fig. 9. The Patient's First Drawing: This drawing of a cobbler's chipping hammer was made in our presence on the 48th day after the first operation.

(B) *A Bus* (Fig. 10). This was a subject which we suggested to him—a bus. We chose it because he was familiar with buses as a blind man, and all transport interested him. We also had some evidence that at first buses seemed to him too tall, though of the correct length, and this seemed a matter of some interest. He had seen several buses since his operation—also cars and lorries—and it was clear that he thought this an interesting task.



(a)

Fig. 10. Drawing of a Bus (48 days after the first operation).

He expressed dissatisfaction with his drawing because he found himself quite unable to draw the bonnet, or radiator. This is striking for it would be the principal part that he would not have touched to any great extent when blind. The rather exaggerated windows might well represent the tactual conception of them, perhaps as felt from the inside. The wheels, it may be noted, are shown as having spokes. We questioned him on this and he replied that he knew that buses had hub wheels, but that he was more familiar with the feel of cart wheels. Evidently the more striking tactile impression would be of a wheel having spokes, and this seemed to mean "wheel" for him. He also said that he did not know how to draw a hub wheel, without spokes, so he "made them simply like cart wheels". He said that he knew the shape of hubs quite well, for he often washed his brother-in-law's car, and then he tried to picture it as it seems by sight. He drew buses later (Fig. 14a and b) and these we discuss below.

When he had drawn the bus and had discussed it, we left him to choose his own subject.

(C) *A Farm House* (Fig. 11). He said that this was meant to be the gable end of a farm house, with a path leading up to the house from a gate. It represented his idea of the Archers' House in the radio serial, to which he listened regularly.

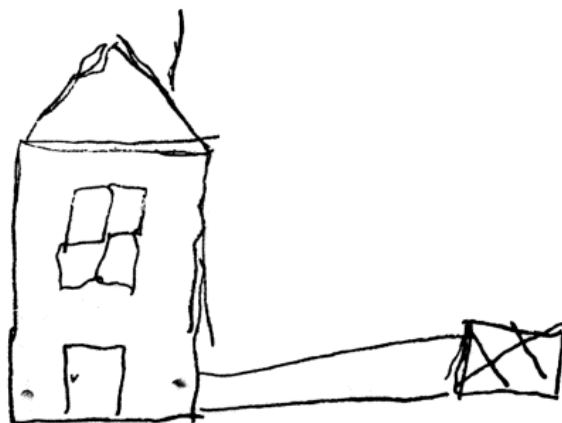


Fig. 11. Drawing of Farm House.

(D) *S.B.'s House* (Fig. 12). This was his own choice. The archway at the right hand side represents the entry to a passage round the side to the back of the house. He was worried by his inability to represent the pavement.



Fig. 12. Patient's Drawing of his Own House.

(5) *A Man* (Fig. 13). (No man in particular). He first drew the head, spending a long time on the mouth. We asked him to add the body, so any distortion of scale between the head and body should not be taken as important. When he had finished the body he said "I'm afraid I forgot to put him any knees".



Fig. 13. Drawing of a Man. (48 days after the first operation).

(5) Discussion on S.B.'s Drawings

It is well known that some blind people are capable of drawing objects familiar to them by touch.¹ Typically, the characteristic tactile features appear to us exaggerated and perhaps they can give us some information as to how objects appear to the blind. It is interesting that S.B.'s early drawings are all typical of drawings of the blind. He introduces no features which he had not known previously by touch, although at that time (48 days after the first operation) he could name these objects confidently from vision alone. Thus although he could use vision to recognise objects he seemed incapable of recalling the specifically visual information and to represent it in his drawings.

The hammer, (his first drawing) was quite certainly drawn from touch memory as he had never seen it. The first drawing of a bus (Fig. 10) is revealing in showing importation of a characteristic tactile feature which was not in fact present in the buses he saw in the period after the operation: the spokes of the wheels. The buses he had seen had disc wheels, but to him a wheel characteristically has spokes and he imported these and added them to his bus, which he drew, as with the other drawings, sitting in the hospital room without having the object present to draw from.

The farm house (Fig. 11) represents his imagined house in a radio serial (the Archers) and incorporates only features known to him by touch. It may be noticed that the window is identical with drawings of the windows of this own house (Fig. 12). It may seem surprising that he should have a touch image of an object as large as a house, but in fact he painted his own house, using a ladder, and feeling the brush along the woodwork, which he did fairly competently. It may be noted that the roof is ambiguously represented.



Fig. 14. Drawings of a Bus. (a) 6 months later; (b) one year later.

He took longer to draw the man (Fig. 13) finding it difficult, and was dissatisfied with the result. Blind people like exploring other people's faces with their fingers, and at that time he knew that his previous conception of faces was highly inadequate, but his vision did not serve to give him recognition of individuals from their faces or of the significance of facial expression. He seemed to have a feeling of inadequacy and disappointment over this. After doing this drawing he looked worried and apparently could make little of his own drawing. He ended by saying: "I'm afraid I forgot to put him any knees", and relinquished it with a sigh.

(6) Addendum: Later Drawings

The later drawings of a bus (Figs. 14a and b) were done six months and a year later respectively. They give some indication of the patient's increasing ability to use specifically visual information. There are several points of interest. In all cases the radiator is omitted, and this would not have been known by touch as the front of a bus is a position of danger to a blind man. The mirror is shown in all three drawings and mirrors always fascinated him. One suspects that he is representing the windows as he knew them by touch from the inside. The spokes, imported from touch in the first drawing, are absent in the second and a much more sophisticated version of the wheels is given in the third. There is no writing present in the first drawing. This appears in the second but is only upper case lettering, which he already

¹ See G. Revesz, (1950) *Psychology and Art of the Blind* (Transl. H. A. Wolff) London, Longman's and V. Lowenfeld, (1952) *The Nature of the Creative Activity* (Transl. O. A. Oeser) Routledge.

knew by touch, while in the third drawing lower case lettering is beginning to appear: this he learned only after he gained his sight.

Finally, it will be noticed that in all three cases the buses are shown in profile and facing to the left. As a blind man he would only touch buses when they presented this aspect to him (since traffic is on the left hand side of the road in this country), and he retains this aspect even in the last drawing.

These drawings illustrate the general finding that although S.B. came to use vision, his ideas of the world arose from touch and his general way of life as a blind man remained with him until his death.

4. Observations Made Immediately After Discharge from Hospital

Before leaving hospital, S.B. had been out for short periods and we were not with him on these occasions. He had spent Christmas at home after the first operation (on the less successful eye) and had been out for one or two walks in Wolverhampton. He was driven to London from the hospital by Mr. Merrick Winn, with whom we stayed with S.B. and his wife at a London hotel.

S.B. was very tired when he arrived, and his eyes were painful. Mr. Winn told us that on the drive down S.B. had been almost completely unresponsive, accepting quite calmly what must have been unfamiliar visual scenes. He complained that the world seemed a drab place, though when the sun appeared he could see more clearly, and he was disappointed when it set. The one spontaneous comment S.B. made to us that evening was to describe the colours in the sky at sunset, to end sadly:

“...then we came down a hill and it all disappeared”. When questioned about his general lack of interest in the journey, he said that the speed was too great for him to see very much; this was probably not the whole story, as later observation shows. He seemed dispirited, and indeed he never seemed the cheerful rather extravert man he was at the hospital when we first saw him.

Next morning, at breakfast, he sat for preference facing a very large wall mirror in which the room was reflected. This fascinated him, and mirrors continued to be chosen objects. (At his “local”, a year later, his favourite place was opposite a mirror from which he could see the street through a window.)

We took him round London, and showed him several of the “sights”, but he was almost uniformly bored. He found all buildings dull, of no interest. His only signs of appreciation were to moving objects, particularly the pigeons in Trafalgar Square. He took great interest in them and liked to touch them while he watched. He described how as a blind man he often felt isolated and sought sounds of activity and movement.

He found the traffic frightening, and would not attempt to cross even a comparatively small street by himself. This was in marked contrast to his former behaviour, as described to us by his wife, when he would cross any street in his own town by himself. In London, and later in his home town, he would show evident fear, even when led by a companion whom he trusted, and it was many months before he would venture alone. We heard that before the operation he would sometimes injure himself by walking briskly into a parked vehicle, or other unexpected obstruction, and he generally did not carry a white stick. As a blind man he was unusually active and aggressive. We began to see that this assurance had at least temporarily left him; he seemed to lack confidence and interest in his surroundings.

We were disappointed in his lack of interest and response to the everyday sights, and so we suggested that we take him to the Science Museum, in South Kensington, with a view to showing him things, particularly tools, which he would have heard about and wished he could have used when blind.

(1) Visit to the Science Museum, South Kensington

S.B. had a long-standing interest in tools and machinery; we were thus particularly interested to discover whether the sight of these things would serve to stimulate him, and dispel the lethargy into which he had fallen.

We took him to the large Watt’s beam engine in the main ground floor gallery. This certainly interested him, especially when we arranged to have it run (by compressed air) for his special benefit. So far as could be told he understood little or nothing of its function and was disappointed.

A model windmill he at first described as: “It’s a sort of cross—is it a windmill?” Upon questioning, it appeared that he had made simple windmills for children, and this enabled him to guess its identity. He made nothing of the rest of the model, only the cross-like sails.

We showed him a large stone-cutting bow-saw, which had large clearly defined teeth. At first he made nothing of it: it took perhaps 30 seconds for him to identify it as a saw.

The most interesting episode was his reaction to the fine Maudeslay screw cutting lathe which is housed in a special glass case. This is a large and fairly simple example. We chose this object because a lathe would be a tool that he must often have wished to use.

We led him to the glass case, which was closed, and asked him to tell us what was in it. He was quite unable to say anything about it, except that he thought the nearest part was a handle. (He pointed to the handle of the transverse feed.) He complained that he could not see the cutting edge, or the metal being worked, or anything else about it, and appeared rather agitated. We then asked a Museum Attendant for the case to be opened, and S.B. was allowed to touch the lathe. The result was startling; he ran his hands deftly over the machine, touching first the transverse feed handle and confidently naming it as "a handle", and then on to the saddle, the bed and the head-stock of the lathe. He ran his hands eagerly over the lathe, with his eyes tight shut. Then he stood back a little and opened his eyes and said: "Now that I've felt it I can see". He then named many of the parts correctly and explained how they would work, though he could not understand the chain of four gears driving the lead screw.

The episode with the lathe was extraordinarily interesting to watch: it is a great pity that a film record was not made.

(2) Visit to the Zoo, Regent's Park

The officials of the Zoological Society Gardens very kindly arranged a special visit in which we were allowed to enter many of the cages normally closed to visitors.

Before he saw the animals, we asked S.B. to draw an elephant as he imagined it would look. (Fig. 15).



Fig. 15. Drawing of an Elephant.

It may be noted that this is a very poor drawing of an elephant; and yet when he saw the real thing, for the first time, later that day, he recognised it and expressed no surprise. This brings out the extreme difficulty we had trying to understand his world.

S.B. had no difficulty in identifying the giraffe, elephant, monkey, lion, snakes or giant tortoises. He appeared to identify the tiger at once, though he was surprised to see that it was striped. However, after several cages of leopards, panthers, etc. there was another tiger and he did not recognise it as such. (As the first tiger was in the next cage to the lion, recognition of it may have been due to a natural association between the two.) He could not identify bears, seals, rhino, hippopotamus, crocodiles, or a gazelle. He was given a mongoose to hold, and thought that it might be a ferret, then a badger, then a stoat. He had never heard of a mongoose. He was amused by the elephants and giraffes, and particularly amused when he saw two giraffe heads looking at him from high up over the top of an adjacent cage. This was the only visual situation noted which ever made him laugh. He was allowed to throw cabbages into the mouths of the hippopotamus and his aim was good. We obtained a film record of this. When allowed to handle the animals, he did so with pleasure, and showed no fear or revulsion when snakes were hung round his neck. This also we filmed.

(3) Visual Skill—A Game of Darts

At S.B.'s request, we played a game of darts with him. He had played when he was blind by touching the board and walking backwards until he was told to stop. He would then be told the result of each throw. He now tried, for the first time, with sight. He occasionally scored accurately but was on the whole inaccurate, with a marked tendency to aim too low. He then tried with his eyes shut, and there was little difference in his performance. There was, perhaps, some evidence that with sight he tended to underestimate the distance.

We made several general observations during the two days that we were with him at this time:— He walked downstairs with complete confidence, with no hand on the rail; but on two occasions when there were three or four steps only, he stepped straight off the top one and had to be saved from falling. He would walk past objects (cages of animals in the zoo for instance) without seeing them when a normally sighted person would have reacted to them at once. On the other hand, when we asked him, outside Buckingham Palace, if he could see Big Ben, he said that he could see “that sort of tower if that was what we meant,” and whenever his attention was drawn to animals in the zoo he would react at once. He said again that he did not recognise people by their faces but by their clothes—the colour—and that he was unable to understand expression on faces. He only looked at faces when spoken to and then in a rather “blind” fashion, though there was some evidence on the second day that he was beginning to look at faces with more curiosity. At a meal one would look up and find him rather tentatively studying one's face. One would have given a lot to know what he saw.

5. Observations Made Six Months After Operation

We visited S.B. at his home six months after the operation and spent a day with him in his familiar surroundings.

At his house we saw his shed, in which were hand tools for cobbling and woodwork and a new circular saw which he had recently installed and which he demonstrated with great pride. He apparently used it only for cutting up fire wood, but he operated the machine with frightening confidence.

The shed was fitted with a coke stove, and he informed us that he had installed this himself while blind, a statement confirmed by his wife, though he may of course have had some help. He was a keen gardener before his operation, growing mainly Vegetables and setting them out in rows with strings. He described how he used to try to picture the plants, and particularly liked their smell.

S.B. was clearly proud of his ability to deal with the tasks of making and mending: he was an aggressive man determined to tackle all that was possible to him with unusual perseverance and on the whole successfully. He used to go for long cycle rides, being guided by a friend's hand on his shoulder, and he took particular pride in the installation of the stove in his shed. But talking to him now he seemed dispirited, and we formed a strong impression that his sight was to him almost entirely disappointing. It enabled him to do a little more, and he had a strong desire to drive a car, but it became clear that the opportunities it afforded him were less than he had imagined. We found a still active middle-aged man of fairly high intelligence, but with a labourer's job and unable to read more than a few simple words. His income and status were obviously lower than they would have been if he had not been so handicapped, and these facts were very clear to him. He described the world as rather drab; he still to a great extent lived the life of a blind man, sometimes not bothering to put on the light at night, and he still made little of the normal visual occupations of the cinema or television. He did not get on well with his neighbours, who regarded him as "odd", and his workmates played tricks on him and teased him for being unable to read.

At his favourite "locals" he cheered up considerably, and was clearly regarded as a "character". He was able to recognise his friends at a distance of at least fifteen feet, from one bar to another, and he would now cross roads with some confidence. He certainly relied a great deal on vision, but we formed the impression that this very reliance cost him his self-respect, for he had been proud of his abilities when the handicap was obvious, but now his previous achievements seemed paltry and his present position almost foolish. He was not a man to talk freely, but was obviously depressed, and we felt that he had lost more than he had gained by recovery of sight.

In view of his depressed state, we felt it best not to undertake formal tests. We did, however, ascertain that he was able to find his way about without the use of his eyes, and that he could detect the presence of houses and doors by the echoes from his footsteps. He was still fascinated by mirrors, and he still noted improvement in his ability to see. In particular, he said that he noted more and more the blemishes in things, and would examine small irregularities and marks in paint work or wood. Quite recently he had been struck by how objects changed their shape when he walked round them. He would look at a lamp post, walk round it, stand studying it from a different aspect, and wonder why it looked different and yet the same.

6. The End of the Case

We find that a common feature of the earlier cases is a psychological crisis following the operation. There are many instances given by von Senden; two examples will serve as illustrations:—

Mesmer (1777)

In her ill-humour she once complained to her father; ‘How comes it that I now find myself less happy than before? Everything that I see causes me a disagreeable emotion. Oh, I was much more at ease in my blindness.’ The father consoled his daughter with the thought that her present agitation was solely due to the sensation of strangeness in the sphere she was now moving in. The new situation she found herself plunged into by the recovery of her sight must necessarily awaken in her an uneasiness never felt before. She would, however, become as calm and contented as others, as soon as she had grown more accustomed to seeing. ‘I am glad to hear it’, she replied, ‘for if I were always to feel such uneasiness as I do at present at the sight of new things, I would sooner return on the spot to my former blindness’.” (von Senden, p. 160—61)

Beer (1783—1813)

“Among the most remarkable psychological phenomena presented to my observation in all the patients so far operated upon, is the rapid and complete loss of that striking and wonderful serenity which is characteristic only of those who have never yet seen; for hardly are the first lively sallies of their curiosity satisfied after the operation, than already they evince this striking transformation of their attitude. Gloomy and reserved, they now shun for a time the society of others, which was so indispensable to them while they were blind that they lamented every moment that they were obliged to spend without it.

Might not the reason for this sudden and striking change of temper, indeed I might say of the whole character, be partly due, perhaps, to the fact that the patients have supposed all objects, which they could only get to know by feeling when blind, to be quite different from what they subsequently see them to be; and might not also even a sort of injured pride contribute something to this transformation, in that they now suddenly find themselves so far behind other people of their age, even in the most trivial matters of knowledge? I fancy that in some at least, I have found traces of such a thing.” (von Senden, p. 161).

Now it seems clear that S.B. had a similar crisis, starting at the time he left hospital, and not ending before his death.

Before the operation he was regarded by everybody as a cheerful rather dominant person, and we independently formed this opinion when we first saw him at the hospital. He seemed changed when he came to London; dispirited and bored. It seemed to all of us that he was deeply disturbed; yet too proud to admit or discuss

We give now two letters written to us by his wife, which give some insight into his mental condition at this time.

10.12.59

Dear Mr. Gregory,

Sorry to have kept you waiting for the enclosed drawings from my husband, but he is not at all well. He has been at home from work for the last six weeks with internal shingles and nerve pains, mostly in his right arm, hand and shoulder, also all underneath his arm and chest it is swollen with pain.

He has treatment continually from his doctor. It is the reaction no doubt, and he is not well enough to join you as you talked about when you were here.

He is very disappointed about everything. But when he feels better he says he will do more drawings for you when he is able. S. says Mr. Hirtenstein is very pleased with the condition of his eyes. And he wishes you a very Happy Christmas and hopes to see you again soon.

Best wishes to Miss J. Wallace and yourself.

H.B.

The second letter we do not give quite in full because she has described part as confidential. (It does not add a great deal to the picture.)

8.6.60

Dear Mr. Gregory,

I was very sorry that Mr. B. was not well enough to be at your lecture [a lecture given at the Christmas meeting of the British Psychological Society in London at which we had hoped he could be present] but he really wasn't fit to undertake the journey. He is not any better. I wish you could help him. His nerves are so bad, I can see his hands trembling, even as he ate porridge this morning, and he could not cut even sausages on his plate. He had a notice from National Health Ins, to see another Doctor, and I have been told it was a Psychiatrist. But instead of seeing him Mr. B. signed off and went back to work. I think hospital rest would do him good. If he collapses again, I shall see what his doctor says, He (Mr. B.) has been at home weeks, ill, having injections from his doctor and Codines and tablets, and has great pain in his right arm.

We shall be pleased to hear from you. I think it would be well not to mention this letter of mine. Mr. B. needs the help, which I think you can give to him, but would not agree to my asking for it. I want to get him well again, as he was a cheerful help to me and lots of people, and he had great faith and patience, which has now gone. It seems to me our world is not grand as we thought and Mr. B. did not know the way people acted—until he got his sight. I still think that the physical and mental ill-treatment, which we have both endured years ago, before we met each other, have contributed a great deal towards his ill health. Some things best forgotten, but some people can be very cruel. (There follows a paragraph about S.B. 's present state which she describes as confidential) . . . but since last Sunday, he has sat listening to the wireless, in the evenings, content with the dog which makes a great fuss of him, S., as he does not get home until 5.30 p.m. from 7.0 a.m. and I can't imagine S. will manage to keep going at that rate.

Yours sincerely,

H.M.B.

On 2nd August, 1960, S.B. died.

His story is in some ways tragic. He suffered one of the greatest handicaps, and yet he lived with energy and enthusiasm. When his handicap was apparently swept away, as by a miracle, he lost his peace and his self-respect.

We may feel disappointment at a private dream come true: S.B. found disappointment with what he took to be reality.

7. Relevance to the Theory of Perception

The fact that we have attempted to make some sort of a study of a case of recovery from early blindness does not give us the right to attempt an authoritative statement as to the importance of such cases for the theory of perception. In thinking about this single case, however, the whole problem has been much in our minds and has inevitably led us to develop some opinions.

In 1949, D. O. Hebb made a great deal of the cases assembled by von Senden in his well-known book on *The Organisation of Behaviour*. Indeed he regarded them as providing powerful evidence for the slow development of perception in infancy. "We are not used", he writes, "to thinking of a single perception as slowly and painfully learned, . . . but it has already been seen, in the discussion of the congenitally blind after operation, that it actually is". (Hebb, *opus. cit.*, pp. 77—8). In the light of our experience with S.B., this inference strikes us as distinctly questionable. Is it really certain that what applies to perception after recovery of vision in the adult applies in essentially the same way to its normal growth in infancy?

First, what are the reasons for the slow recovery of vision in the adult patient? Hebb evidently believes that the situation of such a patient is essentially that of the child, with its normal perceptual development arrested until the eyes are opened. Although he is evidently aware of the "emotional crisis" through which such patients commonly pass, he plainly does not regard reduced motivation as the principal cause of slowness in learning. Indeed he draws special attention to the fact that motivation is not disturbed in the first phase after operation, immediately upon beginning to use the eyes. He suggests, further, that the "crisis of motivation" is due directly to the difficulty in achieving pattern vision, and is thus a direct response to the disheartening slowness with which perceptual skill is acquired.

But is it? In the case of S.B., the patient made extremely rapid progress after operation and very soon found that his vision was useful, as in telling the time. It did in fact change his whole way of life within a few weeks of the first operation and some progress continued for the next two years, until his death. It is true that he did not learn to read, and for this and many other reasons found himself handicapped in the world of sighted people. It is this sense of overall inadequacy, we suggest, rather than deficiency of pattern vision *per Se*, which produced a crisis which lasted until the end.

Further, if emotional crisis is primarily a response to slowness in perceptual learning, why does it not occur in the normal child? It could of course be argued that the process is more difficult for the adult, but throughout Hebb argues that the position in the child is basically similar to that of the adult whose vision is restored after operation. Is this a tenable assumption? The adult, after all, has developed a "touch world" which has served him well for many years, and which has become accepted as the principal vehicle of his occupational and social adaptation. The child, on the other hand, is concerned to develop a "visual world" *ab initio*, and although tactile and motor activities contribute in an important way to its evolution, it is difficult to think of the two cases as in any real sense similar.

We find similar difficulties where Hebb tries to show that the perception of form is largely built upon patterns of eye movements. (Hebb, *opus cit.*, pp. 84—91). Hebb takes as evidence here the reported fact that operated patients count the corners of polygons in order to name them, moving their eyes from corner to corner as a man might move his fingers in active touch. Yet can one really infer that the patient is reproducing the normal visual behaviour of the young child? First, there is no clear evidence that, in the acquisition of form perception, children really do scan the contours of objects or figures in the manner suggested by Hebb. And secondly, it would indeed be surprising if people who had lived for years without vision did not, at least at first, tend to "touch" the salient features with their eyes though one must bear in mind that ocular scanning is often severely disturbed by nystagmus. Although further study of the role of eye movements in the growth of form discrimination is evidently needed, it would appear *prima fade* unlikely that cases of the kind described in this study can tell us anything very significant about the normal development of perception in infancy.¹

It is of course true that in nearly (though not quite) all these cases of recovery of vision after long-standing blindness the development of perceptual skill is very slow, even when considerable sight was present before operation. But this, we suggest, is due not to the fact that visual learning, whether in the

¹ The same objections apply, *mutatis, nutandis*, to arguments from studies such as those of A. H. Riesen (see, e.g. his chapter in "Plasticity of Behaviour" in *Biological and Biochemical Bases of Behaviour*, edited by H. F. Harlow and C. N. Woolsey, Wisconsin, 1958) on bringing up animals in darkness and then studying their behaviour as adults after exposure to light. Studies of this kind are of course important in so far as they throw light on arrested development and its *sequelae* but it is doubtful whether inferences regarding normal development can properly be based upon them.

child or the adult, is *inevitably* slow but to lack of practice in making appropriate use of the available input. It would seem that the difficulty, is not so much in learning *per se* as in *changing perceptual habits and strategies from touching to seeing*. A not dissimilar phenomenon occurs in many cases with gradual loss of a sense or a limb; the patient will, at a certain stage, do better to abandon using the sense or limb altogether; to change his way of life to avoid and ignore it even if it is partly functional. In the event of some recovery of function, great difficulty may be experienced by the patient (and by those concerned with his rehabilitation) in inducing him to revert to the use of the impaired sense or limb. Indeed this may be one of the principal obstacles in the re-education of patients with any type of higher neurological disability.¹

Another point of some interest in the present case is the relatively good intelligence and education of our patient, in which he resembles the patient reported by Latta (1904). Our patient, like Latta's, was much concerned while blind in trying to *visualise* the world and to know it as other men know it. One might even say that their attempt to see was made long before their eyes were opened to the light, and in this respect they differ not only from most other cases in the literature but also of course from infants.

The finding that S.B.'s visual space was not disturbed by the geometrical—optical illusions, and that apparent depth was not evoked by perspective drawings, show that his spatial organisation was far from normal. Since investigating the case, we have devoted considerable thought to the origin of these illusions and have arrived at the tentative view that they depend upon inappropriate scaling by the mechanism which produces size-constancy. If this should prove correct, it may be surmised that the figures failed to evoke constancy size-scaling in our patient, either through lack of early learning or maturational defect. It would seem of some importance, therefore, to devote attention to the study of these illusions in children with special reference to the development of size constancy.

Perhaps the most important outcome of our study is the evidence it provides for *transfer from early touch experience to vision many years later*. The fact that our patient was able, certainly with a minimum of training—and perhaps with none at all—to recognise by vision upper case letters which he had learned by touch, and that he was *unable* to recognise by vision lower case letters which he had *not* learned by touch, provides strong evidence for cross-modal transfer. It will be borne in mind, too, that it took him many months to learn to recognise by vision letters which he had *not* previously learned by touch. One may point out that the “control” provided by the lower-case letters is vital to the argument, since we can never wholly rule out the possibility of some residual vision (undoubtedly present in this case). The fact that S.B. could recognise the figures in the Ishihara Plates (by far the most surprising observation we made) gives evidence of transfer and, incidentally, renders it most unlikely that the *modus operandi* of transfer lies in identity of motor patterns (i.e. patterns of eye-movement corresponding with patterns of active touch). As has been said, gross observation of eye-movements, which consisted in large and apparently uncontrolled jerks resembling exaggerated saccades, made it impossible to believe that the patient could follow outlines of relatively small figures, such as the Ishihara digits, by controlled movements of the eyes.

We may conclude that this case does provide evidence of transfer of perceptual information from the tactual sphere to the visual modality.² This seems somewhat at variance with the evidence from studies of cross-modal transfer in animals³ and we can only speculate as to the reasons for the discrepancy. It may be that language is the decisive factor.

In our view, these cases tell us nothing about the classical philosophical problems of the nature of perceived space (as von Senden fondly hoped that they would) and they tell us little or nothing about the importance of early visual learning for perception in the adult. We cannot sustain the view of Hebb that these cases provide windows through which we may see the perceptual system of the infant—they are not living fossils in which the past is re-enacted. We studied an adult with a unique past; what we found was the effect of this past on a normal brain. We did not find the brain or the perceptual system of an infant and we learned little or nothing about the normal development of vision. At the same time, we believe

¹ See, e.g. K. Goldstein: Restitution in Injuries to the Brain Cortex. *Archives of Neurology and Psychiatry* (Chicago), Vol. 27, 1932, pp. 736—44.

² Professor D. O. Hebb has suggested to us that the surprising degree of cross-modal transfer which we ascertained in this case may have been due to the amount of vision available to the patient in early infancy. (Hebb, personal communication, 1961). [This could hardly apply to writing or telling the time.]

³ G. Ettlinger. Cross-modal transfer of training in monkeys. *Behaviour*, 1960 **16**, 56—65. D. Burton and G. Ettlinger, Cross-modal transfer of training in monkeys, *Nature*, 1960, **186**, 1071—2.

that our case has demonstrated the impact of visual experience on a man to all intents and purposes long blind, and the gains and losses which this revelation brought in its wake. We have ascertained that vision, although it may prove genuinely useful to the man long blind, is at the same time a potential source of grievous hurt. We have further ascertained that, in such a case, direct transfer of information from patterns of touch to equivalent visual patterns is almost certainly possible.

Appendix

Correspondence on the Case

A correspondence took place between Mr. Hirtenstein, Dr. von Senden (who is still interested in the problem though he has not been active in the field for many years)¹, and ourselves. Since quite a number of points arise in the correspondence we include it here, publishing the letters in full except for small passages of a conventional nature, which would not be of general interest.

First we have a letter from Dr. von Senden to Mr. Hirtenstein, dated 14th May, 1959. This letter has several points of interest. It gives Dr. von Senden's reaction to the newspaper accounts of the case. Since Dr. von Senden quotes the relevant passages we do not give them separately here.

14th May, 1959

Dear Dr. Hirtenstein,

I still have to thank you for your kind lines of the 3rd February. Some days before Miss Schweppe had already sent to me a copy of your letter to her of the 16th January which was especially important, since you had written to her: "He had no difficulty in recognising shapes, faces and objects with which he was tactually familiar whilst blind. This he explains by saying that he had a very accurate mental picture of things he could feel."

If he used the word "picture" it is the question whether he used it like other blinds do without an idea what this word means to the seeing person, or with an at least partially influenced by visual experiences, conception of space and shape.

With regard to the hand movements which he could perceive prior to operation on the last operated eye, he will have perceived them only as a change of more or less light, without a change of "direction". But if you write that he had an accurate light projection on the first operated eye then he must have had to my opinion also a certain idea of a visual "direction", that a light can change this direction independent of his own behaviour. And if you have moved the light beyond the reach of his arm he could get conscious of the fact that visual objects cause sensations to the visual organ without touching it, that they are remote in a "space", this otherwise being unconceivable for the blind. He *can* have possessed even a certain ability to discern some colour shades, e.g. the difference of the normal eye-lid grey of a closed eye from some more yellow or brown or even red shades.

In this regard I would like to know (a) whether your patient had a nystagmus ante operation, (b) how he had pointed out before operation the different positions of the light, by following it with the whole head or by showing at it with his arm?

When the journalist of the *Daily Express* interviewed him Mr. B. told him with regard to his wife: "She was just as bonny as I thought she would be. My wife had given me a word picture of what the world was like and I found out that buses I travelled on and cars looked just as I imagined. Lorries seemed very strange." Here the word "picture" seems to have no optical component. Therefore I presume that the "mental picture" as well as the "word picture" means what I have called in my book the tactual schema. Mr. B. had no doubt compared before operation, e.g. his own rather tall figure with that of his wife by feeling. The result of this feeling act could be with regard to his wife "long and thin" or "short and roundish". I find it not so astonishing that the first visual impression which he got of his wife confirmed in his mind anyhow this gross tactual schema; especially if he has had at this moment already a certain experience in the interpretation of visual impressions, if his wife has not been among the very first "objects" presented to his new sense.

In the meantime, Mr. Merrick Winn of the *Daily Express* has published a series of articles after having spent 10 days with Mr. B., together with Mr. R. L. Gregory and Miss Jean Wallace of the University of Cambridge, two months after his first act of seeing. I have no idea how Mr. Winn has attained his very dissolving pictures which shall adequately show how your patient could really see at this period, according to the physiological status of his eyes. But if he could get indeed no sharper images from the visual things I find therein a confirmation of my standpoint that he *could* get at the first aspect of his wife no more than confirmation of his tactual schema "long and thin" or "short and round".

In virtue of my examination of 66 cases of operated blind-born patients described in the literature I had come to the conclusion that a blindborn—by means of his tactual sensations—can neither get an idea of the deep space nor a conception of the shape of things, which one can reasonably design as such; and that he will

¹ At Dr. von Senden's request, a few minor alterations in phraseology have been made to improve his already excellent English (Editor).

get post-operation this spatial idea immediately but the comprehension of shape only after a more or less long lasting learn process. On reading the publications about your case one has the impression as if space *and* shape were (so to say) presented to him without his doing in his first act of vision, in spite of his very distracted vision. If this would be true one could only wonder why Mr. B. should show such an antipathy against any practical use of his new sense; if it comes not from an anxiety for eventual consequences for his economical life (e.g. loss of a pension).

Very significant in the report of Mr. Winn was the matter with a fork: "I'd pick up a fork, feel it and remembering how a fork felt when I was blind I could say: 'This is a fork'. Then I had to learn to remember it the next time I saw it". Without feeling the corresponding visual object before he cannot say what it is. I dare suppose that it was a similar proceeding in your tests with him: a visual aspect, a feeling act for control, say what it is and then impress the visual image upon his mind ("learn to remember it the next time".) You seem to have wondered how quickly this proceeding had a good success with Mr. B. But according to the report of Mr. Winn he must have had still infinite difficulties in this later period of his learning to see.

Mr Winn describes your patient as a cheerful, very good-natured and courteous man—which is confirmed by the picture of Mr. B. in the *Daily Express*—who likes to do any favour to his fellow-creatures if he can. Since you—and probably some other surgeons—had made all imaginable efforts with him and had to surmount so many obstacles for about 3 years he felt a deep gratitude for you and had the best will not to undeceive you. Therefore he showed during your tests full interest and full energy to support your efforts by his own efforts "to learn to remember as soon as possible the visual images, and tried to declare to you his success in his regard by his 'mental pictures'." When Mr. Winn spared no pains with him and was rather disappointed at the end Mr. B. was in the same crisis which is reported in nearly all cases and which can be surmounted only by full moral energy of the patient.

After all I have not the impression that it has been really of visual cognising of a former tactually gained "mental picture" or "word picture", but a confirmation of a tactual schema after feeling control of the respective visual object.

The first visual object he caught sight of was your face of which he could not have a "mental picture". In this regard he has told Mr. Winn "I saw a dark shape with a bump sticking out and heard a voice, so I felt my nose and guessed the bump was a nose. Then I knew if this was a nose I was seeing a face". I find this description very exact and conclusive. Above all it has been his consciousness of the situation which led him, which generally is highly developed in all blind persons. He knew your voice already before operation i when he heard it post-operational close to him the situation was quite clear for him. If you use perhaps a well-scented hairwater this would have been a further confirmation for him. The first visual impression which excited his reflection (probably as being the nearest and the lightest object) was the "bump" in the middle of a darker surface which he called "shape" as he knew this word pre-operatively from a seeing person. He knew that a nose is "in the middle of a face", asked himself whether this bump could be a nose, controlled his doubt by feeling his own nose. But even then he felt not quite sure but "guessed" that it was indeed a nose, and concluded that the whole surface (if his guessing was right) must be your face. Thus the seeing of the "bump" was not a recognising of a "mental picture" "nose" but partially a knowledge of the situation, partially a real seeing act, partially a controlling tactual proceeding and for the rest a mental conclusion.

Now Miss Schweppe and the publisher of the English translation mean that there is an essential contrast between the declaration of your patient with regard to the "mental picture" and the conclusion in my book that a man born blind cannot get any kind of a shape-conception. Therefore she has suggested to me that I should (1) ask Mr. B. himself by letter, (2) declare in the Preface of the English edition of my book for which reason the result of your investigations is such a contrast to my own conclusions.

(Ad 1) I cannot imagine that Mr. B. would be delighted to receive a letter from an unknown foreigner or could be encouraged thereby in his efforts to improve his vision. I am afraid indeed to increase by my questions his feeling of embarrassment and misery. And if he would be inclined to reply then I must doubt whether his declarations will have a greater value, since he scarcely can understand the special point of my questions. In this respect it would be a more promising way if you—having his full confidence—would try to elucidate this contrast, if you believe that this would be possible, and if you have the time for it.

(Ad 2) I have only tried to evaluate in my book the reports of those who have executed such an operation on a man born blind without having myself an occasion to occupy myself with such a blindborn, neither before nor after an operation. Therefore I feel myself not competent enough to express an opinion with regard to your case of which I know too little, and would do it only if you mean that it would be favourable to mention your case in the Preface.

Nevertheless you will understand that it is my personal interest to clear up this seeming contrast resp. to hear your opinion about it. This is the principal purpose of my letter. Therefore I beg your pardon if I have still some more questions:

(1) How long have you occupied yourself with Mr. B. before the first operation? Have you had an opportunity to examine whether he has had more than a mere knowledge about space and shape, as communicated to the blind by seeing persons?

(2) What has happened in the 3 weeks between the first and the second operation with regard to the training of his seeing? It is mentioned somewhere that your patient has visited other patients within the hospital and has walked about in the hospital garden in this period. Has he made his experiences under control or without it?

(3) In your letter to me you write that the psychological aspect following the operation (the second op.?) was investigated by Mr. R. L. Gregory of Cambridge University. In this respect I would like to know how long after the operation Mr. Gregory has seen your patient the first time. Had you given him information before the operation or was he induced only by the first notice in the *Daily Telegraph*? Was it possible in your opinion to reconstruct at that moment truly the whole development of his learning to see? I have the impression that Mr. Gregory cannot say out much more than Mr. Winn in his press articles.

I am regretting, dear Mr. Hirtenstein that this letter has become so long and that I waste your time immoderately. But I would be very obliged to you for a reply which can be so much shorter. If you want to read the conclusions of my book in English please ask Miss Schweppe to send them to you. For I believe that the contrast is only in the words but not in the real state of your case, as I have tried to explain above.

With kindest regards,

Yours sincerely,

Signed M. von Senden.

Secondly, we have Mr. Hirtenstein's reply to the letter quoted above, dated 24th November, 1959. This letter gives several details concerning both the eyes and also S.B.'s visual ability as observed by Mr. Hirtenstein.

24th Nov., 1959

Dear Dr. von Senden,

I apologise for not having written to you sooner, but your letter dated 14th May never reached me, and I have just received a copy of it from Miss Schweppe.¹

As to your questions:—

(1) S.B. had no nystagmus before or after the operation.

(2) The light projection before the operation was tested by a pencil-light, and the patient indicated with his hand from which direction the source of light came. This was quite accurate in his case, with both eyes. Moreover, trans-scleral retinal stimulation produced a clear pattern of retinal vessels subjectively, and this was the main reason that I decided to operate on him.

(3) S.B. was referred to me by a fellow-ophthalmologist, and I knew the patient for a few weeks prior to his first operation. I had no means of testing him about space and shape of objects before the operation.

(4) As soon as the operated eye was uncovered after the first operation, the patient's ability to assimilate new visual sensations was truly remarkable. He was able to learn colours quickly and recognise simple objects with which he was familiar through tactile sensation, (chairs, tables, doors, etc.). He walked through the Hospital corridors without difficulty, and avoided objects and subjects in his path. It is interesting that his visual re-education still continues; every time I see him in my Out-patient Department he seems to be more

¹ Miss Sylvia Schweppe, of the British Museum, was instrumental in arranging for Dr. von Senden's book to be translated into English and published. The story of how she managed to find a micro-film copy of the German—the publisher's copies were destroyed by Allied bombing—and how she overcame other difficulties is quite remarkable.

confident in his walking and ability to “get around” generally. He now travels a considerable distance by train and bus to visit me at the Hospital from his home.

(5) Mr. Gregory saw the patient only after the second operation; he learnt about the case from the daily newspapers, and I invited him to examine S.B. whilst still in the hospital. He spent a considerable time with the patient, and he is just about to publish his findings. I think it would be perhaps worthwhile for you to get in touch with him, as he would, I’m sure, give you all the information you require about this case.

Yours sincerely,

Signed: A. Hirstenstein.

Thirdly, we give extracts from a letter written by one of us to Dr. von Senden. We include it here because it gives an account of our general impression of S.B. at that time (November, 1959) before later events had a chance to change and perhaps dull our impressions. (This letter was written before we had read Dr. von Senden’s book, though we knew of his work and had read accounts of it.)

Psychological Laboratory,
Downing Place,
Cambridge.
30th November, 1959.

Dear Professor von Senden,

We found that S.B. has a strong personality, and is not suggestible.

He had difficulty in naming some colours, in particular yellow, but could name most objects and judge distances accurately. He made very little from pictures, or large clear colour photographs projected on a screen.

We gave him a large number of perceptual tests, including reversible figures (the Necker cube for example) and we also gave him the Ishihara colour test. This produced a most interesting result, for he was able to read correctly every one of the numbers represented by the coloured dots seen by normal observers. What struck us was not so much that his colour discrimination was normal on this test, as that he was able to recognise block letters and figures tactually, and it is quite clear that this knowledge had transferred to sight without special learning being required. This was the most definite and the most striking finding of our examination.

He did not seem to get any depth from perspective drawings, or to get reversals of Necker cubes, although his visual acuity was probably adequate. (It is worth pointing out that one can get reversals of Necker cubes when the retinal image is degenerated, by viewing through highly astigmatic lenses).

The patient showed no nystagmus at any time I examined him. His eye movements were far from normal, however, for his “searching” or “scanning” movements were infrequent. He did not look round to the source of a noise anything like as often as normal, and he did not look at people’s faces. He could however recognise people by the way they moved and from their clothes, or so he informed me.

As for the “psychological” reason why he became upset after the operation, my own opinion is that while blind he had managed exceptionally well. He went for bicycle rides with companions; he tended his garden and was something of a craftsman. Once he regained his sight, he felt, I think, up against the competition of sighted people. Further, he had throughout his life been treated with special consideration by his family and friends. After the operation this became modified. To his workmates he became something extraordinary and they would play small jokes on him. He must feel that by being blind for more than 50 years he has lost a great deal, not only sensory experience, but perhaps more important the chance of holding an interesting and well paid job. One must remember that he is an intelligent man with a strong personality. He would undoubtedly have risen above the social position into which he was born if he had not been handicapped, and he must realise this. I should add that this last point was not made explicitly by him; I give it as a reasonable inference from the evidence which is available to me.

With regard to his first “perception” of the surgeon: he told me that the newspaper account was wrong. His account is that he heard Mr. Hirstenstein’s face and looking toward him (by Sound) “saw” a confusion of colours, and knew that this must be Mr. Hirstenstein’s face. (He may, of course, have been wearing a mask). He was able, within hours, to name many objects correctly, and would get up early in the morning to watch cars passing on the street below.

He tended to misjudge the size of objects he had not been able to touch or walk along. For example, a bus looked too high but the right length.

Yours sincerely,

Signed: R. L. Gregory.

Before replying to this letter, Dr. von Senden wrote to the Editor responsible for the English translation of his book "Space and Sight" commenting on a report of our case appearing in the *Daily Express*.

Hamburg, 12th December, 1959

According to the first short report of the *Daily Express* of the 7th January, 1959, Mr. B. had told his interviewer that his wife "was just as bonny as I thought she would be. My wife had given me a word picture of what the world was like and I found out that buses I travelled on and cars looked just as I imagined" . . . "When the doctor removed the pad I could see his black hair and his face."

People who read those lines were glad that learning to see apparently was a rather simple affair. But those who knew my book were surprised, having the impression that these assertions of Mr. B. were contradictory to the conclusions which I had drawn from my studying all comparable cases reported in the literature.

The question is how the words of Mr. B. must be interpreted, whether the circumstances he tried to express with these words corresponded with the signification which seeing people adjudge to them. A person born blind learns all words of his language from seeing persons but cannot know which sensual or mental content they have for a seeing person. He uses all these words indeed, but as a seeing person cannot explain to a blind one much about things, a blind person cannot explain exactly (by means of the words of the seeing world) to a seeing person what occurs to him in his daily life. The same words have a different sense for these two categories of human creatures.

As Mr. Hirtenstein—who has executed the two operations on him—wrote to me he has "had no means of testing him about space and shape of objects before the operation". According to him the patient had a very poor vision but could indicate before the operation accurately the direction of a little pencil light with his hand! This fact indicates that Mr. B. has had already before operation a certain idea of a visual "direction"; he had been aware that a light can change this direction independent of his own behaviour, how it is when a light "moves". Thus he must (or at least could) have become conscious pre-operatively of the fact that visual objects cause sensations to the visual organ without any participation of the sense of touch, and could conclude that they are remote in a deep "space". Therefore we may say that "space" was nothing fundamentally new to him before operation. As I have shown in my book every operated blindborn has the space immediately post-operatively without any education for this purpose, but B. has had it already earlier.

When Mr. Gregory—as he wrote to me the other day—asked him later how it really has been when he used his new sight for the first time after the operation he has answered that the newspaper account was wrong! His own account is that he "heard Mr. Hirtenstein's voice, and looking toward him (by sound) 'saw' a confusion of colours, and knew that this must be Mr. Hirtenstein's face" (who may, of course, have been wearing a mask in this moment). This description is quite analogous to all other descriptions in the literature, as mentioned in my book.

This report of Mr. Gregory is very interesting indeed also in many other points. But as he intends to publish something about this case I don't want to anticipate him. But as he has accompanied Mr. Winn and Mr. B. for several days during their stay in London I like to allude to the remark in the very fine report in the *Daily Express* (two months after the operation) where Mr. Winn says: "S.B. was still basically a blind man. He could see but did not care. All this time he had been 'seeing' largely not to let us down"; and on another spot: "He never knew my face properly in all these 10 days we were together but he knew me instantly by my voice, clothes, walk, even breathing". Therefore I agree with Mr. Hirtenstein and do not wonder if he writes that B. "was able to learn colours quickly and recognise simple objects with which he was familiar through tactile sensation (chairs, tables, doors, etc.)". But I am sure that in these acts of "recognising" sight was participating only a very little. A hospital room contains only a small number of furniture objects. An intelligent blind man like Mr. B. has no difficulty in building up for his own use the tactual schema of the room within the first 24 hours. He can exactly indicate then where the different objects are, which name they have, etc. And if "he walked through the Hospital corridors without difficulty and avoided objects and subjects in his path" there is nothing extraordinary in this, especially if we remember that during the 3½ weeks between the two operations he could attain any kind of visual experiences without a scientific control, that he walked alone in the garden and had passed the Christmas days in his own home.

With regard to his assertion that his wife was "as bonny as I thought she would be" I may remark that this word "bonny" to my opinion has no component of space or shape. It merely signifies that the aspect as well as the tactile feeling causes agreeable sensations. B. himself declared to Mr. Winn: "I always felt in my own way that women were lovely, but now I can see them I think they're ugly". Also for this "lovely feeling" we have parallels in some other cases.

Concerning the bus I can imagine that he has had indeed a certain conception of it preoperatively. When he awaited (very very often in his long life) on the halting-place of his bus he could *hear* the typical rolling noise of the arriving vehicle and that this noise ceased together with the stopping of the bus; he could *see* that the diffused brightness surrounding his eyes before the arrival of the bus was darkened when it is quite near to him and that the brightness eventually reappeared when the bus had passed his place; and he could *number* how long the light was darkened by the outrolling bus. Having got these three different dates and correlating them to each other he could have got to a certain degree the idea what it means what seeing people call the “movement” of a vehicle, what seeing people call the “length” of an object, and that one can measure “breadth” and “height” on a similar way. Thus he could imagine already pre-operatively a “mental picture” of a bus. But it is quite clear that in the forming of this or other “mental pictures” the visual sense has participated a great deal.

Therefore I am sure that this case is not fundamentally different from the other known cases, and that this case does not alter the conclusions in my book.

Signed: M. von Senden.

The relevant parts of Dr. von Senden’s reply were as follows :—

Hamburg-Othmarschen,
Schwindstr, 13.
14th December, 1959

Dear Mr. Gregory,

What has equally struck me as yourself is your test with the block letters and numbers. Had anybody punched out them for his personal use in wood or some other material? Block letters and numbers have indeed a very pregnant form and are easily distinguishable from each other. Also in this regard it would be very interesting to ask him anew how he has proceeded to transfer from touch to vision. Have you observed perhaps that he has made some movements with his finger-tips as if he followed out mentally (perhaps with closed eyes) the outlines of the block letters which he saw and recognised their name by controlling the well known tactual sequence of the resp. letter?

Very interesting also are his drawings. What order had he got when he made these drawings? Was he to draw for instance a table out of memory as a proof for the “word picture” which he had affirmed to possess from touch? Or was he drawing an object he could see in this moment?¹

In any case I may assure you that I shall be very pleased to read some day your publication about this case, don’t forget it please!

With kindest regards,
Yours sincerely,
Signed: M. von Senden

We have presented all the evidence available at this time, and it is now unlikely that more will ever be learned. We hope that the material has been presented in a form which makes it possible for the reader to form his own opinions as to what, if anything, this and other cases can contribute to our understanding of human perception and its development.

We feel privileged to have had the opportunity of studying this case, and feel grateful to all those—including poor S.B.—who made it possible.

¹ As described above his drawings were from memory, and some were of objects he had never seen, especially the chipping hammer.

The "Visual Cliff"

This simple apparatus is used to investigate depth perception in different animals. All species thus far tested seem able to perceive and avoid a sharp drop as soon as they can move about

by Eleanor J. Gibson and Richard D. Walk

Human infants at the creeping and toddling stage are notoriously prone to falls from more or less high places. They must be kept from going over the brink by side panels on their cribs, gates on stairways and the vigilance of adults. As their muscular coordination matures they begin to avoid such accidents on their own. Common sense might suggest that the child learns to recognize falling-off places by experience—that is, by falling and hurting himself. But is experience really the teacher? Or is the ability to perceive and avoid a brink part of the child's original endowment?

Answers to these questions will throw light on the genesis of space perception in general. Height perception is a special case of distance perception: information in the light reaching the eye provides stimuli that can be utilized for the discrimination both of depth and of receding distance on the level. At what stage of development can an animal respond effectively to these stimuli? Does the onset of such response vary with animals of different species and habitats?

At Cornell University we have been investigating these problems by means of a simple experimental setup that we call a visual cliff. The cliff is a simulated one and hence makes it possible not only to control the optical and other stimuli (auditory and tactual, for instance) but also to protect the experimental subjects. It consists of a board laid across a large sheet of heavy glass which is supported a foot or more above the floor. On one side of the board a sheet of patterned material is placed flush against the undersurface of the glass, giving the glass the appearance as well as the substance of solidity. On the other side a sheet of the same material is laid upon the floor; this side of the board thus becomes the

visual cliff [see photograph on cover].

We tested 36 infants ranging in age from six months to 14 months on the visual cliff. Each child was placed upon the center board, and his mother called him to her from the cliff side and the shallow side successively. All of the 27 infants who moved off the board crawled out on the shallow side at least once; only three of them crept off the brink onto the glass suspended above the pattern on the floor. Many of the infants crawled away from the mother when she called to them from the cliff side; others cried when she stood there, because they could not come to her without crossing an apparent chasm. The experiment thus demonstrated that most human infants can discriminate depth as soon as they can crawl.

The behavior of the children in this situation gave clear evidence of their dependence on vision. Often they would peer down through the glass on the deep side and then back away. Others would pat the glass with their hands, yet despite this tactual assurance of solidity would refuse to cross. It was equally clear that their perception of depth had matured more rapidly than had their locomotor abilities. Many supported themselves on the glass over the deep side as they maneuvered awkwardly on the board; some even backed out onto the glass as they started toward the mother on the shallow side. Were it not for the glass some of the children would have fallen off the board. Evidently infants should not be left close to a brink, no matter how well they may discriminate depth.

This experiment does not prove that the human infant's perception and avoidance of the cliff are innate. Such an interpretation is supported, however, by

the experiments with nonhuman infants. On the visual cliff we have observed the behavior of chicks, turtles, rats, lambs, kids, pigs, kittens and dogs. These animals showed various reactions, each of which proved to be characteristic of their species. In each case the reaction is plainly related to the role of vision in the survival of the species, and the varied patterns of behavior suggest something about the role of vision in evolution.

In the chick, for example, depth perception manifests itself with special rapidity. At an age of less than 24 hours the chick can be tested on the visual cliff. It never makes a "mistake" and always hops off the board on the shallow side. Without doubt this finding is related to the fact that the chick, unlike many other young birds, must scratch for itself a few hours after it is hatched.

Kids and lambs, like chicks, can be tested on the visual cliff as soon as they can stand. The response of these animals is equally predictable. No goat or lamb ever stepped onto the glass of the deep side, even at one day of age. When one of these animals was placed upon the glass on the deep side, it displayed characteristic stereotyped behavior. It would refuse to put its feet down and would back up into a posture of defense, its front legs rigid and its hind legs limp. In this state of immobility it could be pushed forward across the glass until its head and field of vision crossed the edge of the surrounding solid surface, whereupon it would relax and spring forward upon the surface.

At the Cornell Behavior Farm a group of experimenters has carried these experiments with kids and goats a step further. They fixed the patterned material to a sheet of plywood and were thus able to adjust the "depth" of the deep side. With the pattern held immediately be-



CHILD'S DEPTH PERCEPTION is tested on the visual cliff. The apparatus consists of a board laid across a sheet of heavy glass, with a patterned material directly beneath the glass on one side and several feet below it on the other. Placed on the center board

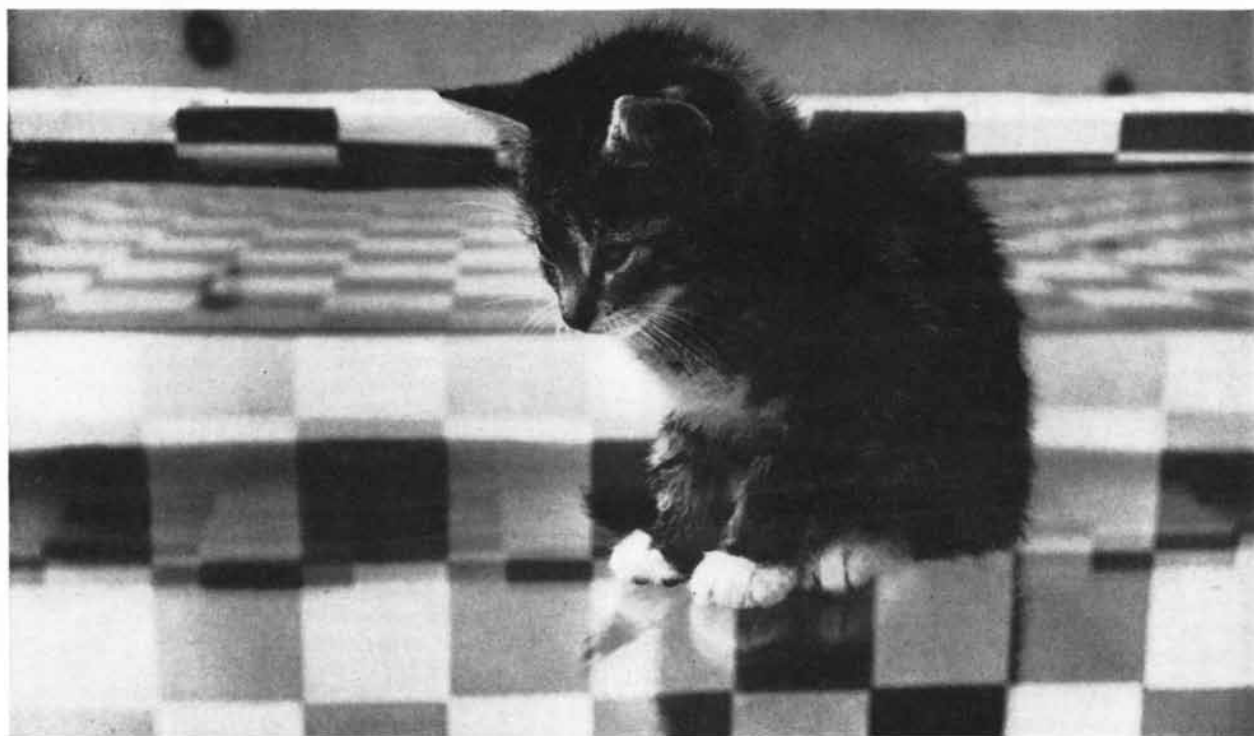
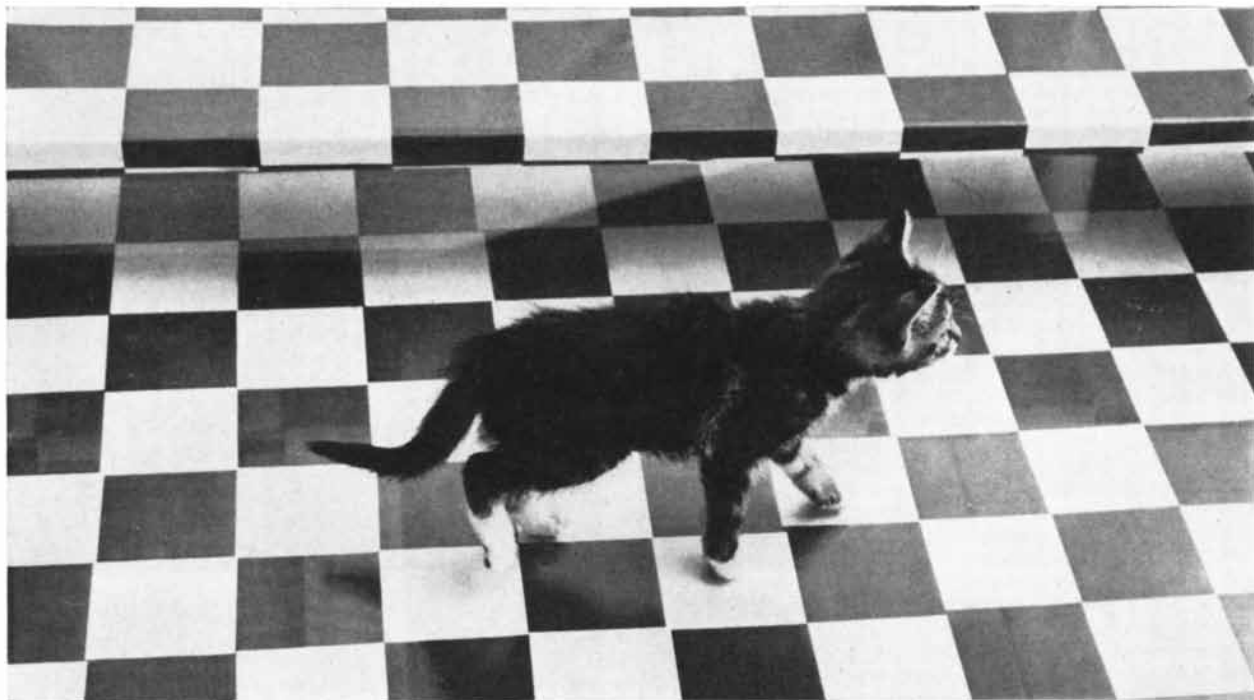
(*top left*), the child crawls to its mother across the "shallow" side (*top right*). Called from the "deep" side, he pats the glass (*bottom left*), but despite this tactual evidence that the "cliff" is in fact a solid surface he refuses to cross over to the mother (*bottom right*).

neath the glass, the animal would move about the glass freely. With the optical floor dropped more than a foot below the glass, the animal would immediately freeze into its defensive posture. Despite repeated experience of the tactual solidity of the glass, the animals never learned

to function without optical support. Their sense of security or danger continued to depend upon the visual cues that give them their perception of depth.

The rat, in contrast, does not depend predominantly upon visual cues. Its nocturnal habits lead it to seek food largely

by smell, when moving about in the dark, it responds to tactual cues from the stiff whiskers (vibrissae) on its snout. Hooded rats tested on the visual cliff show little preference for the shallow side so long as they can feel the glass with their vibrissae. Placed upon the



KITTEN'S DEPTH PERCEPTION also manifests itself at an early age. Though the animal displays no alarm on the shallow side (*top*),

it "freezes" when placed on the glass over the deep side (*bottom*); in some cases it will crawl aimlessly backward in a circle.

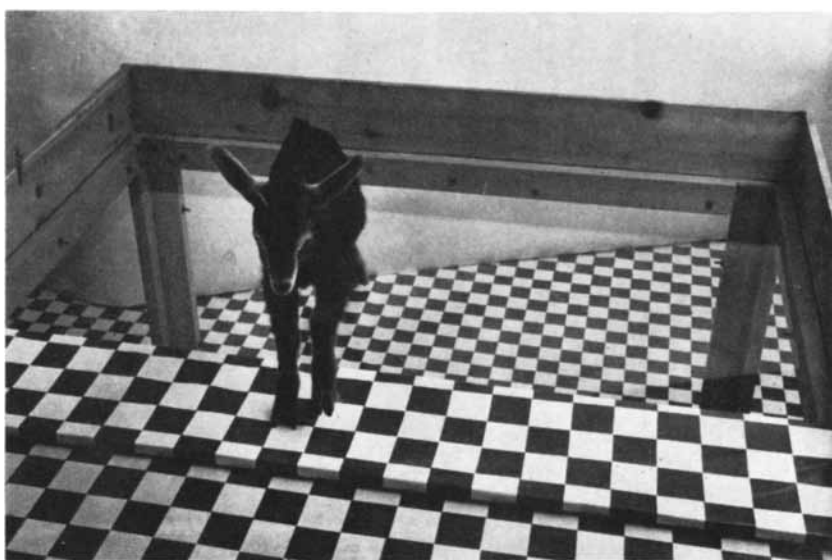
glass over the deep side, they move about normally. But when we raise the center board several inches, so that the glass is out of reach of their whiskers, they evince good visual depth-discrimination: 95 to 100 per cent of them descend on the shallow side.

Cats, like rats, are nocturnal animals, sensitive to tactual cues from their vibrissae. But the cat, as a predator, must rely more strongly on its sight. Kittens proved to have excellent depth-discrimination. At four weeks—about the earliest age that a kitten can move about with any facility—they invariably choose the shallow side of the cliff. On the glass over the deep side, they either freeze or circle aimlessly backward until they reach the center board [see illustrations on opposite page].

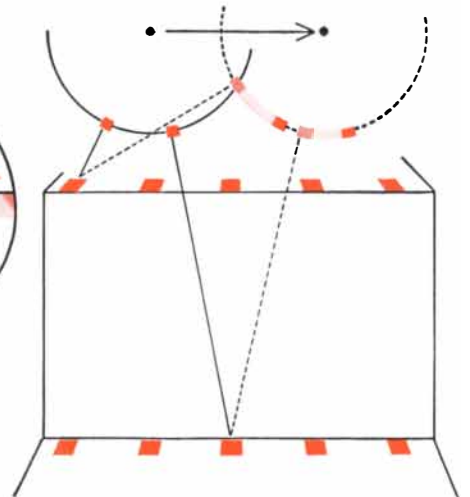
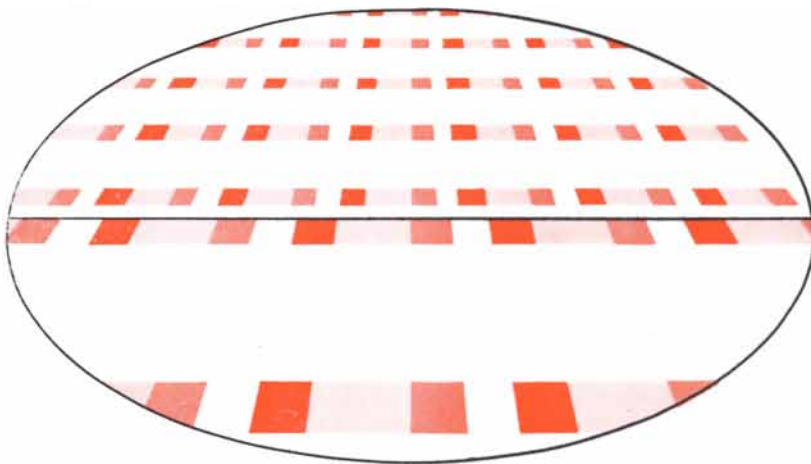
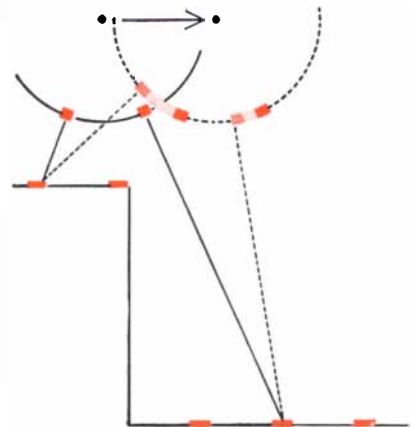
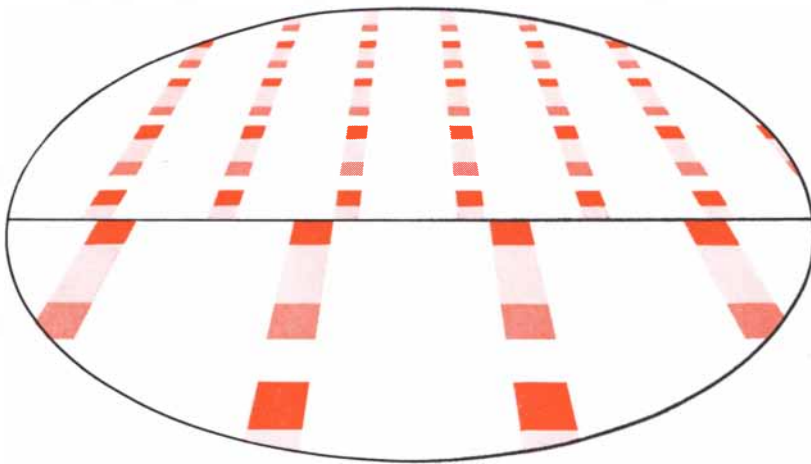
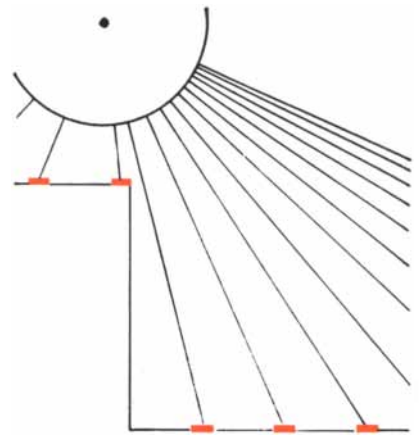
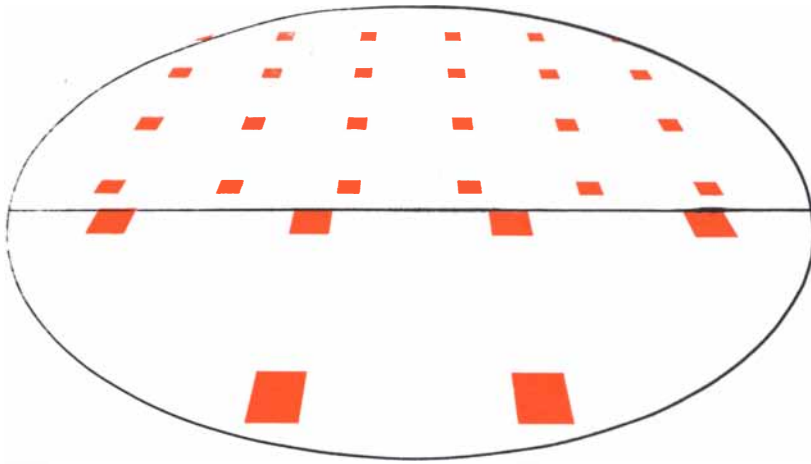
The animals that showed the poorest performance in our series were the turtles. The late Robert M. Yerkes of Harvard University found in 1904 that aquatic turtles have somewhat poorer depth-discrimination than land turtles. On the visual cliff one might expect an aquatic turtle to respond to the reflections from the glass as it might to water and so prefer the deep side. They showed no such preference: 76 per cent of the aquatic turtles crawled off the board on the shallow side. The relatively large minority that choose the deep side suggests either that this turtle has poorer depth-discrimination than other animals, or that its natural habitat gives it less occasion to “fear” a fall.

All of these observations square with what is known about the life history and ecological niche of each of the animals tested. The survival of a species requires that its members develop discrimination of depth by the time they take up independent locomotion, whether at one day (the chick and the goat), three to four weeks (the rat and the cat) or six to 10 months (the human infant). That such a vital capacity does not depend on possibly fatal accidents of learning in the lives of individuals is consistent with evolutionary theory.

To make sure that no hidden bias was concealed in the design of the visual cliff we conducted a number of control experiments. In one of them we eliminated reflections from the glass by lighting the patterned surfaces from below the glass (to accomplish this we dropped the pattern below the glass on both sides, but more on one side than on the other). The animals—hooded rats—still consistently chose the shallow side. As a test of the role of the patterned surface we



GOATS SHOW DEPTH PERCEPTION at an age of only one day. A kid walks freely on the shallow side (top); on the deep side (middle) it leaps the “chasm” to safety (bottom).



TWO TYPES OF VISUAL DEPTH-CUE are diagrammed schematically on this page. Ellipses approximate the visual field of an animal standing near the edge of the cliff and looking toward it; diagrams at right give the geometrical explanation of differences

in the fields. The spacing of the pattern elements (*solid color*) decreases sharply beyond the edge of the cliff (*top*). The optical motion (*shaded color*) of the elements as the animal moves forward (*center*) or sideways (*bottom*) shows a similar drop-off.

replaced it on either side of the centerboard with a homogeneous gray surface. Confronted with this choice, the rats showed no preference for either the shallow or the deep side. We also eliminated the optical difference between the two sides of the board by placing the patterned surface directly against the undersurface of the glass on each side. The rats then descended without preference to either side. When we lowered the pattern 10 inches below the glass on each side, they stayed on the board.

We set out next to determine which of two visual cues plays the decisive role in depth perception. To an eye above the center board the optical pattern on the two sides differs in at least two important respects. On the deep side distance decreases the size and spacing of the pattern elements projected on the retina. "Motion parallax," on the other hand, causes the pattern elements on the shallow side to move more rapidly across the field of vision when the animal moves its position on the board or moves its head, just as nearby objects seen from a moving car appear to pass by more quickly than distant ones [see *illustration on opposite page*]. To eliminate the potential distance cue provided by pattern density we increased the size and spacing of the pattern elements on the deep side in proportion to its distance from the eye [see *top illustration at right*]. With only the cue of motion parallax to guide them, adult rats still preferred the shallow side, though not so strongly as in the standard experiment. Infant rats chose the shallow side nearly 100 per cent of the time under both conditions, as did day-old chicks. Evidently both species can discriminate depth by differential motion alone, with no aid from texture density and probably little help from other cues. The perception of distance by binocular parallax, which doubtless plays an important part in human behavior, would not seem to have a significant role, for example, in the depth perception of chicks and rats.

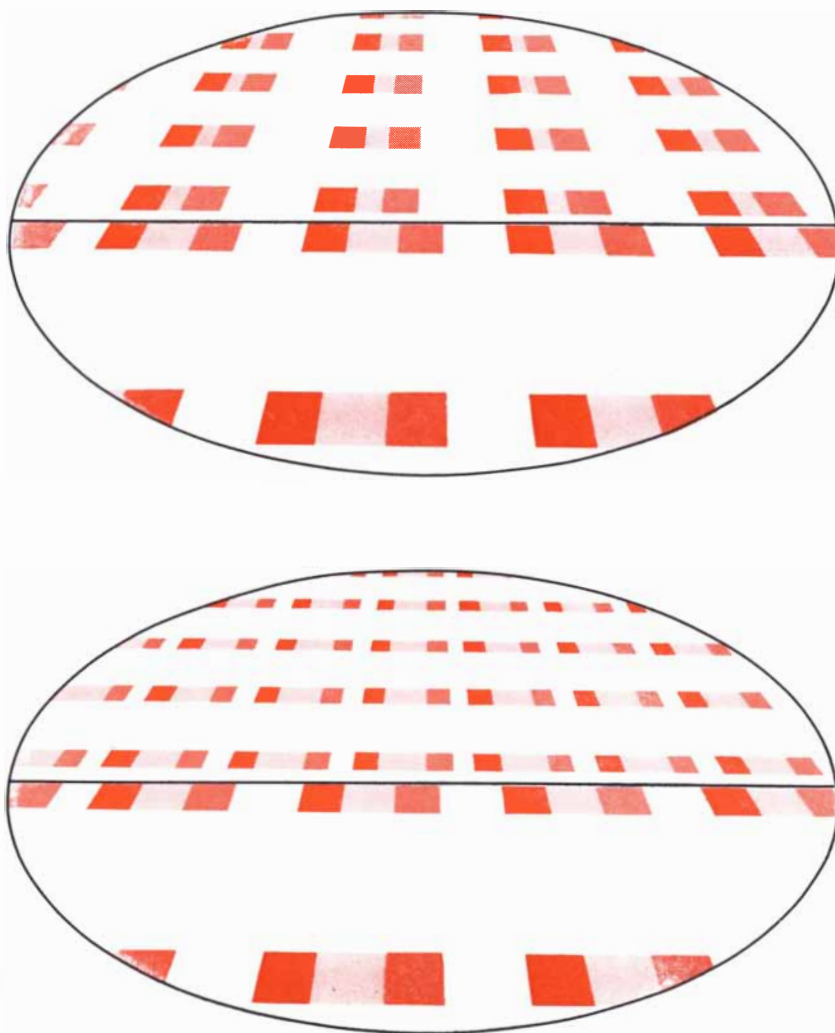
To eliminate the cue of motion parallax we placed the patterned material directly against the glass on either side of the board but used smaller and more densely spaced pattern-elements on the cliff side. Both young and adult hooded rats preferred the side with the larger pattern, which evidently "signified" a nearer surface. Day-old chicks, however, showed no preference for the larger pattern. It may be that learning plays some part in the preference exhibited by the

rats, since the young rats were tested at a somewhat older age than the chicks. This supposition is supported by the results of our experiments with animals reared in the dark.

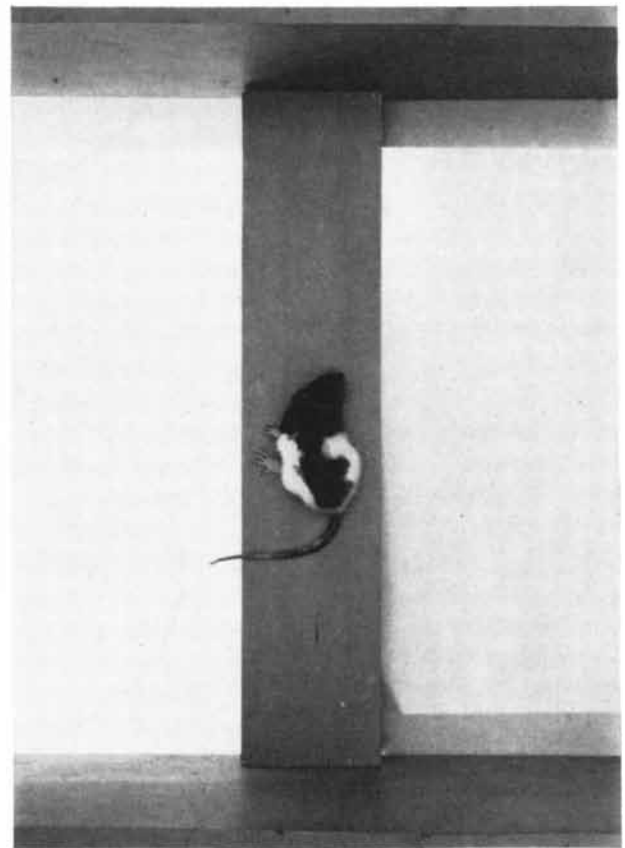
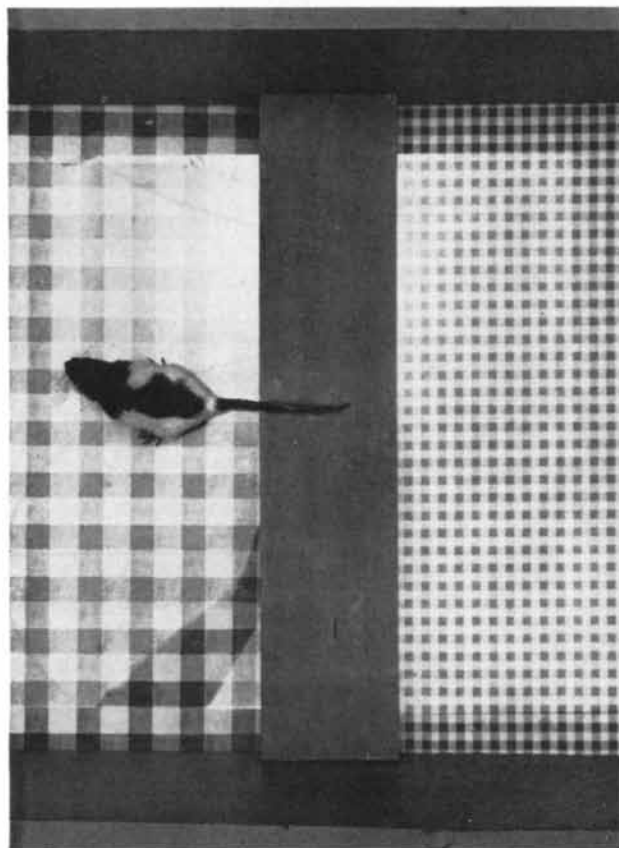
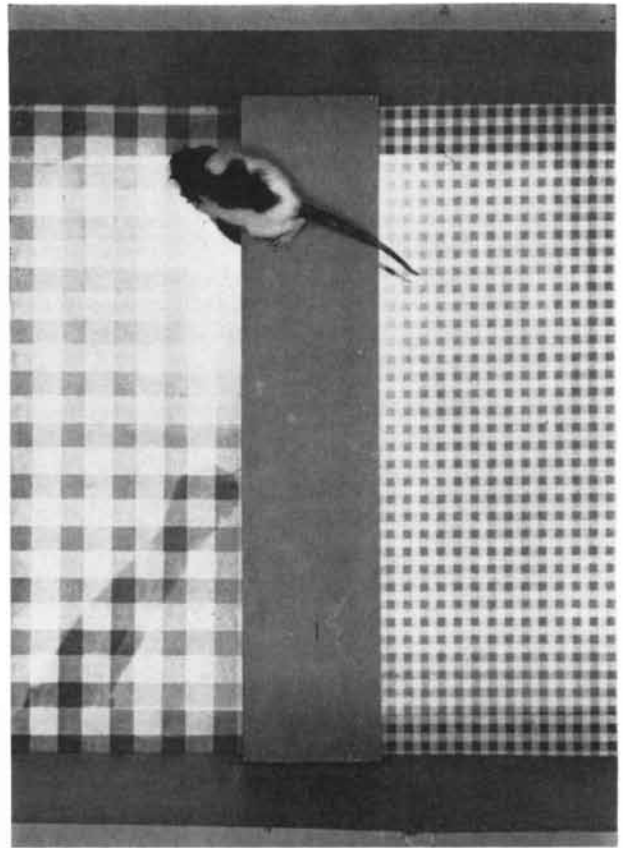
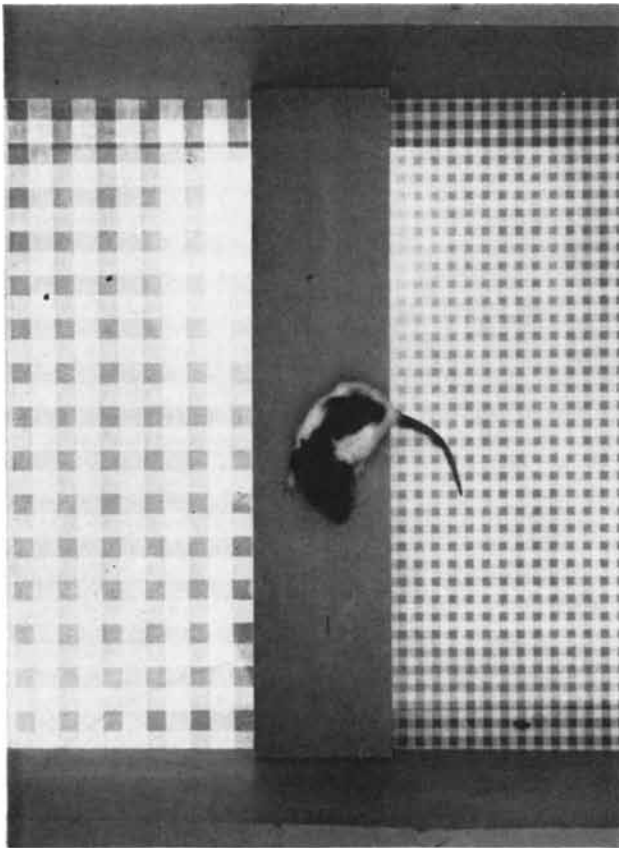
The effects of early experience and of such deprivations as dark-rearing represent important clues to the relative roles of maturation and learning in animal behavior. The first experiments along this line were performed by K. S. Lashley and James T. Russell at the University of Chicago in 1934. They tested light-reared and dark-reared rats on a "jumping stand" from which they induced animals to leap toward a platform placed at varying distances. Upon finding that both groups of animals jumped with a force closely correlated with distance, they concluded that depth perception in rats is innate. Other investi-

gators have pointed out, however, that the dark-reared rats required a certain amount of "pretraining" in the light before they could be made to jump. Since the visual-cliff technique requires no pretraining, we employed it to test groups of light-reared and dark-reared hooded rats. At the age of 90 days both groups showed the same preference for the shallow side of the apparatus, confirming Lashley's and Russell's conclusion.

Recalling our findings in the young rat, we then took up the question of whether the dark-reared rats relied upon motion parallax or upon contrast in texture density to discriminate depth. When the animals were confronted with the visual cliff, cued only by motion parallax, they preferred the shallow side, as had the light-reared animals. When the



SEPARATION OF VISUAL CUES is shown in these diagrams. Pattern density is held constant (*top*) by using a larger pattern on the low side of the cliff; the drop in optical motion (motion parallax) remains. Motion parallax is equalized (*bottom*) by placing patterns at same level; the smaller pattern on one side preserves difference in spacing.



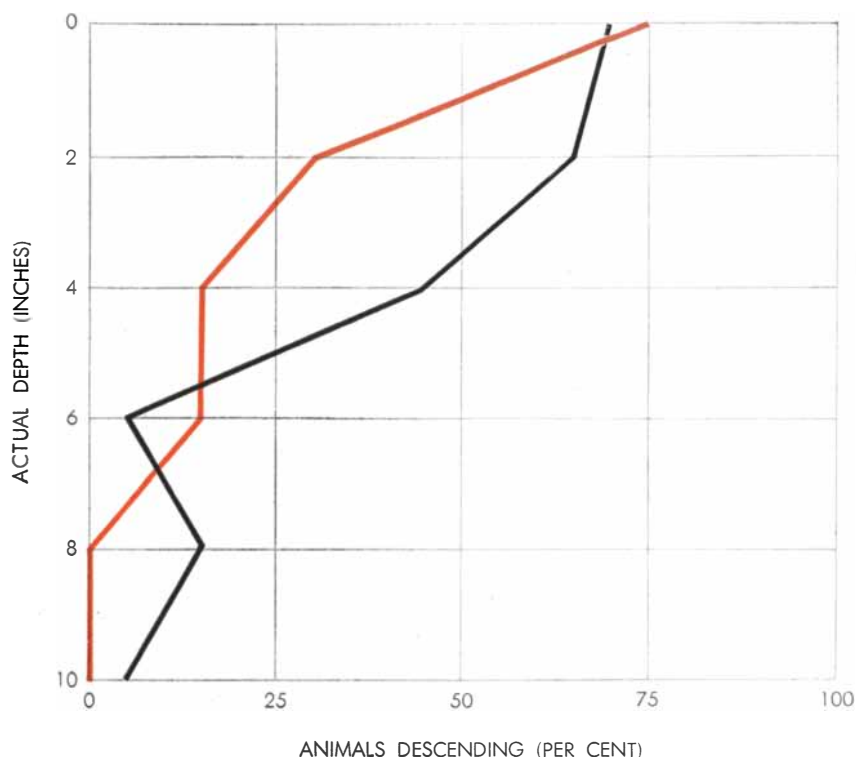
IMPORTANCE OF PATTERN in depth perception is shown in these photographs. Of two patterns set at the same depth, normal rats almost invariably preferred the larger (*top row and bottom*

left), presumably because it "signified" a nearer and therefore safer surface. Confronted with two patternless surfaces set at different depths, the animals displayed no preference (*bottom right*).

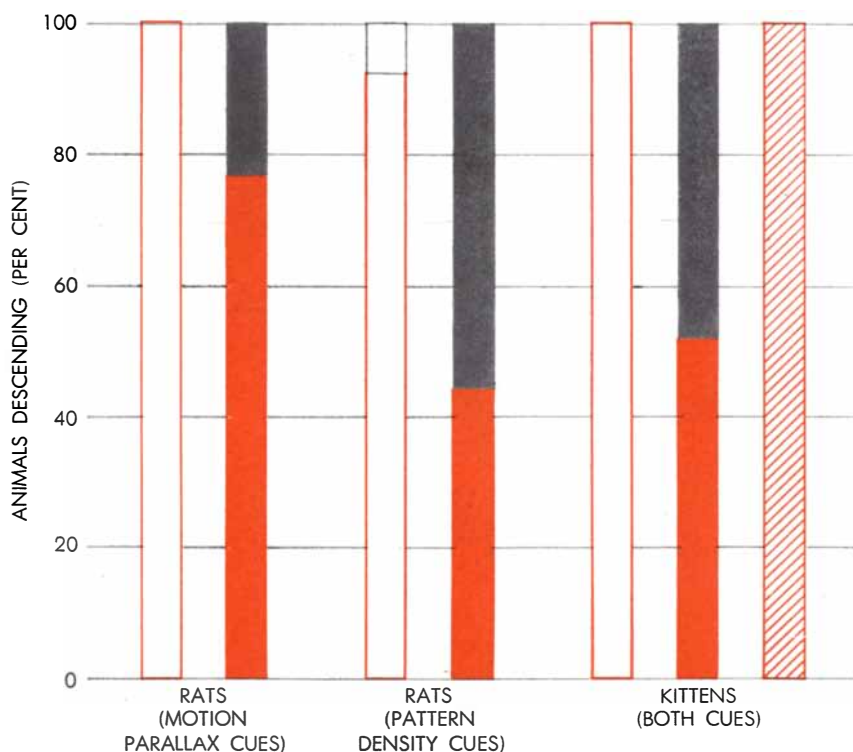
choice was cued by pattern density, however, they departed from the pattern of the normal animals and showed no significant preference [see bottom illustration at right]. The behavior of dark-reared rats thus resembles that of the day-old chicks, which also lack visual experience. It seems likely, therefore, that of the two cues only motion parallax is an innate cue for depth discrimination. Responses to differential pattern-density may be learned later.

One cannot automatically extrapolate these results to other species. But experiments with dark-reared kittens indicate that in these animals, too, depth perception matures independently of trial and error learning. In the kitten, however, light is necessary for normal visual maturation. Kittens reared in the dark to the age of 27 days at first crawled or fell off the center board equally often on the deep and shallow sides. Placed upon the glass over the deep side, they did not back in a circle like normal kittens but showed the same behavior that they had exhibited on the shallow side. Other investigators have observed equivalent behavior in dark-reared kittens; they bump into obstacles, lack normal eye movement and appear to "stare" straight ahead. These difficulties pass after a few days in the light. We accordingly tested the kittens every day. By the end of a week they were performing in every respect like normal kittens. They showed the same unanimous preference for the shallow side. Placed upon the glass over the deep side, they balked and circled backward to a visually secure surface. Repeated descents to the deep side, and placement upon the glass during their "blind" period, had not taught them that the deep side was "safe." Instead they avoided it more and more consistently. The initial blindness of dark-reared kittens makes them ideal subjects for studying the maturation of depth perception. With further study it should be possible to determine which cues they respond to first and what kinds of visual experience accelerate or retard the process of maturation.

From our first few years of work with the visual cliff we are ready to venture the rather broad conclusion that a seeing animal will be able to discriminate depth when its locomotion is adequate, even when locomotion begins at birth. But many experiments remain to be done, especially on the role of different cues and on the effects of different kinds of early visual experience.



CONTROL EXPERIMENT measured the effect on rats of reflections on the glass of the apparatus. The percentage of animals leaving the center board decreased with increasing depth in much the same way, whether glass was present (black curve) or not (colored curve).



DARK-REARING EXPERIMENTS reveal the order in which different depth-cues are utilized as animals mature. Animals reared in the light (open bars) all strongly preferred the shallow side (color) to the deep side (gray). Dark-reared rats (solid bars), utilizing motion parallax alone, still preferred the shallow side; pattern density alone elicited no preference. Dark-reared kittens also showed no preference, because of temporary blindness. After seven days in the light all of them chose the shallow side (hatched bar).