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PICTORIAL SPACE: A COMPARATIVE ACCOUNT OF  
PROJECTIVE VERSUS CONSTRUCTIVIST THEORIES OF  
GRAPHIC PERCEPTION

A THESIS SUBMITTED TO  
THE DEPARTMENT OF GRAPHIC DESIGN  
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FOR THE DEGREE OF MASTER OF FINE ARTS

By

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June, 1996

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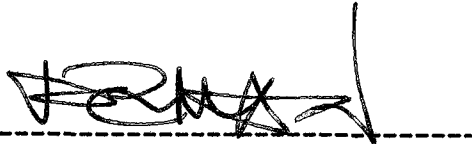
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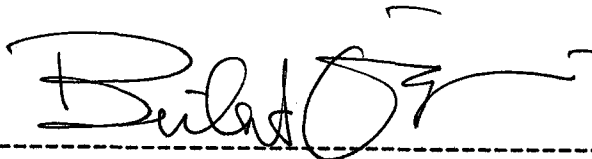
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## ABSTRACT

# PICTORIAL SPACE: A COMPARATIVE ACCOUNT OF PROJECTIVE VERSUS CONSTRUCTIVIST THEORIES OF GRAPHIC PERCEPTION

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June, 1996

This study aims at constructing an 'overall theoretical outline' that would structure the existing approaches to graphic perception within a comprehensible whole. In this context, two dominant theoretical paradigms, namely 'projective' and 'constructivist' arguments of pictorial perception is analysed in a comparative manner. Due to the fact that different theorists adopt these two arguments in varying degrees, 4 distinct approaches to pictorial perception is analysed extending within two extremes. The comparison is based on the phenomenon of pictorial space as a significant feature of graphic imagery.

**Keywords:** Visual Perception, Pictorial Space, Psychology.

## ÖZET

### RESİMSSEL UZAM: PROJEKTİF VE KONSTRÜKTİVİST GRAFİK ALGI TEORİLERİNİN KARŞILAŞTIRMALI BİR DEĞERLENDİRMESİ

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Bu çalışmanın amacı, varolan grafik algı teorilerini anlaşılabilir kılmaya yönelik genel bir kuramsal çerçeve oluşturmaktır. Bu bağlamda, resimsel algı olayına iki temel yaklaşımı temsil eden 'projektif' ve 'konstrüktivist' algı kuramları karşılaştırmalı olarak değerlendirilmiştir. Farklı kuramcılarının bu iki paradigmayı değişen derecelere benimsemeleri sebebiyle, çalışmada iki uç arasına dağılmış 4 farklı yaklaşım ele alınmaktadır. Karşılaştırma önemli bir grafik olgu olan 'resimsel uzam' üzerine temellendirilmiştir.

Anahtar Sözcükler: Görsel Algı, Resimsel Uzam, Psikoloji.

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## CHAPTER 1

### 1-INTRODUCTION

#### 1.1. Concept of 'Pictorial Image'

This is a thesis about humans' visual perception and pictorial images. With regard to the wide variety of contexts within which it is used, the word 'image' does not seem to denote a common meaning across different domains and people. As the psychologist James Gibson remarks, it is quite possible to multiply the derived meanings of the word image such as: 'mirror image, retinal image, afterimage, mental image, conceptual image' and etc. As a consequence of this confusion, "we slide from one (meaning) to another without realising it when we talk about images" (1980, Foreword xv-xvii). To avoid such a semantic problem, Gibson's basic formulation of the term is adopted throughout this study which constructs the definition of image as "an environmental source of optical stimulation, the cause of an optic array, but not the array itself." In this sense, "an image can be a solid model, sculpture, or statue, on the one hand; or a flat relief, picture, painting, drawing, or photograph on the other" (1966, 225).

As evident with regard to the above quotation, the notion of image that is dealt with in this study covers the objects that are made by human beings. According to historical records, humans are known to

have been constructing such 'artificial' images for at least fifteen thousand years (Gombrich 1986, 19), and the beginning of this activity marks the 'discovery of representation.' To quote Gibson again: "...men of a group called Cro-Magnon made a startling discovery... scratching, daubing and shaping began to be used for a new purpose - to make reliefs, pictures and sculptures..." (1966, 224). This was what Gibson called "the structuring of light by artifice," that is, the act of altering the visual environment by building such 'displays' (1966, 224-49).

Transformation of the visual world, that is, constructing images has been possible in two major ways. It is imaginable to alter either 'the surface layout' or 'the surface reflectance' of an object. While the former denotes the act of transforming a material in three dimensions such as making sculpture or relief, the latter involves drawing or painting on a two dimensional plain surface (Gibson 1966, 228). At this point we reach a subdivision between two dominant tools of image making namely 'plastic' and 'graphic' acts. Though not being mutually exclusive ways of constructing imagery that can be separated by clearly defined boundaries, both tools possess certain peculiarities unique to them. Sowers, in order to extract such peculiar aspects of different visual media, brings forth the concept of the three primary 'modalities' of visual expression which are architectural, sculptural and pictorial (graphic) modalities (Sowers 1990, 10). Each modality can be distinguished from others not only by its visual dynamics but by the expressive task it is best equipped to perform. This model of categorising visual imagery takes the basic relation of an image

with the observer and environment as its variable of classification.

Accordingly, the determining aspect of the pictorial modality is:

...its radical 'self containedness.' Although any such work may affect or be affected by its immediate surroundings, it bears no intrinsic relation to them. Visually, in the starkest diagrammatic terms, 'it always moves inward' two- or three-dimensionally - usually both... pictorial modality is almost ideally equipped to function as an instrument of pure *envisagement* (Sowers 1990, 11-12).

In contrast, sculptural modality moves 'outward' visually, as Langer declares, it "has a complement of empty space that it absolutely commands, that is given with it and only with it, and is, in fact, part of the sculptural volume" (qtd. in Sowers 1990, 12). In this sense, sculptural modality proves to be a tool of ordering the physical space with its basic aspect of outward growth and expansion. While the pictorial image acquires a place within the three dimensional space as a flat surface the empty volume is a legitimate element of sculptures (Arnheim 1954, 254). Finally, architectural modality is the extreme case of ordering space where the whole structure transcends our total visual apprehension. These three modal points of visual imagery form the points of a gradually structured scale on which each image stands in a definite place. Accordingly, it is quite possible that a particular image can embody certain properties of more than one modality. This can be seen in many instances where a certain sculpture acquires pictorial qualities or a picture commands space just as a solid sculpture does.

This study is mainly concerned with images possessing the most genuine aspects of the pictorial modality which are produced by the 'graphic act,' that is, the activity of altering the surface

reflectance of a plane. Consequently, it is of necessity to extract a rather clear definition of the term 'pictorial image' with regard to the above reviewed interpretations. By utilising Gibson's (1966, 224) formulation of image as a base of departure, pictorial image can be defined as "a two dimensional plane whose surface reflectance is altered and modified for the special purpose of being looked at." This alteration of surface reflectance ranges from the simplest linear tracing to manipulating different patches of color contrasts on a two dimensional area. At this point, the scope of this study delimits itself to flat reliefs, paintings, drawings, photographs and any product of graphic design while excluding solid models, sculptures and statues from the main argument. The physical (not to mention 'the represented') dimensions of the conveyed image proves to be crucial as a determining factor in this issue. Pictorial images are constrained within two dimensions in the sense that they are constructed to be viewed perpendicularly in front (except some extreme cases such as anamorphosis or trompe l'oeil) unlike the sculptural images that can be observed from infinitely many directions. Dondis illustrates the same point in his words:

The essence of sculpture is that it is constructed of solid materials and exists in three dimensions. Most other visual art forms -painting, drawing, graphics, photography, film- only suggest three dimensions by highly refined use of perspective and the light and shade of chiaroscuro. Our fingertips placed on a painting or photograph would supply no information about the physical formation of its subject matter... (1973, 150-51).

## 1.2. Perceptual Psychology as a Tool of Analysing Pictorial Images

From the simplest acts of doodling to the most complicated pieces of pictorial art creating pictures has been an integral part of man's

life. If we inquire the basic and underlying reasons for the creation of many forms of pictorial image it is not possible to find coherent and immutable goals. The circumstances within which graphic production takes place are:

...many, sometimes clear and direct, sometimes multilateral and overlapping. The prime motivating factor is response to need, but the range of human needs covers an enormous area. They may be immediate and practical, having to do with the mundane matters of daily living, or they may be concerned with loftier needs for self-expression of a mood or an idea (Dondis 1973, 146).

In this sense, the picture-viewer relationship proves to be quite a complicated issue with innumerable factors to be considered. An image can 'represent' objects or scenes, 'communicate' pieces of information or 'express' certain feelings. Accordingly, a successfully constructed perspective can stimulate the illusion of concrete reality, some abstract concepts can be expressed by pure shapes devoid of direct meaning, a poster prepared for a propaganda campaign may easily arouse powerful feelings of joy, anger or anxiety in viewers, or many international signs function properly without the need of recouring to verbal language. The power of pictorial imagery is even more evident if one considers the recent advance of 'flowing digitised images' that have access to nearly everywhere through what Crary terms VDT's-video display terminals (1984, 290). Present state with such a high degree of image consumption has neither been enduring since the discovery of representation nor emerged all of a sudden. Today's 'image polluted world' is actually an outcome of a long and fluctuating progression through which people 'searched' for different potentialities of pictorial images. The dominating paradigms of pictorial

representation has undergone tremendous transformations through history and ways of depiction changed corresponding to this track.

Till the beginnings of the modernist paradigm the above mentioned functions of pictorial imagery (communication, expression etc.) had been taken for granted without questioning how such things may 'really' occur. This unconscious state had lasted until there emerged an awareness about the probable existence of some basic perceptual mechanisms that govern the functioning of pictures. This awareness marked the historical period where the 'science of psychology' became intertwined with the ongoing experimentation in the field of pictorial arts.

Throughout the epoch before the advance of modernism the varying properties of pictures had been readily accepted without being inquired in terms of any perceptual working mechanisms. As Gombrich states, explanations concerning these issues about pictorial representation were considered to be 'only problems of style and convention.' Different approaches to representing were thought to be rigidly connected to prevailing conventions of picturing and artists' personal styles without searching for any probable underlying perceptual and cognitive bases such different styles might stem from (1992, 24-29). The analysis of pictorial arts along with their criticism was in the responsibility of the 'art historian' whose actual task should rather have been to point out the emerging transformations in the prevailing paradigms of representation and to provide his readers with appropriate tools of historically categorising artwork in terms of their varying styles (Gombrich 1992, 19). It is quite a common fact that each period of



historical development has its own approach to depiction and a particular way of picture making is possible only in a corresponding 'particular' period, not in any other one. For instance, an impressionist painting could have not been done in the seventeenth century. To categorise such different 'artistic styles' in relation to their formal properties is within the responsibility of the art historian; but who will unveil the hidden essence that drive people to paint in different manners through the history? The person that should carryout this job is certainly not the art historian. Perceptual psychology has been the appropriate field for such examination; but the merging of psychology with art analysis didn't occur till the beginnings of the nineteenth century.

The essential union between perceptual psychology and pictorial arts began to be established around 1840's along with the newly developing theories of vision and human physiology (Crary 1990, 138). The perceptual capabilities of human vision began to be investigated for the sake of discovering the basic physiological elements of seeing. The experimental studies of Helmholtz, Goethe, Schopenhauer and Brewster proved the fact that human sight didn't function like a photographic camera which obeyed the scientific rules of projective geometry. Instead, what we 'see' as the actual environment was quite different from what we really sense on our retinal plates. In this sense, the spectacle that we perceive as the outer world could be a 'construct' rather than a faithful pictorial correspondence. Moreover, Goethe, after his experiments concerning with the phenomenon of after-images, found out that human body was even capable of producing subjective visionary experiences, a discovery that shuddered the belief in the objective perception

(Crary 1990, 137-50). All these developments stimulated the emergence of the idea that 'seeing' was something much more complicated than as it had been imagined. There could be innumerable 'inner' as well as 'outer' factors that determined the way we perceive the physical environment. Consequently, the continuing scientific inquiry concentrated on extracting the basic elements of visual perception.

This new 'awareness' towards seeing found deep echoes in the realm of modernist graphic arts. Within the new historical paradigm, where the possibility of any objective correspondence of sight with environment is questioned with suspicion, the pictorial arts could no longer continue to search after the 'perspective realism' being inherited from the Renaissance. A similar task of experimentation was being carried out in artistic studies which corresponded to the one continuing in the realm of psychology. As Gilmour points out, the whole system of visualisation was challenged - a challenge stimulated by the newly developing cosmology in science which destroyed our pre-existing conception of the 'real' (1986, 82). Krauss emphasises the newly established parallelism between perceptual psychology and pictorial arts as she illustrates Mondrian's story of appropriating the modernist style of depiction:

His entry into modernism took place on the site of the rationalisation of painting around the laws of color theory and physiological optics, at the point where composition and pictorial harmony were at last to be demystified by science and to find their grounding in a set of abstract theorems - theorems that bore the names of great physiologists and physicists like Fechner, Young, Helmholtz, Hering (1990, 11).

With the destruction of the established pictorial conventions embodying all the rules of perspective and geometrical space the

modern artist began to search for the new possibilities of representing visionary experiences. Vision and visuality became the primary subject of pictorial art. Impressionism emerged with the artists' intention of depicting visionary phenomena 'as they are sensed on the retinal surface.' Painters struggled to liberate representation from the conventionalist procedures of the past, a fact mostly evident in Ruskin's desire of reaching the 'pure vision' by what he calls the "contemplative abstraction from the world" (Krauss 1990, 5). Many facts related to picture-viewer as well as picture-artist relationship that had been taken for granted up to that time became intricate puzzles to be solved. What was 'realistic' depiction? Could there be transcendent rules of pictorial composition? or was it possible to express feelings in a pictorial display 'directly' without recouring to conventional signs? (Gombrich 1992, 30). With the establishment of the essential correspondence between pictorial arts and perceptual psychology such questions came to be directed to both realms of application. While the scientific domain tried to reach at plausible theoretical constructions concerning these issues, artists concerned themselves with questioning these notions by visualising them.

As a historical consequence of the developing awareness related to the perceptual bases of pictorial effects, today, no argument about graphic and visual arts can totally be abstracted from issues related to psychology of seeing. Arnheim illustrates the close kinship between psychology and visual arts as:

All seeing is in the realm of psychologist, and no one has ever discussed the process of creating or experiencing art without talking psychology. Some art theorists use the findings of psychologists to advantage. Others apply them one-sidedly or without

admitting what they are doing; but inevitably they all use psychology, some of it up-to-date, some of it home-grown or left over from theories of the past (1954, 3).

Rudolf Arnheim is one of the most eminent personalities in the field of art theory who uses the tools of 'gestalt' psychology in analysing visual artwork. Having written extremely influential treatises on pictorial arts as a psychologist, he symbolises the ultimate unification of psychology and art-criticism - two formerly distinct fields of study. There are also many other celebrated psychologists (Shepard, Kubovy, Gregory, Gardner etc.) who are quite productive in this area. Ernst Gombrich, on the other hand, uses the same tool -psychology- in illustrating certain issues related to visual arts while being an art historian himself. Like Gombrich, there are also many art historians and philosophers that refer to perceptual psychology as a scientific base in explaining certain issues. The significance of psychological knowledge even increases in the area of 'applied arts' such as graphic design or illustration where certain practical concerns related with the required functions of the outcome product is crucial. The designer refers to the findings of perceptual psychology in deciding about certain formal features of his prospective product. Myers illustrates the practical significance of possessing knowledge about perceptual mechanisms in the following words:

Understanding perception allows visual artists to express themselves in language that is clear, precise and effective. Whatever mode of expression visual artists choose, from photographic realism to totally abstract, non-objective works, understanding how perceptual processes work expands their capability to express their intentions more precisely - to clarify or, if they choose, to obscure meaning...(perceptual) knowledge provides artists with tools to exert a greater influence over a viewer's emotional response to their work and over the precision with which visual communication takes place (1989, 5).

### 1.3. Statement of the Problem

The established directory of knowledge about psychology of human perception seems to be the most convenient source in interpreting the graphic-viewer relationship. However, a brief survey on different approaches and trends in psychology would reveal the fact that today's psychological science is quite far from providing the art analyst with a concrete data base to retrieve perfectly reliable information. In other words, contemporary psychology is full of divergent, even mutually exclusive approaches, each modelling the perceptual phenomena in fundamentally different ways. Moreover, the ongoing experiments continually declare new information which, in turn, results in the addition of a new approach to the mixed stream of diverse trends. Today, it is impossible to read anywhere a statement such as: "As it is ascertained by psychology that..." due to the indecisive nature of the field (Gombrich 1992, 38). The most significant theoretical paradigms that dominate the field of perceptual psychology can briefly be named as, Empiricist, Gestalt, Behaviorist, Gibsonian, Information-Processing and Computational approaches all of which model human perception in a different manner (Matlin and Foley 1992, 6-8). Though it is accepted that psychology -science of the mind- should be adopted as a scientific guide in approaching to issues about perceiving pictures there is no consensual agreement on which model of human perception is the appropriate one.

As a logical consequence of such a divided scientific field, the dominant theories related to pictorial perception correspondingly differ among themselves. There are serious variations among the

treatises written on pictorial perception in terms of approach, method and terminology (Gombrich 1992, 40). Theorists writing on this subject adopt different psychological models in dealing with issues related to picture-viewer relationship which leads the way to the formation of a diverse theoretical field full of mutually exclusive approaches and quite rigorous debates. As Hagen mentions: "It is not at all clear that continuation of the armchair debate would end eventually in a consensual resolution of the critical questions about the nature of pictures and their perception" (1980, xxiv). Nevertheless, the high degree of fragmentation prevailing in the theoretical field does not create the essential problem this study intends to point out or resolve. To unify all the existing psychological approaches for the sake of reaching at a rigid theory of pictorial perception can not be a decisive, even plausible, solution for any possible problem. Such a proposal, while being technically impossible, means, as well, to deny the experimental and divergent nature of science.

The main problem this study considers as its point of departure is not the inconsistency in the theoretical field of graphic perception but the absence of an awareness in the art reader about these different approaches and the relative isolation the proponents of these opposing theories display in their works. Actually, the solution to the former problem would efface the negative effects of the latter by persuading the reader to apprehend the theoretical work he reads within a certain structural as well as historical framework.

As mentioned earlier, theorists writing on pictorial perception adopt different psychological models in dealing with issues relating to picture-viewer relationship. While some of the authors inform the reader explicitly about the theoretical framework through which they approach their related issues, some treat their topics directly omitting such an important remark. Even, there are authors that treat psychology as a 'flexible reference book' from which every required information that is adaptable to various contexts can easily be derived regardless of the theoretical frameworks those pieces of information stem from. There are many books written on pictorial perception appropriating this eclectic style of writing.

#### 1.4. Projective and Constructivist Approaches

Regarding these problems stated above, this study aims at constructing an 'overall theoretical outline' that would structure the existing approaches to graphic perception in a comprehensible whole. To form such a framework, two dominant theoretical paradigms that subsumes all these trends will be analysed in a comparative manner. Accordingly, all the diverse approaches to graphic perception seem to gather around two major opposing paradigms which are *projective* and *constructivist* positions. Simply defined, while the projectivists claim the natural relation between visual perception and pictorial images constructivists emphasise the artificial and conventional nature of this relationship. Hagen, by referring to the issues related to 'realistic depiction, illustrates the essential opposition of these theoretical paradigms as follows:

Projective theorists argue that a picture succeeds as a representation of ordinary objects and scenes because it contains the same kind of information for determinate perception as is provided by the light reflected from ordinary environment. Thus, the information carried by pictures is both necessary to determinate perception and sufficient without recourse to cultural convention or cognitive constructions. Quite the contrary, the radical constructivists claim that pictures succeed as representations of objects because they are constructed and read according to an arbitrary but shared code (1980, xxiv).

Rather than forming two mutually exclusive groups, these two approaches form the poles of a gradually structured theoretical arena where each theorist stands on one point along this scale ranging from radical projectivism to radical constructivism. Viewed through this framework, any theorist that studies on graphic perception can be considered either to be representing a radical deed or constructing a combined approach by adopting both of the paradigms in certain degrees. The basic working mechanisms underlying the significant functions of pictorial imagery such as representation of space, communication or expression are all explained in different terms by the proponents of these two approaches due to their distinct points of departure. While the constructivist position begins with the premise that our experiences with graphic displays are the products of human cognitive system which is conditioned by what we acquire by learning, projective theory constructs a rather unconstrained relation between the natural act of seeing and perceiving pictures (Best 1986, 75-93).

#### 1.5. Pictorial Space as the Basis for Comparison

This study intends to construct a comparative account of the above mentioned contrasting theoretical positions while treating the



concept of 'pictorial space' as a significant property of graphic imagery. Pictorial space, within the framework of this thesis, can be defined as the sense of three dimensional extension conveyed by an image belonging to pictorial modality. The reason for the selection of 'space' as the basis for comparison is that it is the unique domain in which visual theorists have produced the most characteristic arguments of their specific approaches. Other features of pictorial imagery, like communication or expression, do not allow for the same degree of illustrative comparison as 'space' does. Utilising this benefit, the following chapters will construct a systematic comparison of the projective versus constructivist approaches under the subject 'pictorial space.' The comparative limitations and advantages of the two approaches will be considered in terms of how they handle certain specific issues. Due to the gradated extent through which different theorists adopt either positions, four distinct approaches will be discussed extending from radical projectivism to radical constructivism. Every chapter will construct its frame around the claims and statements of one significant theorist who seems to lead the approach he supports.

This evaluative as well as comparative account of the two theoretical positions which determine the extremes of a divergent theory of graphic perception will construct a general perspective of the whole field of picture-viewer relationship. Forming such a broad framework of pictorial theories this study firstly aims at stimulating an awareness in the reader of art theory about the existence of such different approaches; being informed of these diverse trends existing in the field of pictorial perception he or she will avoid accepting one particular approach as the ultimate

one. Moreover, by the utilisation of such a structured framework various written treatises on graphic perception can easily be perceived through their related categories while the inconsistencies existing within a particular work can be discerned with relative ease.



## CHAPTER 2

### 2. GIBSONIAN APPROACH: GRAPHIC SURFACE CONVEYING ENVIRONMENTAL INVARIANTS

This section analyses the most significant theoretical paradigm which is constructed around the arguments related to the supposed 'natural' correspondence between the perception of environmental space and its pictorial representation. Among the various projective models of pictorial space, James Gibson's 'direct theory' seems to be the most influential one elucidating a wide range of phenomena about picture-viewer relationship. Indeed, with his unique approach to visual perception, Gibson has transformed the basic assumptions of the projective model into a sophisticated visual theory which based its claims on rather a new idea of 'paralellism' between pictorial and natural space awareness. Abandoning the conventional difference between sensation and cognition his theory proves to be quite far from being an average psychological account of perceiving two dimensional displays. Quite the contrary, it transcends the psychological boundaries and influences the fields of philosophy and art as well (Pick 1974, 7).

#### 2.1. Extreme Projectivism

As mentioned in the introductory remarks of this study, this section, being the first subtitle of the chapter 'pictorial space,'

is intended to portray the extreme projectivist approach concerning with issues related to the representation of space on two dimensional displays. Accordingly, Gibson and his many disciples argue that "a picture succeeds as a representation of ordinary objects and scenes because it contains the 'same kind of information'... as is provided by the light reflected from the ordinary environment. Such a correspondence between the environmental structure of light and the picture surface is accepted to be established in accordance with the rules of projective geometry which also governs the formation of retinal images (Hagen 1980, xxiv). In this sense, pictorial space recognition proves to be immediate, and requires no intervening mental imagery or cognitive processing; because the same concrete cues are believed to function in the apprehension of both environmental and pictorial scenes (Millar 1994, 211).

## 2.2. Gibson's Information-Based Model of Pictorial Space as Distinguished from the Sense-Based Models

Though he is usually included in the general projective theory of pictorial space perception, Gibson differs from the other projective theorists in an important respect. His model of visual perception is an 'information-based' one as distinguished from the 'sensation-based' approaches. While the latter emphasises the aspect of sense stimuli in pictorial perception, the former deals with 'direct experience' excluding the physiology of senses from the main argument (Henle 1974, 48). Sense-based model of visual perception historically precedes the information-based one and it provides the essential structure that a projective theory of pictorial vision

should possess. However, due to its insufficiency in explaining certain perceptual and physiological issues related to picture-viewer relationship, sense-based model proves to be inadequate in particular contexts. Such an inadequacy has driven some theorists to construct an information-based model which disregards the problems of sense stimulation. Though both approaches share the essential belief in the projective correspondence of visible environment with human's perceptive system, information-based approach successfully illustrates certain specific issues related with pictorial space without falling into the muddle of physiology. The following parts of this section analyses the essential claims of the sense-based projective model of pictorial space within its historical context conclusively concentrating on Gibson's information-based model which dominates the radical approach this section explores.

### 2.3. Historical Roots of the Sense-Based Projective

Model: Leon Battista Alberti and *Della Pittura*

Projective model of the pictorial representation of space has a long and developmental history which has started with the publication of *Della Pittura* (On Painting) written by Leon Battista Alberti in 1435. Presenting the art of painting as a kind of scientific activity based on mathematics and observation, Alberti is accepted to be the personality who stimulated the first historical momentum towards the modern era (Spencer 1976, 11). Indeed, his treatise embodies many important propositions, yet unprecedented until that time, about human's acquisition of knowledge of the outer world. Alberti's philosophy, as summarised, suggests that:

Knowledge comes first from 'sensory perceptions.' These perceptions are compared with each other and related to man to derive general conclusions. The conclusions are tested and made applicable by means of mathematics (Spencer 1976, 17).

As evident from the above quotation, Alberti adopts an 'empiricist' as well as a sense-based deed by claiming that all human can know about the world is acquired from sensory impressions. Also in accordance with the empiricist philosophy, 'comparisons' carried out on the information available through the sense organs (in this context, retinal field) guides the process of extracting reliable information from a rather limited source (Hochberg 1974, 20). Such a notion of 'sense comparison' is intended to illustrate the sufficiency of retinal images despite their limited capacity of scene duplication. Therefore, the internal coherence of the retinal image, which logically corresponds to the physical structure of the outer world, enables the observer to perceive his environment with exactitude. This is a strong proposal developed by empiricism against the intellectualist theory which asserts that a tiny retinal image, itself, can not account for our apprehension of the limitless real space. Surely, Alberti wasn't accepted to be an empiricist at his time as such a concept wasn't known yet. However, his theories implied a very important fact about human's perceptual relation with the outer world: the 'direct' correspondence of what we perceive with what really exists. Alberti applied the same philosophy to the 'art of painting' which is a medium used in conveying visual impressions. In this sense, a painted surface proved to be a substantial area so treated that it can simulate the retinal field of human eye in conveying reliable sense data recorded from the 'visible' environment.' The enduring acceptance of this philosophy

is evident in the contemporary psychologist Norman Haber's statements:

...geometry, color mixing, shadowing and induction processes (in pictorial representation) are all used to produce the same retinal patterns as that reflected from the three dimensional scene when viewed from the correct position (1980, 12).

In Alberti's philosophy depiction becomes a device of 'capturing' stable sense impressions from a selected portion of the environmental vista. This is also known as the "picture-as-window assumption" illustrated in Alberti's words: "First of all about where I draw, I inscribe a quadrangle of right angles, as large as I wish, which is considered to be an open window through which I see what I want to paint" (1976, 56). The observable characteristics of the environment projects on Alberti's imaginary window enabling him to trace a pictorial correspondence of what he sees through it. The projection may differ in size depending on its end purposes and the placement of the imaginary window in relation the objects drawn. However, as the Albertian concept of internal coherence implies, this does not create a problem of misperception because the perceiving subject regards the 'relative' consistency of the drawn forms within a particular depiction rather than absolute magnitudes which, above all, can not be duplicated (1976, 52-55).

The underlying factor which renders the representation of a particular portion of the real space so 'natural' and 'realistic' regardless of its size is that it shares certain concrete rules with the ordinary act of perceiving space. Alberti determines the common base shared by ordinary and pictorial space perception as the 'laws of projective geometry.' Accordingly, pictorial surface and retina are isomorphic planes on which light rays being emitted from the

environment form a projective correspondence of the real space. The artist, in constructing a correct projection of the outer environment can be said to imitate the related retinal image of the captured scene with utter accuracy. In this sense, perceiving space from a depiction does not essentially differ from perceiving the real space to the extent that a picture can fool the eye of the observer simulating the existence of concrete objects.

In accordance with his formulation of mathematics as 'the ultimate tool for translating natural phenomena applicable to practical situations', Alberti summarises all of his above stated assumptions to form the theory of "linear perspective." Based on reason and sensory data controlled by mathematics, linear perspective provides the artist with a means of creating apparent space in pictorial scenery. Spencer illustrates the underlying essence of Albertian perspective as:

In the monocular vision proposed by Alberti the visual rays extending from the eye to the object seen assume the form of a pyramid. A painting, in Albertian terms, should be an intersection of this pyramid equidistant to the plane seen and at an established distance from the eye. Given such an approach to vision and to work of art, geometry provides the only certainty for knowledge (1976, 21).

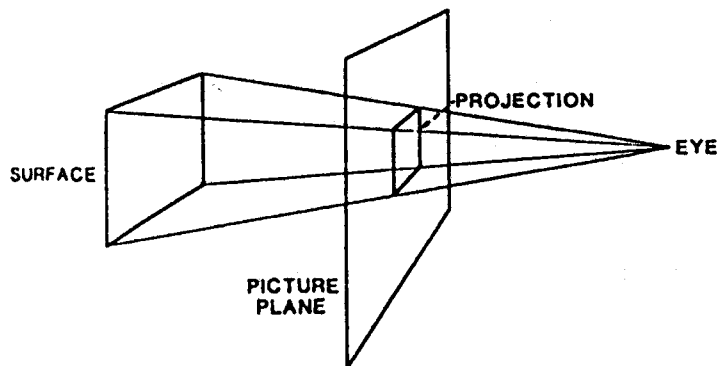


figure 1



Departing from this fundamental assumption, linear perspective is accepted to be the unique way of pictorially representing space as it can ordinarily be perceived. Due to its directly measurable correspondence with what it represents perspective is also utilised by professionals of certain technical areas as well as artists. According to Gill "(perspective representation) is very important in the work of architects, industrial designers and engineers making it possible to view the design as a finished product before committing it to manufacture" (1973, 7).

#### 2.4. Problems of the Sense-based Model

The projective model of pictorial space representation considered upto here has been related with the most radical 'sensation based' descriptions claiming a one-to-one correspondence of what we 'sense' with what appears on the pictorial display. Although there is a consensual agreement among all the projective theorists regarding the 'naturalness' and 'directness' of perspective, it is not at all clear whether this is due to its replication of retinal images or some other perceptual fact. To determine the rules of projective geometry as a governing factor in both pictorial and natural space perception does not suffice to explain all the related phenomena about seeing the space in pictures.

The primary issue to be pointed out in this context is the fact that 'central projection,' which forms the basis of perspective, is not the exact way our 'light sensitive plates' are stimulated by the visible scene. Kubovy deems perspective as a "geometric fiction" which is a mathematical tool of constructing space representations

(1986, 20). It is, to be sure, not an arbitrary or culturally determined method of representing space; but to say that perspectively constructed pictures are apprehended directly without recursing to cognitive constructions does not imply that they mimic what appears on retinal surface of the human eye (Kubovy 1986, 21).

Radical sense-based theorists generally ignore the fact that retinal image is a projection on a concave surface rather than a flat one due to the spherical structure of the eye (Panofsky 1991, 31). In this sense, no flat canvas can exactly duplicate what goes on in the eye of the beholder. Moreover, humans view the world with two eyes (binocularly) whereas the theory of central projection bases all its claims on the existence of a single eye which does not move. Two important types of perceptual cue that can not be conveyed by a pictorial display are the information derived from binocular disparity and motion parallax (Rock 1975, 96). The only reality these two powerful tools of human visual system can extract from a picture is 'absolute flatness.' Another problematic consequence of the moving observer for the projective theory is the pictorial distortions caused by differing viewpoints. To the extent that perception of spatial relationships in pictures depends on exact isomorphism, we should expect that viewing a picture from an incorrect location would affect the perception of layout (Rosinski and Farber 1980, 138). Yet, ordinary experience clearly suggests that people can apprehend the depicted space in a picture easily even in extremely skewed viewing locations. How can a sense-based projective theory of pictorial space perception account for the fact that perceived spatial layout from a picture is 'not affected' due

to any serious mismatch between the observer's viewing angle and picture's center of projection? A last thing to be pointed out against the sense-based explanations is that outline drawn caricatures, in many instances, represent the intended scenery or object even more accurately than projectively correct drawn perspectives or photographs (Rock 1984, 102); and this proves the fact that linear perspective is not the only prerequisite to represent space pictorially.

#### 2.5. Gibsonian Theory of Vision: The 'Visual Information' Available for the Moving Observer

The problems of the sense-based model stimulated the formulation of a new approach which could account for all the above stated pictorial phenomena, because the physiology of the eye, itself, was an insufficient tool to elucidate the working mechanisms of pictorial perception. While it was accepted that the relation of retinal images to visible environment was based on projective correspondences, the mere physical characteristics of the retinal image did not reveal anything significant about how we perceive spatial layout from pictures. Moreover, it was, within itself, a problem to separate sensation from perception, namely the retinal image from the final percept, as this raised the ceaseless questions related with how we transform retinal pictures to well comprehended scenery.

Gibson believed that it was worthless to analyse the structure of retinal images, as human's relation to the visible environment was too complicated to be elucidated by merely considering static

projections. It was the 'phenomenal world' as it is experienced by an 'active' observer that a theory of spatial perception should account for (Gibson 1966, 253). Gibson's emphasis on the 'visual experience' is evident in his well-known distinction between 'visual field' and 'visual world.' Accordingly, the visual field is the retinal image itself which is formed by moving and transforming patterns of stimulus correlates whereas the 'visual world is the stable environment that we consistently perceive. The stimuli that appears as the visual field is just an input which, itself, can not be considered to be the ultimate percept. In this sense, the 'unbounded and perfectly stable' visual world is:

... the familiar ordinary scene of daily life, in which solid objects look solid, square objects look square, horizontal surfaces look horizontal, and the book across the room looks as big as the book lying in front of you (Gibson 1950, 26).

Unless the visual theorist considers the 'visual world' as the basis of our spatial perception while continuing to believe in the sense-percept dichotomy he or she accepts to cope with the question of 'how a flat image can be converted to a three dimensional space apprehension' along with other such questions about pictorial space mentioned in the context of sense-based explanations.

Gibsonian model of 'direct perception' is essentially based on the idea of 'visual information' that is available to a 'moving observer.' Unlike the traditional theories which deem 'the static retinal image' as the unique material utilised in 'inferring' the spatial structure of environment, Gibson's theory relinquishes the notion of retinal image altogether from the argument. Accordingly, perception does not begin with a flat picture but with a general

structure and behavior of light patterns that we directly experience as a function of our 'moving body' (Gibson 1986, 149). The activity of perceiving the structure of the environmental space is named by Gibson as the process of 'information pickup' that involves the exploratory performances of looking around, getting around and glancing at things (1986, 147). These performances form a continuously changing optical energy flow through the eye which contains highly structured information about a rigid spatial environment. The information about space inherent in this optical flow is given in a continuous projective transformation appearing at the retinal area (Johansson 1974, 136). The 'consistencies' that are picked from this ever-changing structure of the sensed pattern enables the observer to perceive the 'constant' environment that do not transform in itself. In this sense, not the sensory bits of stimulation but the above mentioned consistencies can be considered as the basic elements of spatial perception.

## 2.6. Environmental Invariants

Picking up the consistencies from the transforming visual field underlies the Gibsonian theory of 'invariance detection.' Accordingly, the movements of the observing subject causes the formation of a continually transforming projective stimulus pattern. However, this transformation is not something totally chaotic; the underlying logic of projective correspondence gives the transforming optical pattern a basic structure that does not change - which, in Gibsonian terms, remains invariant (Gibson 1982, 156). The perceiver, by moving throughout the visible environment becomes

aware of this unchanging structure and adopts it as his reference to detect 'variance.' As Gibson, himself, declares:

The perceiver extracts the invariants of structure from the flux of stimulation while still noticing the flux. For the visual system in particular, he tunes in on the invariant structure of the ambient optic array that underlies the changing perspective structure caused by his movements (1986, 247).

At this point, the Gibsonian concept of 'stimulation' should be clarified as it essentially differs from the other commonly known psychological definitions. Accordingly, retinal stimulation denotes "a simultaneous variation over the set of receptors,... and the order of such a variation" (Gibson 1950, 63). Departing from this definition, Gibson extends the common meaning of the retinal stimulus to the term "ordinal stimulation" which simply refers to succession or order. Rather than being a passive sensitive plate that embodies a number of detached stimulus points, retinal surface (visual field) is a neural interface area on the surface of which a gradually ordered and transforming pattern of visual impressions resides. The order and general coherence of the visual field which is refined by the projective correspondences caused by a moving body enables the perceiver to distinguish between the varying and in-varying patterns of stimulation. As mentioned in the previous paragraph, the persisting patterns of stimuli - the invariants form a transcendent guide to determine what really varies in the field of view; and these invariants remain similar for all the alike species. Gibsonian theory of direct perception also asserts that the capturing of the environmental invariants is not the product of a sophisticated cognitive process; quite the contrary every animal that moves through the differentially structured environment can

'directly' perceive them as the function of their bodily movements (Best 1986, 95).

One of the higher order invariants that the perceiver picks from the visible environment is the gradient of texture which is something displayed by all the 'surfaces' of the world we live in (Best 1986, 92). Despite the changing properties of the perceived space due to the movement of the observer, the fact that it displays a gradient of texture all over its surfaces remain invariant. The perceiver judges about the general layout of the space which is populated with differently slanted and structured surfaces by considering the texture gradient all these surfaces display in a coherent manner. Accordingly, the ground texture of the visible world gradually diminishes towards the horizon and it creates a framework of size for the objects that stand on it (Gibson 1986, 162). This is also known as the 'ground theory' of space perception which asserts that there can be no space perception unless the perceiver is provided with a continuous background surface. The invariant relations of all surfaces to the ground and to one another determine the layout of space for the moving perceiver (Gibson 1986, 148).

The essential structure of the perceived counter-movement of the ground texture as a function of the observer's movements is another essential invariant. Accordingly, the whole visual pattern expands in an ordered way (from the vanishing point) as the viewer approaches the scene whereas it contracts as he recedes from it (Best 1986, 92). The relative movements and projective deformations of the physical objects clearly reveal their unchanging structure. 'Horizon' is another non changing quality of the visible

environment which never moves regardless of the differing kinds of motion the observer performs.

## 2.7. Graphic Surface Conveying Environmental Invariants

Gibson's theory of pictorial space perception derives from his claim that a picture can represent the space correctly to the extent that it conveys the similar invariants as extracted from the real environment (Sedgwick 1980, 48). Such an approach assumes that some of the invariants of an array can be separated from its perspective structure, not only when the perspective keeps changing, as in life, but also when it is arrested, as in a still picture. Ordinarily, such invariants emerge as a function of bodily movement but for Gibson they can also be distinguished in the limiting case of an unchanging structure. In this sense, the perception of space from pictorial displays prove to be also 'direct' because it preserves the essential factor that an observer relies on when perceiving the real space: the invariants.

One such powerful invariant that can be directly conveyed by a pictorial display is 'texture gradient.' Corresponding to the basic information pickup mechanism of the visual system, the gradient of texture is the major source of information about the 'slope' of a plane in pictorial displays. Accordingly, the direction of the gradient would indicate which way the surface recedes from the observer, the steepness of the gradient would indicate the extent to which the surface is sloped away from the frontal plane and changes in the gradient would indicate changes in slope angle (Rock 1975, 90). In figure 2 an abrupt transition in the gradient (right)



conveys the information about the presence of two planes one occluding the other whereas a change in the gradient amount (left) gives the information of two planes joined to each other forming an edge.

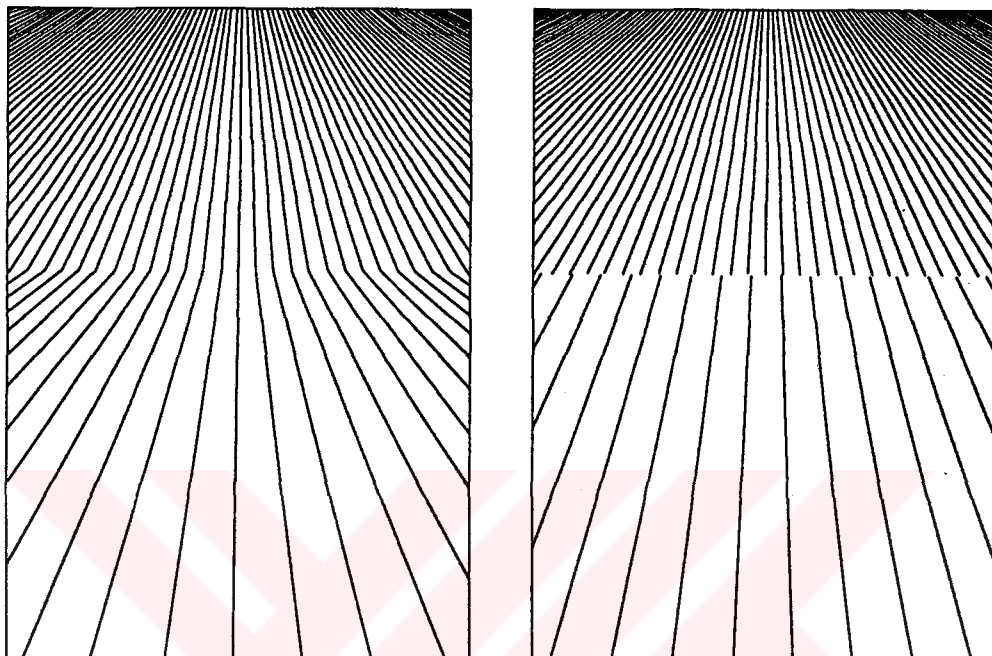


figure 2

Gibson argues that gradient of texture as the basis of all spatial perception is a general phenomenon of which linear perspective is only a special case and it can directly be conveyed in pictures (Gibson 1950, 70). Also the presence of a non changing horizon through which the texture gradient diminishes to zero is another environmental invariant which can be preserved in two dimensions. Similar to the ordinary act of perceiving, the texture gradient of the depicted ground surface forms a general framework through which every object acquires a definite size and shape in relation to the amount of texture it occupies (Gibson 1986, 163). Consequently, the background of a successfully rendered volumetric scene is neither open to the sky nor is it undefined; rather it is made up of

substantial walls and surfaces that provide the gradient of texture that the observer needs in apprehending the virtual space (Forseth 1991, 91).

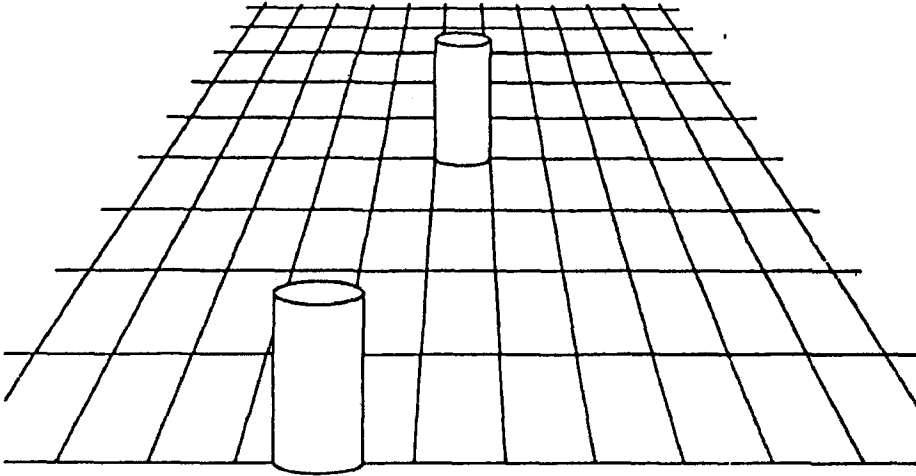


figure 3

Gibsonian theory considered up to here was more or less in correspondence with Alberti's picture as window assumption; because, Albertian perspective, though unconsciously, confirms the presence of texture gradients and the invariant horizon within the projective model. However, the correct representation of space does not essentially require the determination of a fixed viewpoint along with faithfully depicted texture gradients. In Gibsonian model there is an essential difference between the 'photographic' and 'chirographic' methods of representing space; whereas the former involve a camera the latter involve graphic tools of some sort for the hand-eye system (Gibson 1986, 272). In this context, pictorial representations drawn in 'chirographic method' consist of mere outlines rather than scales of grey or color. The unique property of the photographic methods with faithfully depicted perspective renderings is that they put the observer 'in the scene' by assigning him a specific vantage point. But this do not make them preferable

to rather freely drawn outline pictures which can also represent space perfectly (Kennedy 1974, 214). The most problematic issue that the traditional sense-based theories couldn't cope with was the fact that simple outline drawings had the ability to represent space even though they did not replicate the retinal images of the related scenes.

What the outline drawings consist of are not 'pictorial' forms that should be related with the real scene by a cognitive activity or a one-to-one projective correspondence. Gibson deems the outline forms as 'pictorial invariants' that correspond to the environmental invariants revealed by motion in the real space (Sedgwick 1980, 64). Sedgwick illustrates this phenomenon clearly in the following words:

... because the optic array at any moment of direct perception is always in the process of revealing invariants through change, the optic array from a pictorial representation can be taken as an arrested optic array frozen in the process of revealing its invariants... in other words, pictorial invariants are structures in the static optic array from a picture that would remain invariant if the optic array were from a real scene and were being transformed by a movement of the observer (1980, 65).

Accordingly, if the figure of a cat can easily be recognised in an outline form, this implies that the drawn figure preserves the essential invariant features of the 'cat as a physical object' seen through movement: it displays a specific optical discontinuity with the ground surface regardless of the dynamically differing viewpoints from which it is viewed. In this sense, outline drawn figures are not forms that correspond to physical objects, but they are 'formless' invariants. By constructing such a model of pictorial

space perception, Gibson seems to imply that 'what we draw is what we really see':

...when the young child sees the family cat at play, the front view, side view, rear view, top view and so on are not seen, and what gets perceived is the invariant cat... Hence, when the child first sees a picture of a cat he is prepared to pick up the invariants and he pays no attention to the frozen perspective (1986, 271-72).

Similarly, a perceiver never sees a human figure as a flat patchwork or as a cut-out like a paper doll, but probably sees a sort of head-body-arms-legs invariant. Any outline drawing which preserves this invariant property can be recognised as a human and the outlines tend to be seen as the occluding edges of a human figure with interchangeable near and far sides. Viewed from this point, an 'outline' represents a discontinuity in the environmental texture, and when it is presented as a closed pictorial form it conveys an invariant feature of what it represents when viewed in motion. For instance, a door is always seen as a rectangle from wherever it is observed implying the fact that rectangularity is an invariant property of doors. Then, a rectangle in an outline drawn picture can represent a door if it is supported with other similar invariants within a coherent framework.

As the above statements imply, the information in a line drawing is carried by 'connections' of the lines, not by lines as such. In other words, the invariants are found in the ways that the lines are, in Gibsonian terms, 'nested,' not in the forms of these areas. This brings a limitation to the environmental information that can be captured in a line drawing. Gibson enumerates some of the environmental invariants that can be represented in outlines as: "a corner, an edge, an occluding edge, a wire, a crack and the horizon

line" (1986, 287). For instance, a physical edge remains to be an edge invariantly from whichever viewpoint it is observed and this invariant property can be given in an outline picture within a coherent net of line segments. In figure 4 Kennedy points to a number of line segments that depict environmental features that remain invariant when observed in motion (1974, 214).

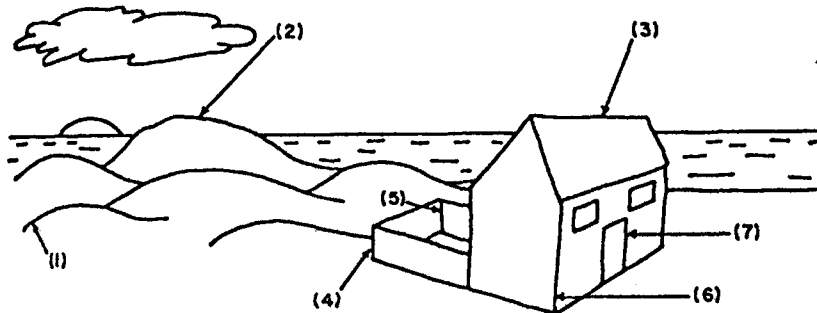


figure 4

Gibsonian theory just considered can easily cope with many questions about pictorial space perception that can not be answered by a sense-based approach. The core of the information pickup theory of Gibson is based on the assertion that both the real and pictorial space perception depend on the capturing of invariants which are 'formless.' Then, the fact that space can be perceived from freely drawn outline pictures do not constitute a puzzle as they can also preserve the essential invariants of the environmental space if they are correct drawings (an outline picture can be drawn intentionally to give false or contradictory information).

The model of invariant detection also answers the question raised by the phenomenon of unchanging percept of the depicted layout despite the observer's changing viewpoints. Accordingly, the internal coherence of the drawn figures remain invariant and convey the

intended scenery if the observer is 'aware of the surface' on which the scene is depicted. A correct apprehension of the represented space requires that the observer can perfectly discern the spatial layout of the picture surface. Wollheim emphasises the same point when he asserts that the observer should firstly become aware of the surface he looks at and then he can discern what is represented (1991, 105). In this sense, though the perception of the depicted layout do not require special learning, awareness of the picture surface is something that is adapted.

## 2.8. Gibson and Merleau Ponty

With regard to its reviewed portion up to here, Gibson's perceptual theory resembles Merleau-Ponty's phenomenological account of how we experience our visible environment. The first essential point that links the approaches of these two theorists is that both accept the irrelevance of sense stimuli in human's perceptual relation with the world. In a similar way with Gibson,

Merleau-Ponty objects to all such mechanistic explanations of perceptual experience on the grounds that they represent 'blind processes' which take place in such a way that 'nobody sees,' processes in which, in leaving the perceiver out of account, prove incapable of accounting for the richness and variety of an experience invested with emotional as well as sensory qualities... (Macann 1993, 166).

For both Gibson and Merleau-Ponty, what we 'directly' experience as a function of our moving body constitutes the essential source of information required for the perception of space. The Gibsonian notion of 'invariants' is also clearly discernible in Merleau-Ponty's account of 'horizon' as an unchanging element of the perceived environment. He held that 'horizon' remains a constant element in the visible world, even as we move toward it:

Although the visual contour shifts when I walk toward the hills or toward the shoreline, it is only the visual content which changes, not the structure between me and the horizon...While the horizon is one 'invariant' of perception, so is my occupation of a visible place in looking toward it (qtd. in Gilmour 1986, 99).

The concept of the 'stimulation gradient' which denotes a 'field' with an internally coherent structure constitutes Merleau-Ponty's essential attitude to pictorial representation as well as language. A child learns how to use and understand language as he discerns the internal structure of the formerly meaningless groups of sound. After a certain period of active involvement and experience he begins to capture the varying and in-varying patterns of information that exists in the endless speeches of people (Ponty 1964, 40-41). Evidently, meaning is not something attached to the 'form' which do not even exist for both Gibson and Merleau-Ponty. Similarly, in a pictorial representation, the internal relations of the drawn elements (the nesting of lines) create the overall effect of the depiction which in turn corresponds to environmental invariants (Gibson 1986, 288). The gradients of color as well as texture determine the discontinuities and irregularities in the whole pattern from which the observer extracts in-varying figures and the general layout of the depicted volume.

## CHAPTER 3

### 3. GESTALT APPROACH: ARNHEIM AND THE LAW OF SIMPLICITY

As illustrated in the preceding section, Gibson's approach to all issues related to visual perception is a 'phenomenological' one which completely disregards the physiological structure of the perceptual system as being irrelevant to the 'direct experience' of apprehending the visible world. Accordingly, perception of pictorial as well as real space is 'direct' and 'unmediated' that does not require any intermediary neural representations or further processing. Such an approach easily explains all the perceptual issues related to picture-viewer relationship merely considering the general rules of projective geometry and without dealing with intricate and rather unclear mechanisms of human physiology and neural structure. Actually, this is the major advantage of the Gibsonian approach over the 'sense-based' models all of which tried to formulate pictorial space as a consequence of a faithful retinal image duplication. However, Gibson's direct approach prove insufficient in explaining certain perceptual phenomena which has stimulated the formulation of different models of pictorial seeing.

#### 3.1. Limitations of the Gibsonian Model

Shepard explicitly states the questions that Gibson and his followers left unanswered as:



In what form is the relevant information contained in the pattern of light available from a mobile observer's viewpoint? By what neural processes does the visual system extract this information from this pattern? And, most pertinently, what does happen under poorly illuminated, partially obstructed, interrupted or in some way constrained unnatural conditions of viewing? (1990, 189).

These questions are the consequences of a number of perceptual phenomena which proved the naiveté of Gibson's model. The existence of certain 'constructive' processes of the perceptive system can be discerned when observers are faced with illusory or tricky visual situations. Such pictorial illusions including reversible figures, impossible objects and other alike aberrant instances of depiction are quite common tools of experimental psychology used in elucidating the hidden working mechanisms of humans' perceptual system. Gibson generally avoided dealing with these data by claiming the unnatural and 'ecologically invalid' conditions in which these displays are presented to subjects. However, the facts revealed by these experiments can not be overlooked as they are quite illustrative about humans' physiology of pictorial as well as natural seeing.

### 3.2. An Evidence for the Constructive Operations of the Perceptual System: Amodal Completion

One of the most significant phenomena revealing the 'constructive' role of the perceiver is 'amodal completion' which is the act of perceptually completing the hidden or occluded parts of objects (Kanizsa & Gerbino 1982, 170).

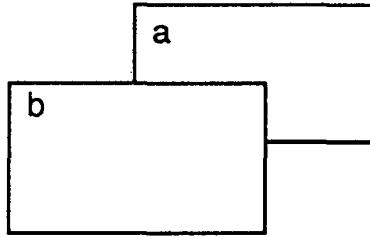


figure 5

Looking at the overlapped configuration represented as figure 5 every human being shares the same spatial impression related to 'a' and 'b.' The common percept is that 'a' is a rectangle partly occluded by the other rectangular surface 'b' which lies on top of it. Though the line configuration in the figure is 'ecologically invalid' and represents no explicit information about the above mentioned facts, any observer directly reaches at this spatial and formal interpretation without even thinking (Kanizsa & Gerbino 1982, 169). The phenomenon of directly apprehending outline configurations was also explained by Gibson as invariance detection; but the same theory proves inadequate in elucidating how 'a' can be perceived as a perfect rectangle while it is only partly projected. Similarly, when looking at ambiguous outline drawings observers generally accept one definite spatial reading among infinite possible layouts while 'amodally' completing the perceived 'hidden' shapes. Where does the information related to hidden objects that do not exist in the drawing come from?

### 3.3. Gestalt Theory of Spatial Perception

Amodal completion is only one of innumerable phenomena forcing the visual theorists to think about a perceptual mechanism which carries

out certain 'constructive' operations to transform the projected retinal patterns into properly perceived layouts of space. Gestalt theory is the outcome of such a drive which supports the idea of a 'mediated' process of perception consisting of a two-step perceptual activity. Accordingly, the outer world is projected on a sensitive neural surface which is then subjected to a kind of organisation process that produced the final percept (Beck 1982, 1). In contrast to the Gibsonian view of human's direct perceptual relation to the environment through bodily movements, Gestalt theory deems space as a 'construct' of the human neurophysiology. Against Gibson's assertions related to the existence of orderly structures 'in the world' being revealed by motion, perceiver is accepted to be responsible in attributing order to the two dimensional 'raw' stimuli according to Gestalt model (Gibson E. 1982, 160). Consequently, Gestalt can be interpreted as a 'form' oriented approach based on the accepted primacy of flat monocular pictures in perceiving space.

With regard to the above reviewed material, Gestalt seems to represent a constructivist approach to spatial perception. However, its physiological model of perceiver-environment relationship claims the opposite. Gestalt builds an 'analog model' of perceptual correspondence between space and human's neural structure in contrast to the 'symbolic' models of radically constructivist approaches (Attneave 1982, 13). Such correspondence between the outer and the inner world is also known as 'isomorphism' a term used to define the fact where the outer stimuli and its internal representation have similar structures (Arnheim 1987a, 210).

Wolfgang Köhler, one of the founders of Gestalt school, illustrates the Gestaltian concept of isomorphism as:

The principle of isomorphism demands that in a given case the organisation of experience and the underlying physiological facts have the same structure...Thus we assume that when the visual field exhibits a thing as a detached entity, the corresponding process in the brain is relatively segregated from surrounding processes (1947, 344).

Accordingly, the projecting light pattern forms an 'analog'(isomorphic) correspondence of itself on the optic neural area which is then subjected to processes of organization determined by the 'physiological functions' of human cortex. The Gestaltian construction of space within the perceptual system is not guided by any 'cognitively oriented' constraints, as it is the case in the constructivist models of perception, but it is a natural consequence of the behavior of cortical structure. Beck defines the perceptual activity proposed by Gestalt as "nonsymbolic self-regulating analog physical processes" (1982, 1).

The idea of a 'mediated' and 'two-step' process gives the first impression as if Gestalt theory exhibits a constructivist approach. However, the principle of isomorphism supported with the built-in organisational activities of human's optical cortex reveal that perception of space depends on organising projective correspondences and it is an innate ability found in every human being (Rock 1975, 273). In this sense, Gestalt theory of perception should be regarded to present a projective model though being less radical than the Gibsonian one.

### 3.4. Gestalt Theory of Pictorial Space

As already mentioned, Gestalt theory sees the process of spatial perception as essentially based on the two dimensional retinal pictures. In contrast to the Gibsonian notion of 'extracted invariants' that are formless, Gestalt model of space perception begins with the accepted primacy of 'retinal forms.' Accordingly, the genuine information that determines the perceived space derives from the fundamental operations of organisation carried out on the projected 2-d retinal patterns to which binocular interaction and movement information are only 'added' (Zanforlin 1982, 254). So, the ordinary act of seeing is essentially based on the 'pictorial' characteristics of the visual field: what we actually see is a 'projectively constructed picture' of the outer world which is, in turn, subjected to various processes of organisation to form an internally coherent apprehension of space. In this sense, the pictorial theory of Gestalt does not basically differ from its general perceptual model as both operate on similar premises related to stimulus patterns and physiological processes. Identical to the perceptual activity that occurs in any illuminated part of the physical environment, how a certain configuration of lines or shapes is perceived depends on the corresponding (isomorphic) neural activity it excites on the related cortex area. Various pictorial phenomena relevant to pictorial space apprehension including figure-ground relationship, overlapping, transparency and linear perspective are modelled by Gestalt theory as outcomes of different analog patterns of excitation and arousal.

What are known as 'Gestalt laws of construction/organisation' derive from the accepted parallelism between intricately observed phenomena and their corresponding neurological mechanisms. As Koffka declares: "For the Gestalt psychologist, phenomenological description is fundamental because, according to isomorphic hypothesis, the phenomenological datum reflects the neural processes underlying perception" (qtd. in Metelli 1982, 220). Following the same line of thought, Arnheim attributes the direct effects of pictorial displays, such as balance, tension, depth etc, to similar activities going on throughout the optical cortex area in the sense that a corresponding disturbance of neural balance arises in an observer's brain if he or she confronts with an unbalanced graphic composition. The possibilities of adaptation and cultural factors are altogether rejected as being only weak factors that can not seriously influence the innate functioning mechanisms (physiological laws) of the human brain (Arnheim 1987b, 306). Any human being is affected by a graphic configuration in the same way as physiology of neural structure is something permanent among cultures and races. Departing from these premises, Gestalt theory constructs a body of 'pictorial laws' that determine how certain two dimensional configurations are apprehended by viewers.

### 3.5. The Notion of 'Wholes'

The fundamental statement of Gestalt is that our perception of a graphic configuration does not depend on isolated apprehension of separate shapes or forms occupying the picture plane/retinal field, but it works by relating parts with the entire configuration. In Arnheim's words: "Seeing something involves assigning it a place in

the whole: a location of space, a score on the scale of size or brightness or distance" (1954, 11). Accordingly, the observer reacts to the 'pattern' of pictorial stimuli to which he or she is exposed; and this points to a 'unitary process' which denotes the experience of 'a sensory field' rather than a mosaic of local sensations (Köhler 1947, 103). This is a logical consequence of the primary claim of Gestalt which represents the optic neural area as a 'field' isomorphic to the picture surface. To quote Arnheim again:

...to see means to see in relation...the decisive phase of visual processing takes place at a level of the nervous system which, whatever its precise physiological nature, must function as a "field," that is, it must allow free interaction among the forces generated and mobilized by the situation (1969, 73).

In pictorial perception the contextual structure of the entire visual/pictorial field determines the phenomenal effects of its subparts. Sometimes the contextual influence of the 'whole' pattern is so strong in a pictorial configuration that it even 'genuinely' distorts its secondary elements.

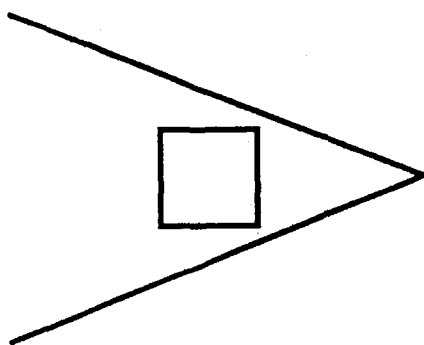


figure 6

In figure 6 the left half of the rectangle phenomenally shrinks being affected by the two legs of the narrow angle drawn in outlines. Such a distortion wouldn't have been experienced if the

square were presented as a single figure, as it wouldn't have shared the whole visual field with another pictorial element. This phenomenon, along with innumerable similar pictorial illusions, are explained by the 'dynamic' field theory of Gestalt psychology (Arnheim 1954, 10). Accordingly, the neural area responsible in organising the visual field transforms the structure of the each projected element in accordance to its spatial relationship with the other elements.

### 3.6. The Law of Simplicity

The essential law of Gestalt in accordance to which the graphic field acquires its phenomenal effect is the 'psychophysical tendency towards balance.' All the drawn elements of a pictorial image project on the observer's 'neural canvas' forming isomorphic traces of excitation. The structural properties of the neural field sets out to construct a 'balanced' interpretation of the graphic pattern for the sake of reducing the neural tension caused by the picture's essentially imbalanced and complex retinal correlate. Neural balance requires that the final interpretation of the seen image should be as 'simple' as possible and this inscribes the basic law of Gestalt responsible for the phenomenon of pictorial space. 'Simplicity' is the main target of the perceptual system in accordance to which it extracts the apprehension of a spatial volume from a two dimensional configuration of lines and shapes. Arnheim illustrates this basic tendency of the perceptual system as: "Any stimulus pattern tends to be seen in such a way that the resulting structure is as 'simple' as the given conditions permit" (1954, 53). The emergence of a 'simple' structure of 3-d space in the neural medium of an observer



means that all the potential energies previously excited by the complexities of the visual field reaches a minimum level settling down for a balanced state. Perkins illustrates the same process in his 'relaxation model' claiming that the perceptual/physical system will tend to relax toward a minimum energy state which satisfies the projective constraints (1982, 87). In this sense, what the observer ultimately perceives as a thoroughly defined representation of space is the 'simplest possible interpretation' of an essentially complex retinal projection. The system prefers to perceive a 'simple' spatial structure that extends towards three dimensions rather than a flat and irregular patchwork of projected shapes. The law of simplicity is also known as 'the law of *pragnanz*,' a term invented by the German founders of the gestalt psychology Kurt Koffka, Hans Wertheimer and Wolfgang Köhler (Rock 1975, 270).

At this point, the criteria of such an 'objective' simplicity requires explanation. For Arnheim, the essential factor that determines the simplicity-complexity of a given graphic configuration is the number of "structural features" it embodies. These structural features, as far as a 2-d shape is concerned, are the aspects of 'distance' and 'angle' the increasing number of which enhance the complexity of the image (Arnheim 1954, 57). Accordingly, the three dimensional form of a wireframe cube is much simpler than its two dimensional projection as the former can be described by two main structural features: an angle (90°) and a fixed distance line. Consequently, when confronted with the projection of such a cube the perceptual systems favors a 'simple' three dimensional interpretation rather than accepting a complicated 2-d pattern with many angles and distances.

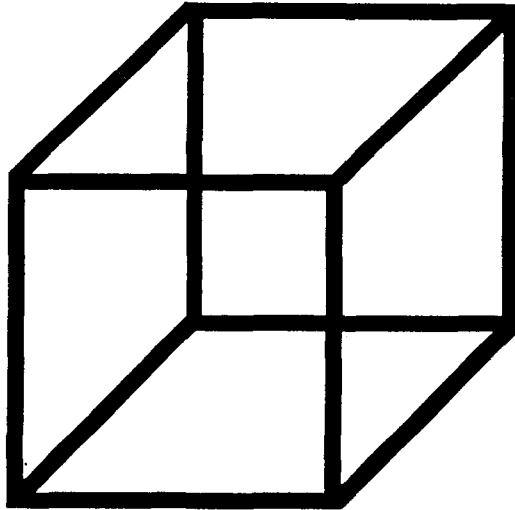


figure 7

The projected pattern in figure 7 is directly apprehended as a wireframe cube residing in three dimensions. The 3-d mental construction of the drawing occurs in such a simultaneity that no one even discerns 'what really exists there:' a flat configuration of lines in various lengths that are skewedly nested together.

Attneave, building his 'soap bubble' model<sup>1</sup>, has formulated the 'simple' features of layout that are favored by the perceptual system in extracting spatial meanings from pictures. Accordingly, equality of length, coplanarity, parallelism, collinearity, inclusion, connectedness and right-angledness are the most dominant features of 'simplicity' that are continually attributed to the observed 2-d configuration as much as the constraints of the projection permits (Attneave 1982, 14-20). In other words, perceived projective distortions call for a recovery of the projected retinal image if these distortions can be interpreted as deviations from a more

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<sup>1</sup> Attneave has used this term being inspired by the fact that a real soap bubble covers a fixed volume by using the 'minimum' and most simple surface area. He has, in this sense, emphasised the inherent similarity between the brain's and a soap bubble's strategy of spatial organization.

'stable' and 'simple' 3-d form (Arnheim 1969, 51). In the example illustrated as figure 7 the variously angled line joints are perceived as projective deviations from 90° degrees. Attneave has also hypothesised the existence of a "three-dimensional neural manifold" which functioned as a three dimensional sketch pad used in constructing the 'simple' representations of the confronted pictorial projections (1982, 14).

### 3.7. Gestalt Principles of Pictorial Space Construction

The fundamental claims of the Gestalt approach to pictorial space has been briefly summarised upto here. The following part concentrates on a number of pictorial phenomena that emerge as functions of humans' physiological tendency to 'see' space in 2-d graphic configurations.

Modelling the phenomenon of pictorial space perception in 'psychophysical' terms Gestalt theory embodies the implication that humans have an innate tendency to 'impose' spatial interpretations to even obviously flat surfaces. As Arnheim emphasises, the act of spatial apprehension is so inherent in human's perceptive system that even a strictly flat, two dimensional image stimulates the feeling of three dimensionality (1954, 219). In this sense, we can never 'really' see our visual field which is involuntarily transformed into different neural models of space. Goldstein shares the same belief with Arnheim concerning humans' innate drive of attributing a sense of 3-d space to any graphic configuration:

Spatial depth, defined as it is by the forms within and around it, is strongly suggested merely by drawing any simple doodle on a blank sheet of paper... any small

shape will serve as a figure, instantly converting the blank page into a ground space. In fact, it requires a special effort to see a small shape as only a subdivision of the shape of the page. It seems we "want" to see volumes in space - we are primed for it (1989, 131).

With such a space-oriented system of pictorial perception, even independent pieces of lines are perceived by any observer as linear masses that float in an empty volume. Arnheim calls such lines as "object lines" as they stimulate the feeling of concrete objects being detached from the graphic surface (1954, 219). Actually, the phenomenon of object line is a logical consequence of the law of simplicity: it is much simpler to perceive lines as objects residing 'on' a background that continues beneath rather than seeing both the lines and picture plane as the pieces of a whole surface. If the lines on the pictorial surface accumulate together they begin to simulate the feeling of a textured or shadowed 'surface' as "hatch lines." This is also another instance of the neural drive towards simplicity: when the combination produces a simpler figure than the mere sum of separate lines would, it is seen as one integrated whole. This is known in Gestalt psychology as "the law of grouping by proximity" (Behrens 1986, 1-6). The neural optic area tends to group stimulus elements together if they excite cortical regions that are close to each other.

One of the most significant phenomena related to pictorial space in line drawings is the 'formation of contours' that stimulate the primary perceptual tendency towards discriminating 'depth levels' on a 2-d surface. Myers defines 'contour' as "the edge of a volume seen against a ground" (1989, 175). In contrast to the Gibsonian notion of contour as a pictorial invariant that refers to an

environmentally unchanging structure under motion, Gestalt theory illustrates the phenomenon of pictorial contours along with figure-ground relationship by again referring to the law of simplicity. A contour, in Gestalt terms, is perceived to circumscribe a 'surface' not just because it is correlated with an environmental invariant; the perceptual experience of a contour line arises as a function of a preferred simplicity in the relevant depiction (Restle 1982, 43). A single closed loop of circular line drawn on a white paper (figure 8) can be perceived either as a wireframe object through which the background can be seen or a flat form residing before a background overlapping it. However, the neural balance system prefers the latter interpretation due to a two steps simplification process.

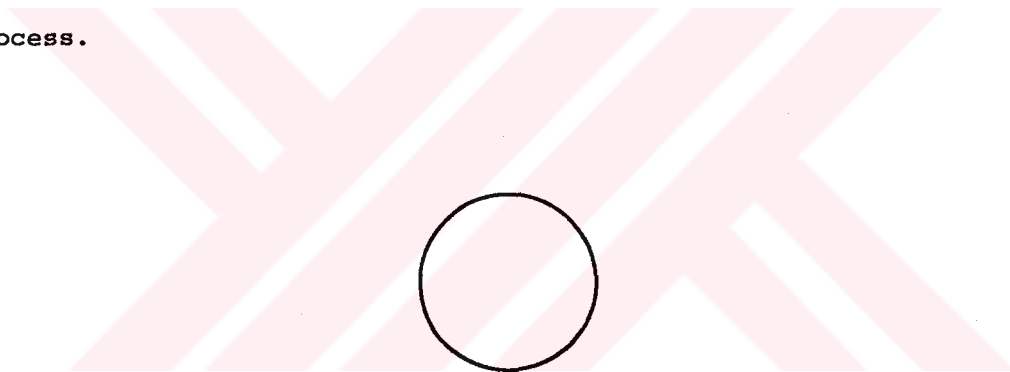


figure 8

If we refer to Arnheim's explanation of this phenomenon:

The assumption of an empty loop requires the observer to see the surface of the paper as a continuous background, or to put it differently, to see the spaces on both sides of the line as related to it symmetrically [symmetry is a strong Gestalt cue for figureness]. This works well as long as we are dealing with a straight line, but [here] such a symmetry is not supported by the shape of the loop, which creates a distinct difference between the small, closed, surrounded space inside and the unbounded, large, surrounding space outside (1954, 220).

Due to the fact that the system apprehends the circular loop as a 'figure' not a wireframe, the secondary process of simplification requires the distribution of the whole configuration into 'two depth-levels' rather than perceiving the disc as being inserted into a surface both sharing a common boundary.

In pictorial depictions of a higher complexity where two or more figures exist on the surface overlapping each other, the law of simplicity functions toward reducing the number of perceived depth levels.

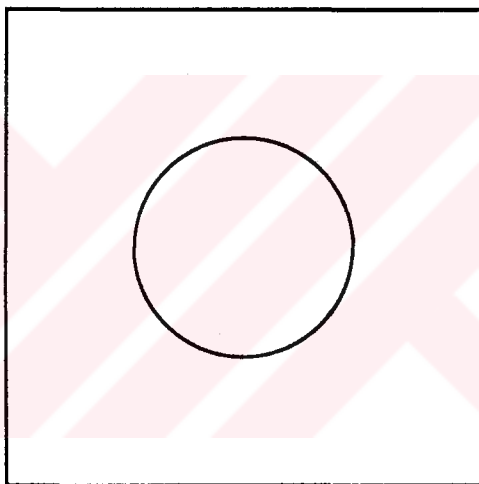


figure 9

In figure 9 the Gestaltian congruity of the two separate shapes would seem to support the interpretation of a three layered space consisting of a disc, a rectangle and the background surface respectively. However, the tendency towards the lowest number of depth levels wins the tug of war against simplicity of shapes and the drawing is perceived as a rectangular surface with a circular cut-out through which background surface is seen.

The two elementary instances given above verify Arnheim's well-known statement: "There is no such thing as a truly flat two-dimensional picture" (1954, 227). Human's inherent tendency to impose spatial interpretations to pictures stimulates the formation of a figure-ground discrimination along with a perceived depth in any depiction. At this point Arnheim introduces the concept of 'subdivision' which is the psychophysiological process of subdividing the projected scene into different levels of depth for the sake of increasing simplicity. Accordingly:

... subdivision occurs when a combination of self-contained parts yields a structurally simpler pattern than the undivided whole...Areas physically located in the same picture plane split apart in depth and assume a figure-ground configuration because simplicity increases when the oneness of the contour is uncontested and when the ground can be seen as continuing beneath the figure without interruption (Arnheim 1954, 245).

The same tendency towards simplicity functions in the amodal completion of the occluded parts where the perceptual system imposes the most regular interpretation to the unseen part of a figure.

The Gestalt rules of pictorial perception just considered have generally been related to the depth separation of flat objects seen in front. The information related to spatial distance have been indefinite in those examples. However, pictorial forms can also give the impression of a thoroughly consistent and continuous sense of space again by stimulating the tendency towards neural relaxation (Arnheim 1988, 167-87). As formerly discussed, the basic tool of constructing such a strong sense of space is 'projective deformation' which forces the observer to convert the two dimensional image into a 3-d object. Accordingly, deformation

decreases the simplicity of the pictorial image and increases tension in the visual field which consequently creates an urge towards a perceptual simplification.

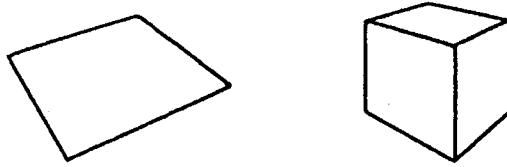


figure 10

The two 'deformed shapes' presented as figure 10 directly acquire spatial interpretations the left one being a plane receding in depth whereas the other being a three dimensional cube. Rather than seeing the configuration as two strange shapes made up of variously skewed rectangles the nervous system favors a right angled (simple) interpretation and attributes those skewed edges to the projective deformations caused by the objects' orientation through depth. If we think in Gibsonian terms, these two shapes represent features of two objects that would remain invariant when physically viewed in motion. In other words, pictures, according to Gibson, represent static correlates of the dynamic environment whereas these correlates (invariants) underlie the unitary act of seeing space. What we see in pictures, in this sense, are not forms but invariants. In direct opposition, Gestalt theory considers 'projective forms' as the basis of pictorial as well as natural seeing. Accordingly, regardless of the fact whether the observer is confronted with a picture or a real object visual perception begins with a flat and static picture on which three dimensional interpretation is imposed for the sake of simplicity. Moreover, familiarity with the represented form (either on retina or a



picture) does not affect the principle of simplicity even though the outcome percept may conflict with what is 'known' about the projected scene (Kubovy 1986, 97-8).

In accordance with all these rules of Gestalt 'linear perspective,' rather than simply being a retinal image duplication, proves to be a 'systematic method' of distorting the pictorial forms so that they can be perceptually interpreted as deviated projections of specific structures of space. Along with all the laws of simplicity formerly stated, basic linear perspective mostly uses two dominant rules of Gestalt which are right angledness and parallelism. As Shepard has experimentally demonstrated, human observers have a strong tendency to perceive a fork junction<sup>2</sup> as a rectangular corner in space if each of the three angles of the fork exceeds 90° (1990, 183). This is the basic Gestaltian tendency towards right angledness. Also the tendency to parallelism drives observers to see converging lines as being parallel which recede towards a vanishing point.

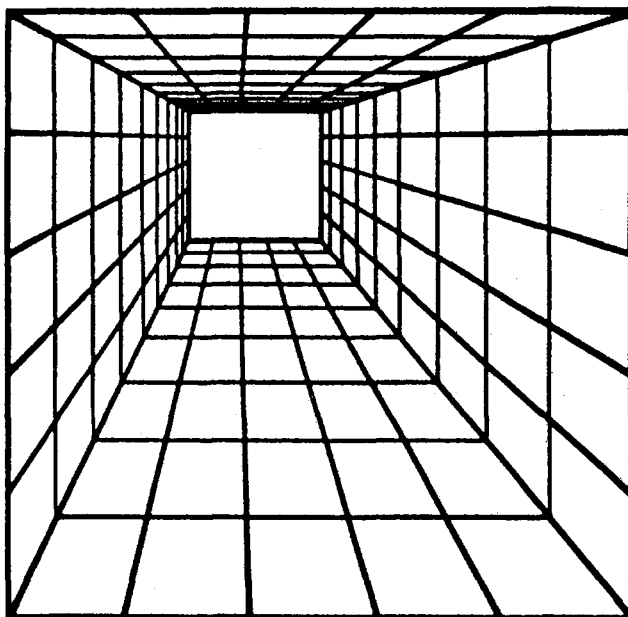


figure 11

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<sup>2</sup> A fork junction is formed by the meeting of three straight lines at a point.

These two basic laws of Gestalt clearly illustrate why we perceive the drawing presented as figure 11 as a rectangularly patterned tunnel receding through depth. Indeed, it is almost impossible to see what 'really' resides on the picture surface due to the neural search towards balance that prevents us seeing the trapezoidal 2-d shapes.

In opposition to Gibsonian assertion related to the primacy of texture gradients from which linear perspective is only a derivative Arnheim accepts the importance of line drawings in conveying the sense of space. Actually this is a logical consequence of the Gestaltian notion of pattern organisation: what we perceive is not only a projective duplicate but an organised and processed configuration derived from the captured scene. In this sense, the ordinary act of seeing is already 'pictorial' in essence as observers, just like a successful painter, tend to 'abstract' the implicit outlines from the projected retinal images of any real scene (Arnheim 1969, 27). Consequently, a representation does not need to duplicate the exact visual information to represent space sufficiently. As Arnheim declares:

Purely geometric line drawings such as converging checkerboard floors... contain most powerful depth gradients. This is so because the effectiveness of a perceptual gradient depends on the visual articulation of the pattern. The more explicitly the gradient is presented in shape, color or movement, the more compelling is the depth effect. Fidelity to the physical is not a crucial variable (1954, 276).

This is the major reason why Arnheim considers the sense of sight as 'intelligent' (1969, 37-53). Though dissonating with the notion of direct and natural apprehension of pictorial space the intricate constructive processes of the visual system has driven him to use

such a term. Nevertheless, Arnheim is quite sure about the 'psychophysiological' bases of human's direct apprehension of pictorial space which is based on an innate tendency toward neural relaxation.



## CHAPTER 4

### 4. BEHOLDER'S SHARE IN CONSTRUCTING PICTORIAL SPACE

The two approaches to pictorial space perception discussed as the second and third chapters of this study have been the 'projective' ones that illustrated the 'directness' and 'naturalness' of perceiving space from 2-d graphic configurations. While Gibson has presented a phenomenological approach with the idea of an 'unmediated' perceptual process, Arnheim, along with the other supporters of Gestalt theory, has talked about a constructive but 'innately founded' human ability of extracting space from two dimensional representations. On the theoretical scale of projective-constructive opposition Gestalt proves to be nearer to the constructivist extreme than the Gibsonian position. However, if we consider the issue from the viewpoint of innate-learned scale Gestalt and Gibsonian models fall within the same category having claimed the innate ability of humans in making sense of 2-d displays in terms of 3-d constructions. Due to this fundamental similarity in emphases some authors even treated these two distinct models as one unified theory (Millar 1994, 29-30).

#### 4.1. Criticism of Gibson and Gestalt

Both Gibsonian and Gestalt models of pictorial space perception have been subjected to severe criticisms by a group of pictorial

theorists who asserted that 'any viewer's perceptual relation to a picture could not be as natural and direct as Gibson and Arnheim have thought to be.' According to Richard Gregory, Gestaltian notion of innateness is the consequence of a lack of clear evidence about 'perceptual learning' at the time when Gestalt theory newly emerged. Gregory also considers the influence of contemporary German metaphysics as the other driving force beyond such a strong emphasis on 'innate human abilities' (1970, 20). Gestalt's 'dualism of form versus content' has been another point of criticism being a problematic concept that contaminated the theoretical apprehension of 'concrete thing perception' which actually operated in quite a different level than abstract gestalt forms (Ehrenzweig 1967, 18). It is known that in many instances object perception may precede the reception of *gestalten* which even evaporates without being slightly discerned. Julian Hochberg, the cognitive psychologist, is critical of both Gibsonian and Gestalt models of pictorial space perception speaking of the indeterminate bases from which these two theories stem from:

The mere fact that the appearance of a pattern cannot in general be completely predicted from the appearances of its parts presented in isolation does not by itself provide basis for reviving anything like Gestalt theory. And the mere fact that what has been called [Gibsonian] higher-order stimulus information about distal object properties are normally provided by the environment...by itself implies nothing whatsoever about the process of perception (1982, 191).

Hochberg's criticisms are stimulated by the ignorance of Gibsonian and Gestalt theories about the underlying mechanisms of perceptual phenomena. Both models tend to keep away from the idea of any intricate mental processes that can form the basis of the act of seeing. While the Gibsonian approach dispenses altogether with any mechanical explanations of picture-viewer relationship claiming the

importance of direct experience uncontaminated with any physiological, let alone cognitive, accounts, Gestalt theory constructs a graceful 'neurological fiction' based on one single principle -simplicity- for which all human physiology is supposed to strive.

The obvious advantage of Gibsonian and Gestalt accounts of pictorial perception is the elegant simplicity of the explanations they propose. Especially Gestalt model is an attractive alternative for a theorist who looks for the most 'parsimonious' explanation of the observed facts. The Gestaltian notion of isomorphism, the claim that the outer and inner phenomena have similar structures and are dominated by the same rules, is such a parsimonious explanation fitting well to Gestalt's eminent philosophy of simplicity (Attneave 1982, 27).

While being quite simple and common sense explanations of the observed phenomena, Gestalt and Gibsonian theories, however, prove insufficient in elucidating the more probable underlying mechanisms of pictorial perception. A number of recent experiments proved the fact that the perceptual system carried out certain 'constructive' operations of extracting 3-d meanings from 2-d displays quite different than those modelled by Gestalt theory (in this sense Gibsonian account is absolutely irrelevant here without having proposed any probable perceptual mechanisms other than certain phenomenological accounts). These new experiments revealed that seeing is an activity based on memory oriented and computational procedures rather than being a direct physiological outcome of external stimuli. It was also experimentally proved that influence

of expectations and cultural factors were quite high which conditioned a viewer's responses to the sense of space conveyed by a graphic configuration (Luria 1976, 41-5).

#### 4.2. The Limited Angle of Sight

The most significant empirical finding that has cast doubt on both Gibsonian and Gestalt theories is the fact that human's visual system can capture a severely limited amount of information at a single glance. While formulating their theories of pictorial perception that depended on the 'direct apprehension of the entire visual field,' Gibson and Arnheim both ignored the fact that human viewers can see a too small amount of the graphic surface to capture it immediately as a 'whole' (Hochberg 1982, 192).

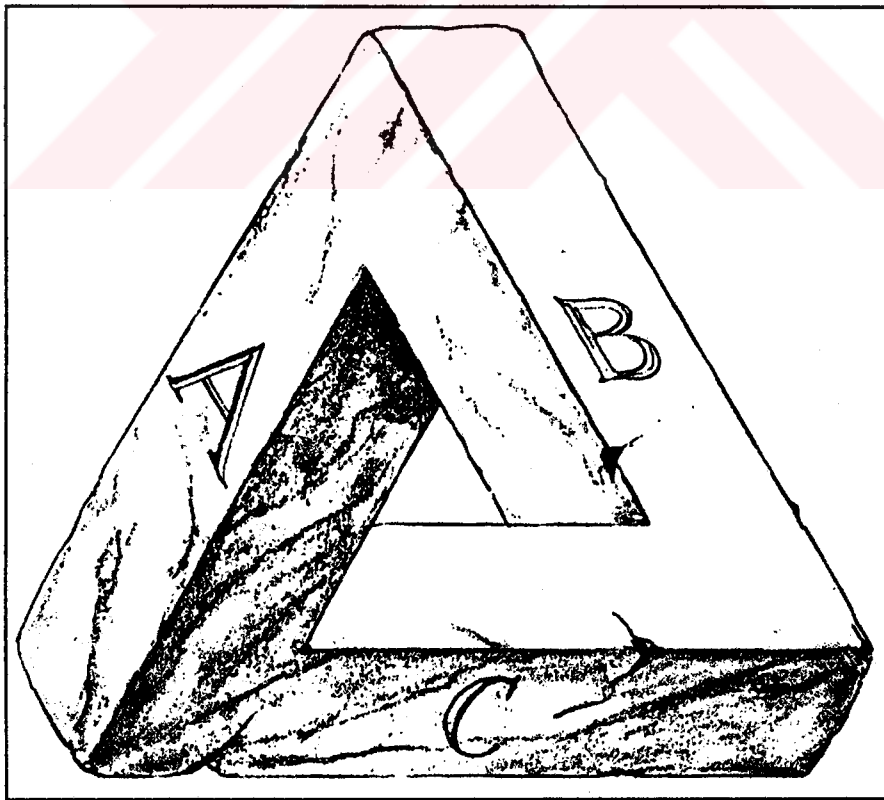


figure 12

The unusual drawing represented as figure 12 can be utilised as a good source to discover the temporal inability of the visual system in capturing extensive areas of pictorial surface. This is one of the most famous so called impossible objects, the Penrose Triangle, the observation of which disturbs any viewer with its inherently contradictory spatial construction. The drawing is so contrived that it is not possible for the 'eye' to settle for a consistent sense of concrete volume, as the three bars of the object are joined in such a manner to violate the physical laws of space. While the joints, viewed in isolation, indicate no spatial problem themselves, their mutual integration arises a sense of impossibility (Ernst 1992, 33). Such a unique property of the Penrose Triangle enables us to probe the limits of the visual system in terms of the amount of information it can capture at a single glance. A brief phenomenological introspection immediately reveals that our experience of the figure is dominated by a 'desperate search for spatial coherence' through an unending act of visual scanning. We shift our gaze on the represented object tracing the main axes of its bars continually jumping from one corner to the other with the aim of mentally assembling the 'separately captured' visual information. Here, the sense of impossibility is actually an outcome of 'the eye's inability of seeing the whole figure at once.' We capture the internally consistent sense of 'pictorial' space in one selected corner and proceed to the next one while keeping the former in 'mind.' This is a piecemeal and sequential process through which the picture is inspected for coherence. In the case of Penrose Triangle this process goes on without an eventual ending as the third captured edge always destroys the sense of consistent space conferred by the two former ones. If we were able to see the figure



in its entirety, in accordance with the Gestalt account, we would definitely have denied the rather 'complex' three dimensionality thus the impossibility of the drawing settling for a two-dimensional, flat interpretation. However, as the viewer is limited to a very small angle of sight, the artist can easily draw an impossible object which presents a contradictory structure for the 'sequential' sight system of human observers. It is actually not so easy to sense this sequential system in 'normal' pictures and real scenes as, in those cases, the search for coherence is satisfied in such an immediacy that we can not become aware of the act of scanning that underlies the processes of vision.

Figure 13, drawn by Hochberg, is a simpler evidence of this phenomenon which illustrates the fact that our spatial apprehension of a whole graphic display is constrained/determined by a very limited angle of sight (Hochberg 1982, 192).

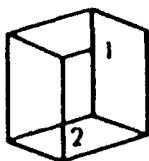


figure 13

The whole perceived spatial structure of the drawn rectangular box in figure 13 assumes a distinct organisation depending on which point the gaze is directed at. When point 2 constitutes the focus of attention the line/edge proximate to this point assumes a closer position in space despite the contradictory information presented by the surface near 1. Inversely, if the gaze is directed at point 1 then the whole object reverses in depth assuming a totally different

space structure. Many other similar experiments carried out with ambiguous figures illustrate that different percepts can arise by merely shifting the attention to different parts of drawn figures (Benjafield 1992, 167-8). At this point, it seems quite hard to preserve the old faith in the Gestaltian notion of 'the whole that determines the meaning/appearance of subparts' as the above reviewed observational evidence proves the contrary: subparts can determine the meaning/appearance of the whole.

While not completely negating the concept of perceptual disposition towards simplicity, which is actually a favorable state of internal representation, the above reviewed evidence related to 'stimulus limits and visual scanning' surely invalidates the holistic principles of Gestalt and the idea of 'isomorphic/physiological' tendency towards neural relaxation. Hochberg claims that many theorists that support a projective theory of pictorial space ignore the question of stimulus limits and all of the associated issues which naturally accompany that question (1982, 192).

#### 4.3. Memory

The limitation of sight angle and the process of visual scanning imply a significant theoretical assumption: if for much of normal perception the effective stimulus span in space and time is too small to instantaneously capture the visual field as a whole then 'mental structures' must comprise a substantial part of the perceptual processes (Hochberg 1982, 195). A part of such a mental structure should be a short-term memory that has to be used in saving/remembering a previously captured visual stimulus to mentally

combine it with the following one. In this way the separate 'snapshots' of the explored area are assembled in the viewer's brain to form a coherent sense of space unless the viewed object is an internally inconsistent depiction that stimulates an unending and desperate cycle of visual scanning (Kosslyn 1990, 87-94). Other than this primary mechanism of visual reading (short term memory), experimental evidence points to the presence of a second type of mental structure. The process of visual inspection proceeds in such an ordered way that implies the probable existence of 'predetermined' mental attitudes reserved for different 'kinds' of visible entities. This points to a 'long term memory' that guides the perceptual attitude to different visual objects by providing a rather large scale of mental scheme. In the drawing represented as figure 12 our experience of the Penrose Triangle is dominated by a highly organised pattern of visual exploration which doesn't seem to be a product of immediate decisions. Rather, we adopt a definite strategy of visualisation determined by the properties of the illustration. Being conditioned by such a mental scheme perception proves to be something highly structured where the saccades<sup>3</sup> are programmed in advance as discrete steps as to when, where and how far the eye will next be sent depending on the confronted object of vision (Hochberg 1982, 204). A piece of written text, an impossible object drawn in outline form and an open spectacle of landscape all require different reading strategies, and it is highly improbable that these mental entities are innately found in human physiology. Departing from all these premises it is not implausible to say that "memory", which provides the viewer with relevant

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<sup>3</sup> The eyes "jump" from one visible region to the other one rather than scanning the field in a gradual progression. Each visual jump is called a "saccade."

methods of seeing, is an important part of humans' perceptual access to the outer world.

#### 4.4. Pictures versus Reality

Having talked about the requirement of distinct mental attitudes for the perception of different objects, at this point, the genuine difference between pictures and reality should be emphasised. In Shepard's words, a drawing, objectively, is "only an array of marks on a two dimensional surface" which bears no intrinsic likeness to its objects of depiction (1990, 158). Though one may strongly resemble an outline figure to a person, such a resemblance can never be proved in objective methods. What, indeed, can be the physical relation between a number of nested lines aligned on a small piece of flat surface and a real human being that has a concrete volume in space? Actually, a two dimensional representation, either a high quality photograph or a loosely prepared line drawing, can really reflect only a very limited number of physical properties of the model object it belongs to (Gombrich 1992, 236). Viewed from this point, pictorial space perception, in opposition to the projective theory, can be considered as the product of a "remarkable kind of problem solving which is 'only partly similar' to reading reality of normal objects..." (Gregory 1970, 33). Though both depend on the piecemeal scanning process of the perceptual system, real and pictorial space should logically require different mental states as well as different exploration strategies. Therefore, pictorial space perception can not be taken as a direct consequence of the humans' ability to perceive the real space. It requires the development of a particular mental attitude and a specialised long-term memory that

can 'construct' the sense of space 'coded' through the outlines or color patches of a drawing.

#### 4.5. Constructivist Approach

The dominant theoretical paradigm that is gathered around these experimental evidences and the premises thus derived is the 'constructivist' or the 'computational' approach to pictorial space perception which models picture-viewer relationship as a constructive/computational process accomplished by the 'active involvement of viewer's memory.' Accordingly, to perceive the virtual space represented in a drawing involves a piecemeal 'reading' process (as illustrated in the above examples) guided by a previously acquired directory of experience with 2-d graphic configurations. In this sense, to construct the pictorial space conveyed by a graphic configuration requires a body of pictorial knowledge in the part of the viewer the absence of which converts any picture to nothing more than a flat surface stained with irregular and meaningless lines and patches of color. Being a product of perceptual learning, this pictorial directory can easily change in accordance to prevailing artistic and representational conventions. Without doubt, a European viewer probably perceives a perspective drawing quite different than a Far-Eastern viewer or a tribesman that has lived in the forests of South Africa. Different pictorial conventions bring the development of different mental directories/habits of picture reading, and no one can claim the superiority of one pictorial convention over the other as there cannot be a transcendent and objective method of representing the real world on flat surfaces (Jamake 1994, 92).

Before dealing directly with the constructive processes of pictorial space perception, 'constructivism' as a significant paradigm of psychological sciences, here, deserves attention. At the core of the constructivist assessment lies the premise that human beings are not passive receptors of incoming stimuli but they are involved in an active process of constructing 'meaning' by utilising their 'recollections' plus what they capture from the sensible environment. As Neimeyer puts it:

Constructivism is founded on the premise of meaning making; being human entails active efforts to interpret experience, seeking purpose and significance in the events that surround us...It is this drive toward meaning, this effort to forge significance and purpose from elements of experience, that typifies the human enterprise and that serves as the cornerstone of constructivist thinking (1993, 4).

Through his search after meaning in the environment, the human perceiver refers to his previously acquired directory of knowledge to supplement his sense impressions. Dretske models the process of visual perception in the same way:

The main function of the visual system is to take the visual data and construct, as best it can, a reasonable "hypothesis" (judgement) about the source of this stimulation. The conclusion that the perceptual system reaches constitutes the subject's perception of a definite object (1990, 139).

In the constructivist model of perception the perceiver, rather than extracting pure data from the available stimulus, 'adds' information to what he senses to reach a perceptual outcome. For, in constructivist terms, the primary stimulation that originates from an object is inherently ambiguous that needs cognitive supplementation to become something understandable (Dretske 1990,

139). As evident with regard to all these formulations, the constructivist notion of 'mediated' perception is essentially different from the corresponding concept of mediation proposed by Gestalt theorists. While Gestalt illustrates the viewer's process of perceptual construction as essentially an innately founded physiological function based on neural activities, the similar process is illustrated by the constructivist theory as an act of mental computation based on not analog but symbolic memory representations. In other words, from the viewpoint of constructivist assessment, what goes on in the perceiver's brain does not bare any analogic resemblance to its outer stimulus source whereas actually it is an act of logical comparison carried out between what is 'known' and what is 'seen' the underlying physiological mechanisms of which remains yet unknown.

#### 4.6. Software and Hardware

Here, the concepts 'software/hardware' used in computer terminology can be exploited as an illustrative analogy to further elucidate the perceptual approach the constructivists adopt (Benjafield 1992, 27). Gestalt can be considered as a theory which tries to model the 'hardware' (the physical structure) of the perceptual system with its emphasis on neurological functions and analog processes. Accordingly, the basic perceptual activities carried out by the human perceiver is the 'legal' functions of his physiological hardware that can not be changed by any processes of learning. Gestaltian hardware of the perceptual system is the cortical "field" of the human brain which is always 'on' through the process of reducing neural balance by altering perceptions. The constructivist

model, on the other hand, deals with how the perceptual system is "programmed" to carryout certain routines/software rather than trying to attribute the observed phenomena to an imagined perceptual hardware the exact structure of which, after all, can not be fully understood. Ulric Neisser, one of the founders of cognitive psychology, bases his theory of visual cognition on a similar analogy with computers:

The task of a psychologist trying to understand human cognition is analogous to that of a man trying to discover how a computer has been programmed... if the program seems to 'store' and 'reuse' information, he would like to know by what "routines" or "procedures" this is done... he will not care much [how] his particular computer stores information... he wants to understand the program, not the "hardware." A program [software] is not a machine; it is a series of instructions for dealing with symbols...The cognitive psychologist would like to give a similar account of the way information is processed by people (1967, 6-8).

The concept of 'mental software' also implies the variable and inconsistent nature of human perception. For, if similar machines/hardwares can be programmed to execute vastly different applications, human brain, with its programmable nature, can also 'run' innumerable different procedures of visual perception. In this sense, different cultures and conventions of depiction can all be attributed to different softwares of seeing.

#### 4.7. Information Processing Theory

Constructivist theory of pictorial space perception adopts the 'information-processing' model of cognitive psychology as a main guide through which it deals with perceptual issues. Accordingly, human mind possesses a finite number of basic mechanisms for processing information, mechanisms that can be grouped or arranged



into strategies, or programs in the computer sense, that allows complex [perceptual] problems to be solved. The basic structure of such an act of problem solving is constrained by the memory capacities of the human mind. As the 'human's short term memory' is seen inadequate to handle a problematic situation with a totalising approach the problem solver has to fragment the problem area into elementary subtasks which are inturn solved in a sequential fashion (Rowe 1992, 51). In the context of picture viewing, the elementary pieces of this stepwise info-process are the snapshots separately captured from the graphic surface. The distinct pieces of spatial meanings derived from the picture are processed within the domain determined by the short term memory (STM)<sup>4</sup>. As evident from the formerly given example of Penrose Triangle the capacity of the short-term visual memory is quite poor requiring saccadic eye movements to apprehend the 'whole' picture and to 'refresh' the parts of the scene deleted due to the continuous income of new information. The basic function of 'long term memory' (LTM), in this system, is to provide the general strategy of "information pick-up" determined by the object of vision. In this sense, LTM proves to be a directory of pictorial meanings acquired in time by a process of so called 'perceptual learning.' The pattern of visual snapshots and the general strategy of pictorial meaning attribution is directed by LTM which 'runs' the relevant software of 'spatial meaning extraction' depending on the kind of 2-d configuration confronted. LTM chooses the most appropriate way of 'reading' the picture within a search space of available pictorial knowledge.

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<sup>4</sup> Being the active part of the system where goes on real-time processing, short-term memory is also known as "working memory"

#### 4.8. Beholder's Share: The Constructivist Model of Pictorial Space Perception

The fundamental premises of the constructivist theory of pictorial perception have been summarised up to here. The following part of this section will concentrate more on the details of constructivist model by considering the ideas of two eminent theorists that seem to lead this approach in the field of pictorial theory. Ernst Gombrich (art historian) and Richard Gregory (psychologist) are the most influential personalities of the theoretical domain that represents the constructivist position. Both Gombrich and Gregory, in their treatises, illustrate pictorial space as a memory based 'construct' of the human mind. The title of this section, "Beholder's Share," is inspired by Gombrich's well known expression which he uses to denote the 'active involvement' of the observer in extracting spatial meanings from pictures (1992).

Utilising the fundamental assumptions of information-processing model of cognitive psychology, Gregory and Gombrich illustrate the process of pictorial space perception as a stepwise perceptual inquiry made up of basic constructive processes. The units/steps of this process are the 'snapshots' sequentially captured from the graphic area. Each of these is limited by the constraints of the treatable stimulus size which is not more than a couple of degrees. Constrained by such limitations the perceptual system carries out a two-step constructive activity. Throughout each instance the eyes capture a new portion of the pictorial image: formation of an object hypothesis and verification of it by a comparison made with the one developed for the previously captured portion. Viewed from this

point, pictorial space, rather than being determined by the stimulus patterns - the graphic configuration itself, proves to be the consequence of a 'dynamic search' for the best 'interpretation' of the available pictorial data (Gregory 1990, 21). In other words, the perceived pictorial space is the object hypothesis mentally approved to possess the highest probability to be represented on the graphic surface. Being such a highly constructive process, perceiving the pictorial space requires a special state of mind that is characterised by a 'readiness' to attribute probable meanings to inherently meaningless lines and patches of color, and the strategy of such a meaning attribution is determined by the ingredients of viewer's 'memory.' The information related to the hypothesised objects and the appropriate mode of scanning relevant to the particular type of depiction both reside in the 'mental directory' formerly named as Long Term Memory. Without such a directory of knowledge any picture whether a photograph or a loosely drawn caricature turns into a piece of paper stained with meaningless patches of color. Thus, the first step in the process of pictorial space construction, after mentally deciding that the encountered object 'is' a picture made to be looked at, is the retrieval of the most appropriate strategy of scanning relevant to the kind of picture confronted. An outline drawing, a photograph or an abstract painting all require different modes of visual inspection. Following this fundamental process of mode decision, the eyes scan the graphic surface sequentially capturing different patches of pictorial data. For each snapshot the system develops an object hypothesis/anticipation that requires to be 'confirmed (Benjafield 1992, 167). The process of confirmation is actually a consistency test carried out among the captured snapshots saved within the

limited capacity of the Short Term Memory. If one particular object hypothesis does not require any revision or change during the following sequence of snapshots then it is said to be 'confirmed.' In this sense, the determining factor in the construction of pictorial space proves to be the 'internal coherence' of the developed hypotheses/anticipations. When the internal congruity of the picture is confirmed within the perceptually determined picturing conventions then the observer is said to 'see' the represented space.

Beholder's Share in constructing pictorial space can be illustrated by using an analogy with the basic act of understanding the spoken and written language. Though we generally experience no difficulty in our oral communication with people this is not just because everybody uses certain 'exactly determined speech sounds' that refer to corresponding concepts residing in a common mental directory. An attentive auditory observation easily reveals that spoken representation of a certain concept varies among people in terms of produced tones, accents and certain omitted sounds. If we relied merely on the selection of precisely fixed sound correspondences from a predetermined directory (language) it would probably be impossible for people to orally communicate. Rather than passively waiting for the exact verbal correlates of meanings to be aurally produced we 'listen' to speeches in a peculiarly 'tuned' way; we develop anticipations about what can be said/meant in a certain logical context. While different languages are quite large contexts of developing anticipations there are innumerable various small scale contexts for the listener to get adapted. This constructive role of the listener in understanding the spoken language is quite

obvious in listening a radio programme corrupted with noise. If the listener ascertains the specific language and the theme of the broadcasted speech then he can 'mentally compensate' for many actually non heard words and sentences. Such a speech is said to be understood if the anticipations/hypotheses developed all through the listened part form an internal coherence. Surely, this process works only if the listener is familiar with the specific language being spoken as mental compensation requires an established directory (LTM) of speech sounds without which any talk becomes a meaningless aggregate of noise. Reading a piece of written text requires a similar act of mental construction as the reader scans the lines with certain expectations determined by the above mentioned factors of context. This is why we usually do not notice misprints perceptually correcting them being guided by a long term memory.

#### 4.9. The Effort After Meaning

Meaning construction is a deeply ingrained tendency of any human perceiver which even obstructs him from perceiving anything as totally 'meaningless.' This is what Bartlett termed as the 'effort after meaning,' an inherently founded disposition of all human beings in making sense of their tangible environment (Gombrich 1982, 179). We do not give up the process of mental search and meaning attribution till we believe that what lies before us have a certain significance and structure that we can understand. This is the main reason why oculists, who wish to test our eyesight, use random letters rather than coherent texts as they aim at separating what is 'really' sensed from what is 'logically anticipated' (Gombrich 1982, 179). The perceptual effort after meaning is

mostly evident in Rorschach inkblots which are drawn intentionally to stimulate the dynamic construction of different perceived objects as they do not favour one definite object-hypothesis to be adopted by the viewer.



figure 14

The unique aspect of a Rorschach depiction is the essential impossibility of settling for a concretely established spatial meaning for what is seen on the paper surface. Despite this intended ambiguity, however, people still tend to 'see' certain objects in Rorschach inkblots. As Gregory states:

Ink spot or object? The Rorschach personality test depends on the fact that we tend to 'see' objects even in the most ill-structured figures... An ink spot has an unlimited number [of interpretations], with no one highly probable. We tend to select objects which have interest: perceptual and personality differences may appear in the selection (1970, 38).

The piecemeal scanning process that looks for the confirmation of an anticipated object hypothesis, confronted by such an ambiguous inkblot, enters into a loop hitting continually upon different percepts determined by various continually changing mental factors.

The other extreme point along such a scale of meaning attribution would be a faithfully rendered perspective picture (without intentionally inserted paradoxes) which utilises the commonly accepted conventions of pictorial space. Such representations are immediately apprehended by viewers as they guide the [western] perceivers' effort after meaning by exploiting the 'most commonly used routine' of spatial meaning extraction. Due to their ease and immediacy of being perceived, perspective depictions are generally accepted to be 'natural' ways of representing space. In technical terms, a detailed perspective construction, nevertheless, can be said to 'resemble' its model object model more than a cubist painting. For linear perspective possesses an objective component; it gives the technically sound knowledge of occlusion. In other words, by looking at a perspective depiction the viewer can correctly learn what things are visually occluded at the exact vantage point from which the representation is constructed. Also the information of color can be given as another component of relative objectivity (Gombrich 1982, 187-201). However, all these by no means imply that perspective does not need beholder's share. The only thing is that it is 'easier to learn' the conventions of linear perspective than the rules of a complicated written language or a highly symbolic procedure of picturing. Such an ease makes the process of perceptual reading so transparent that it drives people to consider perspective as a 'natural' way of pictorially representing space while it is definitely not so.

#### 4.10. Escher: Reading the Impossible Space

The complex underlying mechanisms of 'reading' pictorial space can be most obviously discerned in Escher's illustrations where he has depicted spatial structures that seem 'impossible' to exist in the real world (Locher 1992). These illustrations are Gombrich's most commonly referred material in unveiling the obscure perceptual processes of pictorial space construction/perception (Gombrich 1965, 154-56).



figure 15

A typical Escher illustration initially encourages the viewer to adopt the 'regular' mode of picture reading ordinarily utilised by any contemporary observer accustomed to seeing perspective pictures. However, following a brief period of visual exploration the viewer discerns, for his surprise, that the reading strategy normally utilised for ordinary perspectives do not suffice to 'construct' a



proper sense of space with this graphic configuration. For Escher's 'virtual space' possesses some unresolvable contradictions avoiding the perceiver to perceptually settle for a concretely founded space structure. *Solid and Hollow* presented in figure 15 is such a typical Escher print that disturbs the viewer by presenting mutually conflicting spatial data which avoid the endurance of any 'concrete object hypothesis' during the process of sequential reading. Starting from the left side of the illustration the perceiver/reader easily proceeds without any interruption as the constructed scene is internally consistent: a black woman walking over a curved bridge toward a series of downward stairs. Similarly, the reading process if started from the opposite (right) side does not cause any perceptual problems either: a man climbing a ladder through a space vaulted by a large bridge. However, a catastrophic problem arises when the reader tries to cross the central axis: the object hypotheses held up to that point do not work anymore and the sense of pictorial space totally collapses urging the viewer into a desperate eye search to rebuild the coherence. This search in turn reveals that everywhere in the depiction corresponding shapes must be read as hollow in one context and solid in another and, every time, the meeting of both readings create a stalemate. In Gombrich's words: "The assumption with which we have started breaks down, and we have to begin all over again, only to discover that here too we are led into perplexity" (1965, 155).

Actually, there is nothing impossible in Escher's illustration. The contemporary viewer has internalised the language of linear perspective in such a strong manner that he can not 'see' the depiction as a flat surface. His mind, rather, penetrates the

picture surface forgetting that the encountered object is no more than a flat configuration of lines and variously tinted stains. This is the essential weakness of the perceiver on which Escher builds all his 'magic' depictions. It is easy to 'fool' such a conditioned mind for which the process of reading and hypothesis confirmation have become so transparent. Gombrich deems Escher's prints as unique tools for revealing the hidden complexity of all picture reading:

What [Escher's] prints have in common is that they compel us to adopt an initial assumption [hypothesis] that can not be sustained as we try to follow it through...When we look at a 'normal' representation, there is nothing to prevent us from forming a hypothesis about the figure-ground relationship or about the way the shapes add up to pictures of objects. We therefore believe that we take in the picture more or less at one glance and recognise the motif. Our experience with Escher's contradiction shows that this account is inadequate. We read a picture, as we read a printed line, by picking up letters or cues and fitting them together till we feel that we look across the signs on the page at the meaning behind them (1965, 155).

#### 4.11. Culture and Illusion

Such an internalised 'language' of pictorial space, the linear perspective, also causes the contemporary Western viewer to become highly vulnerable to certain types of pictorial illusions. One such illusion is aroused by the so called Muller-Lyer arrows which manifests itself by the perception of an illusory difference between two lines actually having similar sizes.

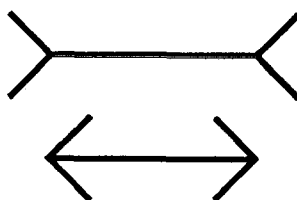


figure 16

Gregory regards the effect aroused by the Muller-Lyer arrows as a 'cognitive' illusion caused by the deeply internalised rules linear perspective (1994, 253). The line at the top 'seems' to be longer than the one at the bottom as it carries a fundamental cue for farness: the lines that are parallel to each other seem to converge as the distance increases, and the inverted arrows of the top figure confer such a cue. The perceptual system culturally programmed to 'run' the software of linear perspective develops different object hypotheses for the two lines the objective sizes of which are exactly the same. The cultural/cognitive bases of this illusion is also confirmed by the evidence derived from the experiments carried out with people alien to our pictorial culture. It has been observed that many African tribesmen, who had spent their lives among forests and irregularly shaped huts, did not experience the Muller-Lyer figures as we did.

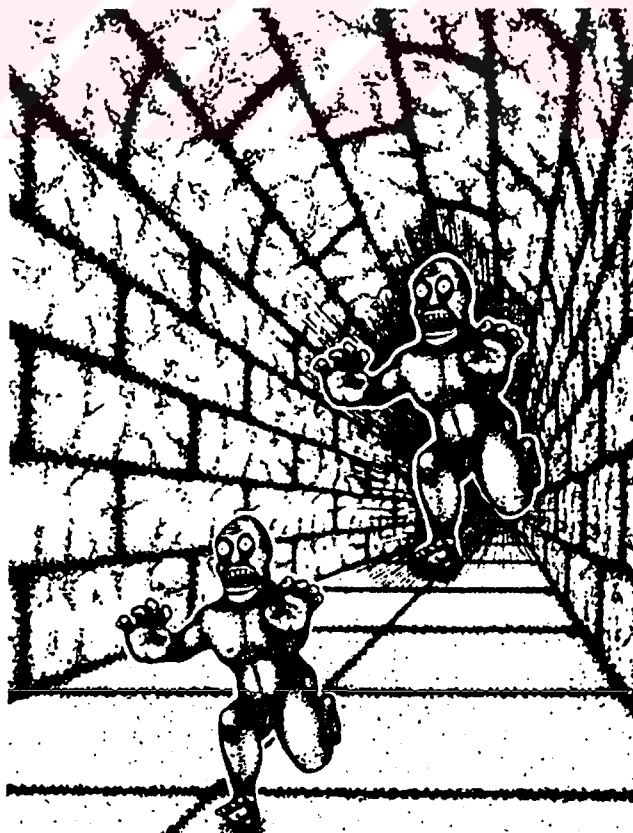


figure 17

In this sense, such people, who do not know how to 'read' our language of pictorial space, can not be supposed to construct one of the monsters in figure 17 as larger than the other.



## CHAPTER 5

### 5. DENOTED SPACE: GOODMAN AND PICTORIAL LANGUAGE

The previous chapter has considered the 'constructivist' views of Gombrich and Gregory who illustrate the perception of pictorial space as a 'piecemeal act' of mental construction. The underlying structure of the model was essentially based on the premises of information-processing school of psychology the founder of which was Ulric Neisser (1967). Neisser had constructed this cognitive system as the incorporation two essential parts. Accordingly, Short Term Memory (working memory) was responsible for the basic act of visual scanning, and the strategy of scanning and meaning attribution was derived from the ingredients of Long Term Memory which consisted of a directory of learned viewing habits and pictorial conventions. Characterised by such mechanistic theories of cognitive psychology the previous section dealt with intricate psychological mechanisms of pictorial seeing. For, the justification of the basic arguments stated by Gregory and Gombrich required the treatment of such technical details related to graphic perception. The present chapter, however, differs from the preceding one in this respect. Dealing with the extreme point of constructivism related to pictorial vision "The Denoted Space", as the title itself implies, concentrates more on the aspects of cultural relativism and signification rather than any mechanical or physiological systems. As a result, the scope of this chapter transcends the boundaries of

the subject "pictorial space" dealing with certain essential questions related to pictorial representation in general.

### 5.1. Gombrich's Relatively Naturalistic Approach

Here, the essential difference between the notions of constructivism presented by this and the previous chapter requires focus. The difference lies in Gombrich's particular approach to pictorial vision. While supporting the constructivist paradigm of picture-viewer relationship Gombrich presents a peculiar attitude towards the opposition of nature versus pictorial conventions which puts him in a place one step before the extreme constructivism. The historical and regional preference for a certain style/type of depiction, in Gombrich's model, proves to be far from being 'totally arbitrary' conditioned by 'natural metaphors, the biological significance of the depicted scene or the object and particular constraints of the human's perceptual system. Therefore, the relation of a picture to what it represents, though the depiction itself requires beholder's active involvement to be read correctly, does not display the same relation as a word does to what it denotes. There may exist a more 'inherent association. These views of Gombrich, actually, do not damage his notion of 'viewer's constructive engagement' in extracting space from pictures. However, they put him in a place through the theoretical scale a bit distant from the extreme point of constructivist assessment.

In the previous chapter, the aspects of relative objectivity that Gombrich attributes to perspective were very briefly considered. Accordingly, a picture drawn in correct linear perspective was 'more

alike' its object of depiction than a cubist painting in a number of features. Perspective, while still requiring a perceptual construction in the part of the observer, possessed a certain degree of reliable information about what it depicts. Through the following parts of this chapter, Gombrich's above mentioned aspects of pictorial objectivity will be treated in more detail to compare his approach with the extreme point of constructivism represented by Nelson Goodman in which pictorial depiction proves to be exactly similar to verbal description.

## 5.2. Intended Purposes of the Depictions

Before emphasising the objective aspects of pictorial representation Gombrich, in his article "Mirror and Map," warns visual theorists not to fall into a very common pitfall which is the main reason for many scholars to become radical constructivists. Accordingly, before 'deciding directly' about the utilised conventions of picturing that point to the existence of different visual languages, the intended 'purposes' of the investigated pictures should be extracted (Gombrich 1982, 188). In Gombrich's view the ignorance to this aspect of pictorial depiction drives visual theorists to adopt absolutely relativistic approaches; they do not consider the originally intended purposes of the pictures they are analysing and attribute all the representational peculiarities to cultural relativism. As Gombrich, himself, states:

...the great variety of styles we encounter in the images of past and present civilisations cannot be assessed and interpreted without a clear understanding of the dominant purpose they are intended to serve. It is the neglect of this dimension which has suggested to some critics that the range of representational styles must somehow reflect a variety of ways in which the world is seen. There is only one step from this assumption to the assertion of a complete cultural

relativism which denies that there are standards of accuracy in visual representation because it is all a matter of convention (1982, 188).

Here Gombrich gives the example of the ancient Egyptian convention of drawing architectural entities in the shape of their ground plan while men in elevation as shown in figure 18

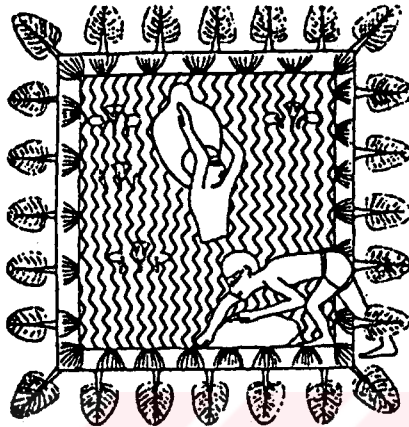


figure 18

Rather than assuming immediately that the ancient Egyptians had seen their world this way or attributing the form of such a depiction to a rigidly established language of visualisation, it seems a better start to investigate the end purposes such a picture would have been drawn for (Gombrich 1992, 127-32). Gombrich resembles this style of depiction to the mapping conventions very commonly utilised in today's tourist-guides which represent a scaled plan of the relevant city overlapped by the appearance of certain sites in side view (1982, 187). Everybody is sure that the tourist guides do not represent a way of seeing the environment. They are drawn in accordance to certain functions to be fulfilled: to show the paths to follow while depicting the outer appearance of certain sites worth visiting. In this sense, every historical depiction should be inquired by keeping in mind the fact that it could have been constructed to serve a very particular purpose other than a desire



of representing the seen environment as it is experienced. For the visual theorist it is crucial to clarify the intended purposes of the inquired depiction to separate the functional forms from ways of seeing and depicting. This is the main argument which conditions Gombrich's attitude to analysing certain historical forms without falling into absolute relativism.

### 5.3. Natural Metaphors

Reminding the visual theorist about the importance of the intended purposes on which depictions may be based Gombrich goes on to consider the relatively 'natural' aspects of pictorial representation which may confer standards of objectivity. He believes that while certain representations are not duplications of reality in any sense of the term, they should not necessarily be 'totally arbitrary' also (1982, 184). In this context, Gombrich considers the pictorial correspondence of color as a 'natural metaphor' the reception of which is relatively more 'direct' and less arbitrary than other elements of pictorial description. He again utilises maps to illustrate this notion of pictorial objectivity:

We would be puzzled to find a map of London in which the parks were marked blue and the ponds green, because the other arrangement is so much easier to learn and keep in mind. It would be interesting to investigate cartographic codes from this viewpoint of *mnemonics*. A map in the Times Atlas representing temperatures in various latitudes shows the warmer regions in darker red and the cold ones blue. No doubt we could also learn the opposite code, but why not make use of these 'natural metaphors'? (1982, 184).

Gombrich attributes the conventionalisation of the use of these 'natural' color correlates to the historical interest in conceptual

categorisation. Another evidence he gives for the existence of a standard of objectivity related to pictorial representation is the common practice of converting photographic negatives into positives. Actually, the negative version of a photographically captured scene contains exactly the same visual data with its positive print. However, all through the history of photography, negative films have always been printed in positive regardless of the fact that the latter is no better than the former in terms of the conveyed information. For Gombrich this conversion can not be due to an arbitrary habit: "In any case if it were just a conventional notation the inventors of photography would not have evolved the process of turning a negative into a positive. It is most 'unlikely' that it is merely our habituation which makes it easier for us to read the latter" (1982, 186). Positives are easier to be read as they provide the viewer with more 'direct,' not to say exact, information related to the captured scene. They utilise the natural metaphor of relative color correspondence.

#### 5.4. Scale of Learning Ease-Difficulty

Surely, Gombrich does not claim for the existence of an absolutely 'objective' method of representing space on two dimensional surfaces. He neither denies the fact that innumerable conventions of depiction can be learned by viewers to the extent of accepting those conventions to be ultimate ways of picturing. What Gombrich, rather, talks about is a continuous scale of learning ease/difficulty determined by the peculiar form of the depiction. In his article "Image and Code" he declares:

As soon as we approach our problem from this angle, the angle of the ease of acquisition, the traditional 'opposition' between 'nature' and 'convention' turns out to be misleading. What we observe is rather a *continuum* between skills which come naturally to us and skills which may be next to impossible for anyone to acquire. Surely a cipher machine can operate with constantly varying codes which no human brain could master and apply (1982, 283).

Viewed from this point, it proves deceptive to equate verbal language with pictorial representation as the latter have a mobility on the nature-convention scale whereas the former resides on the pure convention point except a few voice metaphors like onomatopoeia. As a logical consequence, it is frequently easier to pick up a pictorial code and adjust to its notation than to learn a foreign language.

#### 5.5. Biological Significance and Constraints of the Perceptual System

Other than the use of natural metaphors like the color correspondence just mentioned, the scale of learning ease/difficulty in pictorial representation is determined by the biological significance of the confronted depiction and the constraints of the perceptual system which determines the limits of what can be perceived and adopted as a pictorial style. To illuminate the concept of biological significance Gombrich offers to carry out experiments with people foreign to our pictorial culture. Though the untutored tribesmen who live in dense forests may display difficulty to decode even a high resolution photograph, the crucial point for Gombrich, here is how much time it takes for the subject to learn this language. To quote Gombrich again:

...it would also have to be asked whether any difficulty is experienced in recognising, for instance, toy animals made of wood or outline drawings of familiar objects, particularly of features of immediate cultural and psychological significance. Investigators appear to have been shy, for instance, of using erotic imagery, though the reactions to this kind of material by the most untutored does not appear to suggest great difficulty in learning its significance (1982, 186).

Accordingly, the time interval required to learn how to decode a verbal description of a naked woman should differ from the one required to perceive a nude in a painting. The code of the latter surely demands quite a less time to be acquired. Gombrich presents this fact as a strong evidence against the commonly believed discrete opposition between nature versus representation. Another, rather less obvious, evidence set against the belief in the total arbitrariness of pictorial representation is the existence of certain constraints in the perceptual system beyond which any pictorial convention can not be stretched. The most well-known example for such a constraint is given by Michael Kubovy in his treatise written about Renaissance perspective (1986, 120-1). Kubovy shares the same beliefs with Gombrich regarding the objective aspects of linear perspective, and he sets out to show how this pictorial tool can not be deemed as an arbitrary method of spatial representation since it is constrained thus shaped by certain limitations and tendencies of the perceptual system. In this context Kubovy criticises Nelson Goodman's 'insensitive' constructivism:

Goodman would have to claim that what perception can do depends on what it learns to do, and that there is no limit to what perception can learn. But that argument is false. There are clear limits to the extent of perceptual rearrangement to which human beings can adapt. We cannot change the way we perceive optical information, nor can we arbitrarily change our motor responses to it, regardless of the amount of time or effort we might invest in doing so (1986, 165).

Michael Kubovy clearly illustrates that the mathematical rules of perspective do not inscribe untranscendable laws. They are, quite the contrary, shaped and even distorted by the constraints of human's perceptual system. With regard to Kubovy's mathematical analyses even the most rigorously drawn perspective rendering violates the rules of projective construction in depicting human bodies and cylindrical structures. For, the perceptual system, while experiencing no problem with rectangular settings of architectural environment, does not accept the correct central projection of human bodies and cylindrical columns as 'realistic.' Consequently, many well-known artists of the Renaissance drew human figures from a center of projection irrelevant to the total perspective structure of the picture. This is what Kubovy terms as 'the primacy of perception' denoting the fact that any language of representation can be constructed if only it resides within the boundaries of what human perception can accomplish (1986, 120-1). In the context of linear perspective 'correctly constructed' human figures are pictorial elements outside the acceptable limits of the visionary system. Such figures are drawn in accordance to a different set of techniques other than the strict rules of central projection. Kubovy, along with Gombrich, utilises this cue against the common belief in the total arbitrariness of all the representational techniques as well as linear perspective. In this sense, while it is possible to construct even innumerable 'forms' of pictorial depiction this does not imply that the kind of graphic elements available for the representation of a specific object is totally limitless. It is not possible to devise any form of pictorial representation arbitrarily without considering the basic constraints of the visual system.

## 5.6. Objectivity of Linear Perspective

In addition to the argument of the perceptual limitations, Gombrich attributes an aspect of causality to the system of linear perspective which he formulates as the 'negative rule of objectivity.' In his article "Standards of Truth," Gombrich illustrates that it is not possible to decide exactly on what a perspective rendering may really convey about the subject spectacle; but the question becomes easier if one tries to answer what the same rendering does 'not' show about the depicted scene. Accordingly, a photograph or an accurately constructed perspective rendering is a correct record of what can 'not' be seen from the specific vantage point which the photograph or perspective is constructed. Gombrich believes that this negative rule may eliminate many ill-natured questions about what can be pictorially represented:

I should like to propose that what I have called the negative principle of eye-witness record could lead to an agreement about the nature of perspective and its problematic features. According to my formula, perspective enables us to eliminate from our representation anything which could not be seen from one particular vantage point - which may still leave the question open as to what can be seen . (1982, 253-6).

This objective knowledge of occlusion, moreover, is not affected by the ambiguity or multivalence of the projected third dimension in any pictorial image. It remains available in case the depiction is constructed according to the rules of linear perspective.

The essential points that illustrate the relatively anti-constructivist views of Gombrich have been briefly summarised upto here. While believing in the constructive function of the viewer in extracting spatial meanings from pictures, Gombrich happens to fall

within a theoretical category a bit distant from the point of extreme constructivism. Taking Gombrich's peculiar attitude to pictorial representation as a vantage point the following part concentrates on the extreme constructivist theory adopted by Nelson Goodman and his followers. As formerly mentioned, due to the large domain through which Goodman discusses the issues about depiction, the scope of this section transcends the boundaries of the particular topic 'pictorial space' dealing with the phenomenon of pictorial representation in general.

#### 5.7. Gablik's Criticism of Gombrich

Gombrich has been subjected to severe criticisms by the 'extreme constructivists' who model pictorial representation as the product of a 'language-like' structure which does not retain even the slightest correspondence with the depicted portion of reality. Viewed from this extreme point, anything can represent any other thing and no style or form of depiction can be favored by the perceptual system as it is presumed in Gombrich's scale of learning ease. Having presented such a scale of acquisition Gombrich determines certain standards of objectivity that point to the acceptance of a 'real world' apart from the perceptions of the observer. In opposition, the essential argument of the extreme constructivists begins with the premise that 'no objective world can exist other than what the observer constructs.' This is the major point Suzi Gablik emphasises in her criticism of Gombrich's model in *Progress in Art* (1976). She maintains that Gombrich rests his theory fallaciously assuming the existence of an objective world the

relatively realistic representation of which can be extracted using a number of alternative methods.

Conflicting with his constructivist appearance Gombrich founds his reflections, concretely, on a set of postulates which regards perception as the source of knowledge belonging to the real world that is independent of the perceiver (Gablík, 1976, 168). Indeed, such an idea of objective world can clearly be discerned in the arguments of natural metaphors and the objective aspects that Gombrich attributes to linear perspective. Gablík criticises this aspect of pseudo-constructivism in Gombrich's model in her following words:

Gombrich's theory rests on a psychological relativism which is still far removed from such an idea of 'construction.' He fails to stress sufficiently the sense in which the artist's thought is primarily active rather than merely being reactive. He stresses the role of subjectivity in perception without ever arriving at the concept of an epistemological subject whose power of radically assimilating physical reality allows him to construct it into an object of knowledge (1976, 171).

In Gablík's model viewers do not see the same thing and interpret it differently, but they just see something different (1976, 172). Every distinct memory in the part of the observer, consisting of various cultural and subjective experiences, brings different phenomenal worlds destroying the sense of any standard in accordance to which the correctness of representations can be checked. From this vantage point no special kind of depiction can 'intrinsically' confer ease in acquisition due the arbitrary nature the visual language.



## 5.8. Goodman's Model of Pictorial Denotation

The most significant theorist of the extreme constructivist approach related to pictorial representation is Nelson Goodman who has modelled the picture-viewer relationship in terms of arbitrarily constructed 'symbol systems' (Hagen 1980, xxiv). Actually, Goodman has such an extreme and distinguished position in the area of constructivist thought that, within the scope of this thesis, it is not possible to include more than a few number of theorists in the category represented by him. Goodman has reflected his peculiar approach in a number of areas including logic, epistemology, psychology and arts forming an intricate model of a constructive subject, and he is known for his total relativism related to any system of representation:

[Goodman] refuses to give any priority to a material world or to a description in terms of physics. In his view, physics -be it the variety put forth by Aristotle, Newton or Einstein- is but one version of the world. And this version is not inherently superior to versions of the world fashioned by Homer, Shakespeare, or James Joyce. As scientific or artistic creators, we do not solve the jigsaw puzzle of reality rather, we build endless realities out of lego (Gardner 1982, 62).

Departing from such a relativistic assumption Goodman establishes his model of pictorial representation with 'symbol systems.' The most important treatise where Goodman establishes his language-like model of depiction is *Languages of Art* (1968) in which he illustrates how pictorial representation is essentially based on 'denotative' aspects of graphic sign systems which are totally arbitrary structures of signification. In Goodman's model a picture is a symbol of what it represents. A picture stands for /refers to /denotes the object of the scene that it is said to represent and

all these attributes of signification are absolutely independent of the criteria of resemblance which, above all, can not be tested. (Goodman 1968, 6). Goodman, in his chapter "Reality Remade" explains, in logical terms, how resemblance in any degree cannot be a measure for representation. Primarily, an object resembles itself to the maximum degree but rarely represents itself; resemblance is a reflexive property that cannot be applied to representation. Representation, moreover, does not share the property of 'symmetry' with resemblance in the sense that B is as much like A as A is like B if they are said to resemble each other, however, while a photograph can be said to represent a friend of mine 'faithfully' my friend can definitely not be said to represent the photograph. To give another example, in many cases neither one of a pair of very like objects represents the other: a man can not be the representation of another man, even his twin brother; also none of the perfectly similar products off an assembly line is a picture of any of the rest (Goodman 1968, 4). Deriving from these logical premises Goodman discards the criteria of resemblance as being neither a sufficient nor necessary condition for representation. In addition to the logical puzzle that the concept of resemblance confers for representation a subsequent problem is the selection of the aspects/properties that will be represented in the picture. Goodman talks about the existence of even uncountable 'properties' of things in his book *The Structure of Appearance* (1951, 95-7). The unresolvable question is: which properties/aspects of the object should be represented to achieve a successful picture of it? Departing from this point Goodman severely criticises the conventional imitation theory:

"To make a faithful picture, come as close as possible to copying the object just as it is." This simple-

minded injunction baffles me; for the object before me is a man, a swarm of atoms, a complex of cells, a fiddler, a friend, a fool and much more (1968, 86).

In this sense, the 'copy' theory of representation fails at its start by the inability to specify what is to be copied. In opposition to the perspectivist claim of 'the visible appearance within a range of 30° viewed from a predetermined point in space,' Goodman discards the priority of any specific aspect of an object over the others to be chosen for copying/representing. Any single property, as well as the ones extracted by the projection rules of linear perspective, can be equally valid to serve as a representation of a chosen scene. Gombrich, attributing aspects of objectivity to perspective construction, fails to discern this point and falls into the 'illusory' realism of the Renaissance rules of depiction. The fundamental premise that the system of Renaissance perspective derives its principles is that the visible light rays produced by the picture under specified conditions match the rays disseminated by the scene being depicted. However, to achieve such a complete match between the picture and scene 'very specific' viewing conditions should be satisfied. Primarily, both the picture and the scene should be viewed through a peephole with one transfixed eye; and to construct an exact match between the two scenes two different sets of viewing coordinates should be established for both the depiction and the scene depicted. For instance, the picture is to be viewed face on at a distance of two meters while the 'cathedral' represented has to be looked at from, say, an angle of 45° to its façade and at a distance of sixty meters. Goodman considers these conditions of observation as "grossly abnormal" that can not confer any 'natural/objective' standard of representation: "What can be the grounds for taking the matching of light rays delivered under such

extraordinary conditions as a measure of fidelity?" (1968, 13). Above all, in accordance to Goodman's model, even if there weren't any problem of viewing situations as stated above, identity in the pattern of light rays, like resemblance of other kinds, cannot be a sufficient condition for representation. Then, what is the reason for some theorists to consider perspective projection as a rather more objective method for representation and for some others as even the ultimate way of representing space as it is experienced by the human observer?

### 5.9. Inculcation

The supposed naturalness of linear perspective, for Goodman, is based on a special kind of mind-set in the part of the viewer which is absolutely independent of any transcendent standards of objectivity. Accordingly, realism, rather than being an outcome of any constant or absolute relationship between the depiction and the object, is a matter of relationship between the system of representation employed and the standard system most commonly used (1968, 38). Such a relation is present for pictures drawn in central projection. Practice has rendered the pictorial symbols of perspective so transparent that nobody is aware of the act of 'reading' codes from those so called 'realistic' pictures. This is what Goodman terms as "inculcation:" the temporal process through which the arbitrary codes of a particular type of representation comes to be considered natural due to its highly frequent usage. So, realism can be considered as a matter of "habit" (Goodman 1968, 38). If linear perspective were totally replaced by another system of depiction with an equal degree of conventionality Gombrich and

Kubovy, in this sense, have probably attributed a similar degree of objectivity to that system.

#### 5.10. Panofsky's Notion of Symbolic Pictorial Forms

Here, Erwin Panofsky's famous article "Perspective as Symbolic Form" (1991) deserves attention as it is one of the most influential treatises written on the arbitrary and culture bounded nature of representational techniques. The article, in Podro's words

...takes the perspective construction developed in the Renaissance and argues, firstly, that it has no unique authority as a way of organising the depiction of spatial relations, that it is simply part of one particular culture and has the same status as other modes of spatial depiction developed within other cultures. Secondly, the spatial order between components in a painting is the natural correlate of contemporaneous cosmology and modes of perception (1982, 186).

To establish his case of perspective as a 'symbolic' form that reflects the perceptual tendencies of its time Panofsky illustrates how our sense of sight is conditioned by our viewing habits which are in turn determined by the prevalent modes of representation. The most significant example he gives to this fact is that we never experience the retinal curves of the perceived environment because we have been grown into a pictorial culture where straight lines are always represented as straight. However, in reality we should have been 'seeing' curves and arcs due to the spherical structure of the eye ball, and we would really be 'seeing' them if the current pictorial conventions had represented the environment that way. Our blindness to this perceptual aspect is "surely in part due to our habituation -further reinforced by looking at photographs- to linear perspectival construction: a construction that is itself

comprehensible only for a quite specific, indeed specifically modern, sense of space, or if you will, sense of the world" (Panofsky 1991, 34). Another important point that renders perspective far from being a technique that depicts the visionary experiences is the homogeneous and infinite space that it constructs. Actually these two concepts are the products of the newly developing mathematical sciences and the Euclidean geometry of the Renaissance theory. However, "visual space and tactical space are both anisotropic and unhomogeneous in contrast to the metric space of Euclidean geometry: 'the main directions of organisation -before-behind, above-below, right-left- are dissimilar in both physiological spaces" (Panofsky 1991, 30). "Inculcated" by the homogeneous and infinite space of the perspectively constructed pictures the contemporary viewer 'constructs' his phenomenal visionary environment in a similar way. Perspective does not duplicate the visionary experiences but we tend observe the visionary environment from 'Alberti's window' conditioned by the products of the current visionary culture.

In terms of the constructivist model illustrated in this section rather than forming two distinct realms of experience both the real world and its pictorially represented correlate mutually construct each other forming the viewer's total sense of reality:

That a picture looks like nature often means only that it looks the way nature is usually painted. Again, what will deceive me into supposing that an object of a given kind is before me depends upon what I have noticed about such objects, and this in turn is affected by the way I am used to seeing them depicted (Goodman 1968, 39).

In this sense, pictorial representation becomes the product of an 'articulation of pictorial symbols' which are in turn determined by the cultural/conventional 'ways' of representing. A picture

'denotes' what it represents and the tools of denotation are conventional to the endmost degree without even slightly moving towards the nature pole on Gombrich's imaginary scale of nature-convention. Albert Cook emphasises the similar point in his example about the pictorial representation of grass:

...we are caught in sets of *conventional cues* if we are viewers, of *conventional techniques* if we are painters, in handling the color green and certain strokes of the brush, or black ink and certain lines of the engraver's tools, so as somewhat arbitrarily to "represent" grass in ways that may or may not make the artefact convincingly or plausibly resemble blades growing in the field. Further, to represent grass at all in an art work is a fairly advanced choice, and one not made in most early societies [emphasis added] (1989, 5).

Panofsky has established a three-levelled model of historically analysing the meanings of art works the first level of which is reserved for those 'conventional cues' of representing objects. He terms this first level of interpretation as the act of *pre-iconographical* description through which the art historian reflects on the manner in which, under varying historical conditions, objects were expressed by forms. To unveil the representational meanings of the depicted forms the historian should possess sound knowledge related to the *history of style* without which he is absolutely desperate in his search after any pictorial meaning (Panofsky 1939, 15). Wittkower, emphasises the similar point in his book *interpretation of Visual Symbols*:

One must know that the wavy lines in the 11th-century Bamberg Apocalypse denotes 'sea,' just as one must know or have learned to see that the iridescent patches of colour in a picture by Turner mean the same thing. Without such knowledge the beholder is faced with unintelligible representational phenomena [emphasis added] (1977, 176-7).

## CHAPTER 6

### 6. SUMMARY AND CONCLUSION

The chapters from 2 to 5 have structured the existing theoretical approaches to pictorial space perception into 4 main models. The variable of classification has been the degree of projectivism/constructivism displayed by the proponents of each approach. Accordingly, Gibson's model of pictorial invariants, Gestalt theory of pictorial space construction, Gombrich's information processing model and Goodman's arbitrary system of pictorial denotation respectively form the stages of a whole theoretical field which ranges within the scale delimited by the projective and the constructivist extremes.

The objective of this last chapter is to re-establish the theoretical framework of the thesis as a brief summary. With the help of this abbreviated version of the whole comparison a number of important points will be emphasised and a more comprehensive overview of the four models will be constructed.

#### 6.1. Summary

James Gibson's model of pictorial space perception stands on the extreme point of the projective approach which claims the naturalness/directness of perceiving pictorial space. Accordingly, a



picture succeeds as a representation of ordinary objects and scenes because it contains the 'same kind of information'... as is provided by the light reflected from the ordinary environment.

In Gibsonian theory space is a function of movement. Accordingly, perception does not begin with a flat picture but with a general structure and behavior of light patterns that we 'directly' experience as a function of our 'moving body.' The underlying logic of the perceived counter-movement of the projected light patterns makes the observer aware of the 'unchanging/invariant' structure of space. These invariants form the basis of all spatial perception whereas static retinal forms themselves do not constitute any significance at all.

As evident with regard to the above brief Gibson's model of spatial perception is not a 'psychological' model in the first place. Actually, this is quite a logical consequence of his regarding 'physiology' as something irrelevant to understanding the perceptual phenomena. For Gibson, what goes on through the retinae and the neurological structures of the brain are obscure processes that no scientist can perfectly understand and model. Our mind is a black box. Gibson, above all, does not deem the revelation of these physiological mechanisms as something crucial. What we experience as our 'phenomenal world' possesses every information that we need in understanding the basic mechanisms of spatial perception.

Departing from these premises Gibson recurses to a unique aspect of the human observer on which he can base all his theory of perception without falling into the muddle physiology: motion. Actually, motion

is such a strong cue in revealing the spatial structure of the concrete environment that Gibson has no difficulty in forming a totally motion-oriented model of space. What remains for him is to construct an optical theory in which he has to determine the potentials of the moving observer in unveiling the spatial structure of the visible world. In this context, he figures out the invariants: the aspects of the perceived environment that do not get affected by viewpoint shifts such as texture gradients, basic 3-d structures of objects, the horizon line, etc. By moving throughout the environment the observer 'directly' discerns these invariant aspects of space without the need to carry out any cognitive constructions. Extraction of the invariants is an unlearned activity of every 'seeing' organism that has the ability to 'move.'

Gibson bases his theory of pictorial space on the similar notion of invariants. Actually, while the observer's interaction with the visible environment is something time-bounded depending on the continually transforming patterns of light, the invariants themselves are 'timeless.' Through its constantly changing projective retinal input what we perceive is, say, a constant/invarying table that has four corners and a gradient of texture. In this sense, the Gibsonian invariants can easily be conveyed on two dimensional graphic surfaces. The difference is that the former has to be extracted through movement whereas the latter, if drawn properly, is directly represented by lines and textures. An outline drawn figure, in this sense, represents those aspects of an object that would remain invariant if it were viewed through motion. After building such a correspondence, Gibson attributes the similar naturalness to the perception of pictorial space. Thus, we do not

have to learn how to 'read' a correctly drawn picture because it shares an important aspect with the ordinary act of perception: the invariants.

By constructing his model of pictorial space on the notion of invariants Gibson explains a number of pictorial phenomena about which the sense-based theory proved insufficient. For instance, in Gibsonian model a depiction, to represent space correctly, should not necessarily duplicate the captured projective light patterns of the related scene as it is not the prerequisite of constructing pictorial space. A representation, in its internal consistency, should refer to the environmental invariants and this can be established by many different methods of which linear perspective is only one kind.

Besides its such an essential effectiveness Gibsonian model, however fails in a number of respects. Such failures are due to Gibson's neglect of physiology as being an irrelevant concept about perceptual issues. This leads the way to a strictly limited model of pictorial space which describes even a less number of facts than the number of which it disregards. In many experiments it has been found out that perceivers 'add' non-existing information to pictorial displays. Amodal completion, as explained in the section 3.2, is such a phenomenon which the argument of invariants itself can not elucidate. Moreover, this points to the existence of certain 'constructive' operations of the perceptual system in opposition to the Gibsonian 'direct' theory. Gibson, rather than adding physiological elements to his 'pure' pictorial theory based on motion, prefers to exclude such events from his model by calling

them as 'ecologically invalid' evidences that can not be representative of the natural act of vision.

Consequently, Gibsonian theory proves to be a phenomenological account of how we become aware of the spatial structures of environment and how this is reflected on 2 dimensions. In Gibson's framework human physiology becomes so transparent that the whole model establishes its arguments 'outside' the human mind; and this makes Gibsonian theory the extreme projectivist approach with its emphasis on the totally unconstrained directness of pictorial space perception.

In opposition to the Gibson's optical theory of pictorial space Gestalt approaches to the notion of projectivism from the viewpoint of human physiology. In terms of the general Gestalt theory of perception the light rays emitted from the outer world are projected on a sensitive neural area of the human brain which are in turn subjected to a kind of organisation process leading to the final percept. This formulation seemingly implies a 'constructivist' approach to visual perception by modelling space as a 'construct' of human neurophysiology. However, the neural processes that Gestalt models are not acquired functions but they are innately founded abilities of the human brain. This makes Gestalt a projective/naturalist theory though being less radical than the Gibsonian one.

Departing from the above stated premises Gestalt theorists attribute every observed phenomenon to a specific neural process occurring in the brain. The well-known Gestalt principle of isomorphism enables

the theorist to 'describe' in detail what goes on throughout the neural field of the perceiver by merely referring to phenomenal observations.<sup>5</sup> Consequently, Gestalt has formulated a body of unlearned laws in accordance to which the projected light patterns of the visible environment are transformed into properly perceived layouts of space. And these laws were attributed to the behavioral patterns of the related neural areas of the human brain. In contrast to the Gibsonian theory of mobile vision the whole Gestalt theory is based on 'static' projections captured on a 2-dimensional sensitive surface. Thus, the perceptual theory of Gestalt directly applies to its pictorial space model.

One fundamental law of Gestalt in accordance to which a graphic configuration transforms into a spatial scene is the 'neural tendency towards simplicity.' Accordingly, any stimulus pattern tends to be seen in such a way that the resulting structure is as 'simple' as the given conditions permit. In other words, if it is simpler to perceive a 2-dimensional drawing as a 3-dimensional object the perceiver prefers the latter. This forms the basic Gestalt principle of pictorial space construction which is presented as an innately founded physiological disposition of human brain: the tendency towards neural relaxation. A subsequent Gestalt law that supports the simplicity principle is that the perceiver's apprehension of a graphic surface does not depend on the capturing of separate parts but perceiving it as a 'whole.' Deriving from these points innumerable Gestalt criteria of objective simplicity, such as right angledness, parallelism, coplanarity, etc. have been formulated. The artist who knows how to depict space, in this sense,

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<sup>5</sup> The Gestaltian notion of isomorphism is based on the claim that the outer (environmental) and inner (neural) phenomena have similar structures and are dominated by the same rules

can be said to possess genuine information of how the physiology of vision reacts to certain 'complex' patterns.

One important issue to be pointed out in relation to the Gestalt model of pictorial space is that while it seems to present a perfect 'physiological' description of the picture-viewer relationship a closer look reveals that it actually does not. Gestalt laws of pictorial space construction are all derived from phenomenological observations and are illustrated as the outcomes of a model of human neurophysiology which is itself 'fictional.' This is due to the concept of 'isomorphism' which dominates the Gestalt paradigm. After accepting that the perceived phenomena and its underlying physiological mechanisms have similar forms all that remains is to formulate 'common-sense' rules of pictorial organisation and to attribute them to 'similar' neurological processes. Actually, there is no single Gestalt experiment that really investigates what goes on throughout the neurones of the optical cortex. The philosophy of isomorphism suffices for Gestalt to construct its 'graceful' model of pictorial perception which is based on the principle of simplicity itself: to describe the pictorial phenomena and their physiological bases in terms of similar laws is the 'simplest' approach to modelling the picture-viewer relationship no matter if this leads to an imaginary model of human neurophysiology.

By formulating such a graceful and simple model of picture-viewer relationship with well-defined laws of graphic organisation, Gestalt constitutes the most commonly referred theory in the realm of pictorial arts and graphic design. All the phenomena related to design and composition can perfectly be modelled referring to

Gestalt theory one significant instance of which is Arnheim's influential treatise *Art and Visual Perception*. Actually, Gestalt claim of 'physiological' description is something quite appealing to many art theorists who seek justification for their arguments related to the principles of 2-dimensional composition. However, when it comes to investigating what really goes on within the mind of the beholder Gestalt proves quite far from being scientific. The need for a different procedure of inquiry other than phenomenological introspection arises.

To illustrate such a scientific approach the chapter in title "Beholder's Share" presents the constructivist model of pictorial space perception which is based on the premises of information-processing theory. The primary evidence that the supporters of this approach have brought forth against Gibson and Gestalt is that human perceivers can see a too small amount of the visible environment at an instance to capture it immediately as a whole. Actually, evidence suggests that we 'read' the graphic surface by shifting our gaze over it capturing separate parts and unifying them through our minds. Viewed from this point Gibsonian concept of absolute directness and Gestalt law of 'wholes' both define problematic notions.

The evidence related to the 'limited angle of sight' points to the existence of a visual 'memory' in the part of the perceiver which is probably used in merging separately captured visual information. Such a concept of 'memory' forms the essence of chapter 4's constructivist model which is something completely disregarded in Gibsonian and Gestalt theories. By neglecting this fact both Gibson

and Arnheim (Gestalt) have escaped from modelling the well-known issue of cultural factors that influence perception. Different ways of seeing may point to different memories and this idea is the essence of the information-processing theory of pictorial space.

Information-processing theory does not intend to model the 'hardware' (physiology) of human mind but it tries to figure out the basic routines/software on which the act of perception is based. To reach such an aim it constructs an elementary model of visual perception based on the continual interactions between a Short Term Memory and a Long Term Memory. While the former is used in unifying the separately captured visual snapshots the function of the latter is to store a directory of 'learned pictorial conventions' to be used in decoding the graphic language of the confronted depiction. The model itself implies that to perceive the real and pictorial space requires 'different Long Term Memories' and the latter is something more culture bounded than the former. The basic 'effort after meaning' that every human displays in scanning a picture may be something innate but the manner of scanning and meaning construction definitely differ among cultures, conventions and periods.

All the assumptions that establish the information-processing model of pictorial space are based on experimental evidences and they point to the basic working mechanisms of the perceptual software. Forming such a scientific base that avoids tacit assumptions it is the theory that can model the highest amount of phenomena without directly excluding any single evidence. In this sense, as opposed to the strictly defined boundaries of Gestalt Information-processing



theory proposes a model of picture-viewer relationship which is open to further development. However, it should be pointed out that information-processing itself cannot propose a model for the analysis of such issues like design or composition which are still in the domain of Gestalt.

The three models of pictorial space considered upto here have all inscribed 'causal' theories of depiction presenting different degrees of causality. While Gibson has talked about a totally unconstrained relation between the real and pictorial space, Gombrich (within the info-processing approach), despite his notion of 'beholder's share', implied the existence of certain standards of objectivity in depiction. The last chapter in title "Denoted Space" presents the extreme constructivist model of graphic perception in which there is no causal relation between pictures and reality. Accordingly, anything can represent any other thing and this is not a matter of objective correspondence.

The leading theorist of this approach is Nelson Goodman who has constructed a perfectly defined system of 'pictorial denotation' in his book *Languages of Art*. In Goodman's system there can not be an objective world apart from what the perceiver constructs, let alone any objective method of depiction. Accordingly, a picture stands for /refers to /denotes the object of the scene that it is said to represent and all these attributes of signification are absolutely independent of the criteria of resemblance which, above all, can not be tested. The different ways of depiction are motivated by certain conventional determinants none of which can claim a more inherent relation with the 'outer reality.'

In Goodman's model pictorial realism, rather than being an outcome of any constant or absolute relationship between the depiction and the object, is a matter of relationship between the system of representation employed and the standard system most commonly used. In other words, what we accept as the most realistic method of depiction is the one to which we are mostly accustomed. This is what Goodman terms as "inculcation:" the temporal process through which the arbitrary codes of a particular type of representation comes to be considered natural due to its highly frequent usage.

Goodman's approach resembles the Gibsonian one in terms of the non-psychological deed it presents. The whole system of pictorial denotation isolates itself from the mechanistic processes of picture-viewer relationship and constructs a linguistic model based on the articulation of arbitrary symbolic structures. In this sense, Goodman's theoretical domain proves to be quite different than the ones inquired by Gestalt and information-processing models of pictorial space. Strictly formulating the absolutely conventional nature of graphic representation Goodman proceeds to form his model of pictorial language within the theoretical sphere of symbol systems.

## 6.2. Conclusion

The theory of pictorial representation and graphic design is dominated by a constant reference to the 'psychology of perception' as a rich source in elucidating the relationship between the picture and the observer. However, contemporary psychology is quite far from providing a single and transcendent model of pictorial vision that

can be applied to every single case. As it has been illustrated throughout the main chapters of this thesis pictorial perception is described within a number of different models all dominated by different arguments and premises. The basic problem that the present study considered as its departure point has been the inconsistent usage of this fragmented database through the field of pictorial arts and graphic design. As mentioned in the first chapter many authors treat psychology as a 'flexible reference book' from which every required information that is adaptable to various contexts can easily be derived regardless of the theoretical frameworks those pieces of information stem from.

To stimulate an awareness in the reader of art theory about this different models this study has structured the existing approaches to pictorial perception within four models taking projectivism-constructivism as a variable of classification. These four models have been evaluated in terms of how they handle the phenomenon of 'pictorial space' as a significant feature of graphic imagery.

A consciousness about these different models in the part of the reader persuades him/her to 'perceive' the diverse written material in the field of pictorial theory within a relatively comprehensive framework. By this way every single theoretical study acquires a place within a structured theoretical field rather than forming a distinct model itself.

## REFERENCES

- Alberti, Leon Battista. *On Painting*. 1435. Trans. John R. Spencer. Connecticut: Greenwood Press, Publishers, 1976.
- Arnheim, Rudolf. *Art and Visual Perception*. Berkeley: University of California Press, 1954
- . *Visual Thinking*. Berkeley: University of California Press, 1969.
- . "Reply to Behrens, Roy, R. - Concerning Isomorphism." *Leonardo* 20.4 (1987a): 210.
- . "The State of Art in Perception." *Leonardo* 20.4 (1987b): 305-307.
- . *The Power of the Center*. Berkeley: University of California Press, 1988.
- Attneave, Fred. "Pragnanz and Soap Bubble Systems: A Theoretical Exploration." *Organization and Representation in Perception*. ed. Jacob Beck. New Jersey: Lawrence Erlbaum Associates, Publishers, 1982. 11-29.
- Beck, Jacob. Introduction. *Organization and Representation in Perception*. ed. Jacob Beck. Hillsdale: Lawrence Erlbaum Associates, Publishers, 1982. 1- 10
- Behrens, R. Roy. *Illustration as an Art*. Englewood Cliffs: Prentice-Hall, 1986.
- Benjafield, John G. *Cognition*. Englewood Cliffs: Prentice Hall, 1992.
- Best, John B. *Cognitive Psychology*. St. Paul: West Publishing Company, 1986.

Cook, Albert. *Dimensions of the Sign in Art*. London: University Press of New England, 1989.

Crary, Jonathan. "Eclipse of the Spectacle." *Art After Modernism: Rethinking Representation*. ed. Brian Wallis. Boston, 1984. 283-94.

---. *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century*. Massachusetts: MIT Press, 1990.

Dondis, Donis A. *A Primer of Visual Literacy*. Cambridge: MIT Press, 1973.

Dretske, Fred. "Seeing, Believing and Knowing," *Visual Cognition and Action*. ed. Daniel N. Osherson, Stephen M. Kosslyn and John M. Hollerbach, Massachusetts: The MIT Press, 1990. 129-48.

Ehrenzweig, Anton. *The Hidden Order of Art*. Berkeley: University of California Press, 1967.

Ernst, Bruno. *The Eye Beguiled*. Köln: Benedict Taschen, 1992.

Forseth, Kevin. *Rendering the Visual Field*. New York: Van Nostrand Reinhold, 1991.

Gablik, Suzi. *Progress in Art*. New York: Rizzoli International Publications, Inc., 1976.

Gardner, Howard. *Art, Mind and Brain*. New York: Basic Books, Inc., Publishers, 1982.

Gibson, Eleanor J. "Contrasting Emphases in Gestalt Theory, Information Processing, and the Ecological Approach to Perception." *Organization and Representation in Perception*. ed. Jacob Beck. New Jersey: Lawrence Erlbaum Associates, Publishers, 1982. 159-65.

- Gibson, James. *The Ecological Approach to Visual Perception*. Hillsdale: Lawrence Erlbaum Associates, Publishers, 1986.
- . "What is Involved in Surface Perception?" *Organization and Representation in Perception*. ed. Jacob Beck. New Jersey: Lawrence Erlbaum Associates, Publishers, 1982. 151-7.
- . Foreword. *The Perception of Pictures*. ed. Margaret A. Hagen. London: Academic Press, Inc., 1980. xi-xviii.
- . *The Senses Considered as Perceptual Systems*. Westport: Greenwood Press, Publishers, 1966.
- . *The Perception of the Visual World*. Cambridge: The Riverside Press, 1950.
- Gill, Robert W. *The Thames and Hudson Manual of Rendering with Pen and Ink*. London: Thames and Hudson, 1973.
- Gilmour, John C. *Picturing the World*. Albany: State University of New York Press, 1986.
- Goldstein, Nathan. *Design and Composition*. Englewood Cliffs: Prentice Hall, 1989.
- Gombrich, E. H. *Sanatın Öyküsü*. Trans. Bedrettin Cömert. İstanbul: Remzi Kitabevi, 1986.
- . *Sanat ve Yanılsama*. Trans. Ahmet Cemal. İstanbul: Remzi Kitabevi, 1992.
- . *The Image and The Eye: Further Studies in the Psychology of Pictorial Representation*. Oxford: Phaidon Press Limited, 1982.
- . *Meditations on a Hobby Horse and Other Essays on the Theory of Art*. London: Phaidon Press, 1965.

- Goodman, Nelson. *Languages of Art*. New York: The Bobbs-Merrill Company, Inc., 1968.
- . *The Structure of Appearance*. Boston: D. Reidel Publishing Company, 1951.
- Gregory, Richard *The Intelligent Eye*. New York: McGraw-Hill Book Company, 1970.
- . *Eye and Brain: The Psychology of Seeing*. 4th. ed. New Jersey: Princeton University Press, 1990.
- . *Even Odder Perceptions*. London: Routledge, 1994.
- Haber, Ralph Norman. "Perceiving Space from Pictures: A Theoretical Analysis." *The Perception of Pictures*. ed. Margaret A. Hagen. London: Academic Press, Inc., 1980. 3-31.
- Hagen, Margaret A. Introduction. *The Perception of Pictures*. ed. Margaret A. Hagen. London: Academic Press, Inc., 1980. xxiii-xxvii.
- Henle, Mary. "On Naive Realism." *Perception: Essays in Honor of James Gibson*. ed. Robert B. Macleod and Herbert L. Pick, Jr. Ithaca: Cornell University Press, 1974. 41-56.
- Hochberg, Julian. "Higher-Order Stimuli and Inter-Response Coupling in the Perception of the Visual World." *Perception: Essays in Honor of James Gibson*. ed. Robert B. Macleod and Herbert L. Pick, Jr. Ithaca: Cornell University Press, 1974. 17-39.
- . "How Big is a Stimulus?" *Organization and Representation in Perception*. ed. Jacob Beck. New Jersey: Lawrence Erlbaum Associates, Publishers, 1982. 191-217.
- Highwater, Jamake. *The Language of Vision*. New York: Grove Press, 1994.

- Johansson, Gunnar. "Projective Transformations as Determining Visual Space Perception." *Perception: Essays in Honor of James Gibson*. ed. Robert B. Macleod and Herbert L. Pick, Jr. Ithaca: Cornell University Press, 1974. 117-38.
- Kanizsa, Gaetano and Walter Gerbino. "Amodal Completion: Seeing or Thinking?" *Organization and Representation in Perception*. ed. Jacob Beck. Hillsdale: Lawrence Erlbaum Associates, Publishers, 1982. 167-90.
- Kennedy, John M. "Perception, Pictures and the Etcetera Principle." *Perception: Essays in Honor of James Gibson*. ed. Robert B. Macleod and Herbert L. Pick, Jr. Ithaca: Cornell University Press, 1974. 209-26.
- Kosslyn, Stephen Michael. "Mental Imagery." *Visual Cognition and Action*. ed. Daniel N. Osherson, Stephen M. Kosslyn and John M. Hollerbach, Massachusetts: The MIT Press, 1990. 73-98.
- Köhler, Wolfgang. *Gestalt Psychology*. New York: Liveright Publishing Corporation, 1947.
- Krauss, Rosalind. *Optical Unconscious*. Massachusetts: MIT Press, 1990.
- Kubovy, Michael. *The Psychology of Perspective and Renaissance Art*. Cambridge: Cambridge University Press, 1986.
- Locher, J. L., ed. *Escher: The Complete Graphic Work*. By F. H. Bool, Bruno Ernst, J. R. Kist, F. Wierda. London: Thames and Hudson, 1992.
- Luria, A.R. *Cognitive Development*. Cambridge: Harvard University Press, 1976.
- Macann, Cristopher. *Four Phenomenological Philosophers*. London: Routledge, 1993.



- Matlin, Margaret W. and Hugh J. Foley. *Sensation and Perception*. Boston: Allyn and Bacon, 1992.
- Metelli, Fabio. "Some Characteristics of Gestalt-Oriented Research in Perception." *Organization and Representation in Perception*. ed. Jacob Beck. Hillsdale: Lawrence Erlbaum Associates, Publishers, 1982. 219-34.
- Millar, Susanna. *Understanding and Representing Space*. Oxford: Clarendon Press, 1994.
- Myers, Jack Fredrick. *The Language of Visual Art*. Florida: Holt, Rinehard and Winston, Inc., 1989.
- Neimeyer, Greg J. *Constructivist Assesment: A Case Book*. Newbury Park: Sage Publications, 1993.
- Neisser, Ulric. *Cognitive Psychology*. Englewood Cliffs: Prentice Hall, 1967.
- Panofsky, Erwin. *Perspective as Symbolic Form*. New York: Zone Books, 1991.
- . *Studies in Iconology*. Oxford: Oxford University Press, 1939.
- Perkins, D. N. "The Perceiver as Organizer and Geometer." *Organization and Representation in Perception*. ed. Jacob Beck. Hillsdale: Lawrence Erlbaum Associates, Publishers, 1982. 73-93.
- Pick, Herbert L., Jr., Foreword. *Perception: Essays in Honor of James Gibson*. ed. Robert B. Macleod and Herbert L. Pick, Jr. Ithaca: Cornell University Press, 1974. 7-9.
- Podro, Michael. *The Critical Historians of Art*. New Haven, 1982.

- Ponty, M. Merleau. *Signs*. Trans. Richard C. McCleary.  
Evanston: Northwestern University Press, 1964.
- Restle, Frank. "Coding Theory as an Integration of Gestalt Psychology and Information Processing Theory." *Organization and Representation in Perception*. ed. Jacob Beck.  
Hillsdale: Lawrence Erlbaum Associates, Publishers, 1982.  
31-56.
- Rock, Irwin. *An Introduction to Perception*. New York: Macmillan Publishing Co., Inc., 1975
- . *Perception*. New York: Scientific American Books, Inc., 1984.
- Rosinski, Richard R. and James Farber. "Compensation for Viewing Point in the Perception of Pictured Space." *The Perception of Pictures*. ed. Margaret A. Hagen. London: Academic Press, Inc., 1980. 137-76.
- Rowe, Peter G. *Design Thinking*. London: The MIT Press, 1992.
- Sedgwick, H. A. "The Geometry of Spatial Layout in Pictorial Representation." *The Perception of Pictures*. ed. Margaret A. Hagen. London: Academic Press, Inc., 1980. 33-90.
- Shepard, Roger N. *Mind Sights*. New York: W. H. Freeman and Company, 1990.
- Spencer, John R. Introduction. *On Painting*. by Alberti. Trans. John R. Spencer. Connecticut: Greenwood Press, Publishers, 1976. 11-37.
- Sowers, Robert. *Rethinking Forms of Visual Expression*. Berkeley: The University of California Press, 1990.
- Wittkower, Rudolf. *Allegory and the Migration of Symbols*. London: Thames and Hudson, 1977.

Wollheim, Richard. "What the Spectator Sees." Bryson, Norman, Michael Ann Holly and Keith Moxley, ed. *Visual Theory*. Oxford: Polity Press, 1991. 101-50.

Zanforlin, Mario. "Figure Organization and Binocular Interaction." *Organization and Representation in Perception*. ed. Jacob Beck. Hillsdale: Lawrence Erlbaum Associates, Publishers, 1982. 251-67.



## SELECTED BIBLIOGRAPHY

Arrien, Angeles. *Signs of Life: The Five Universal Shapes and How to Use Them*. Hong Kong: Arcus Publishing Company, 1992.

Baltrusaitis, Jurgis. *Aberrations*. Massachusetts: The MIT Press, 1989.

Bannan, John F. *The Philosophy of Marleau-Ponty*. New York: Harcourt, Brace and World, Inc., 1967.

Berger, John. *Görme Biçimleri*. Trans. Yurdanur Salman. İstanbul: Metis Yayınları, 1986.

Carlson, Neil R. *Physiology of Behavior*. Boston: Allyn and Bacon, 1991.

Cohen, Robert. *The Development of Spatial Cognition*. Hillsdale: Lawrence Erlbaum Associates, Publishers, 1985.

Dodwell, P. C., *Visual pattern Recognition*. New York: Holt, Rinehart and Winston, Inc., 1970.

Emmer, Michelle, ed. *The Visual Mind: Art and Mathematics*. Massachusetts: The MIT Press, 1993.

Feldman, Edmund Burke. *Varieties of Visual Experience*. New York: Harry N. Abrams, Inc., Publishers, 1992

Gardner, Howard. *Frames of Mind: The Theory of Multiple Intelligences*. United States of America: Basic Books, 1985.

Gombrich, E. H. *The Sense of Order: A Study in the Psychology of Decorative Art*. Ithaca: Cornell University Press, 1979.

---. *Resimde Anlam Sorunu*. İstanbul: Kabalcı Kitabevi, 1995.

- Greenland, Maureen. "The Perception of Pattern." *Journal of Art and Design Education* 4.2 (1985): 179-186.
- Harrison, Andrew, ed. *Philosophy and the Visual Arts: Seeing and Abstracting*. Dordrecht: D. Reidel Publishing Company, 1987.
- Holly, Michael Ann. *Panofsky and the Foundations of Art History*. Ithaca: Cornell University Press, 1984.
- Hyman, John. *The Imitation of Nature*. New York: Basil Blackwell, 1989.
- Ivins, William M. *Prints and Visual Communication*. 1953. Cambridge: The M.I.T. Press, 1989.
- Jay, Martin. "Scopic Regimes of Modernity." *Vision and Visuality*. ed. Hall Foster Seattle: Bay Press, 1988.
- Knobler, Nathan. *The Visual Dialogue*. Florida: Holt, Rinehart and Winston, Inc., 1980.
- Kober, Karl Max. "Art Exhibits and Art Galleries: Their Role in Art Appreciation and the Perception of Art." *Journal of Popular Culture* 18.3 (1984): 125-143.
- Kris, Ernst. *Psychoanalytic Explorations in Art*. New York: International Universities Press, 1952.
- Moxey, Keith. "Panofsky's Concept of 'Iconology' and the Problem of Interpretation in the History of Art." *New Literary History* 17 (1985): 265-74.
- Neperud, Ronald W. "The Role of Selective Attention in the Perception of Art." *International Journal of Psychophysiology* 7.2-4 (1989): 333-4.

- Osgood, Charles E., George Suci and Percy Tannenbaum. *The Measurement of Meaning*. Urbana: University of Illinois Press, 1967.
- Osgood, Charles E., William H. May and Murray S. Miron. *Cross-Cultural Universals of Affective Meaning*. Urbana: University of Illinois Press, 1975.
- Panofsky, Erwin. *Meaning in the Visual Arts*. Garden City: Doubleday and Company, Inc., 1955.
- Ponty, M. Merleau. *Phenomenology of Perception*. London: Routledge, 1992.
- Simon, Herbert A. *Models of Thought*. New Haven: Yale University Press, 1989.
- . "Information-Processing Theory of Human Problem Solving." *Issues in Cognitive Modeling*. ed. A. M. Aitkenhead and J. M. Slack. Hillsdale: Lawrence Erlbaum Associates, Publishers, 1985.
- Van Der Heijden, A. H. C. *Selective Attention in Vision*. London: Routledge, 1992.