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Pictures in the Substantiation of Organisation.
A Study of Radiology.

A thesis
submitted in fulfilment
of the requirements for the degree of
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Abstract

The motivation for this study is an interest in technologically produced imagery and its effect on the contemporary world.

Natural events, pictures, diagrams, paintings, spectacular performing arts, icons, etc, are persistent features in the repertoire of language for expressing and constituting knowledge. Much of present day common sense knowledge, however, is constituted through observation made in direct, yet technologically mediated ways. From television to computer graphics and radiographs, a plethora of technologies offer visual experience of a kind available only through techno-scientific means.

Using technical instruments requires constructs created by user's and seer's. Language that evolves, is often interpretable only through a unique cultural practice dependent on expertise. Technically produced imagery raises issues of individual and collective interpretation. The thesis method is eclectic to discern the complexity this involves. Intertwining of technical and scientific modes of professional conduct is examined through the implication of Galilean discovery, by way of the technical effects of glass in the 17th Century, and Roentgen's accidental discovery through x-rays in the late 19th Century.

Field work centers on issues pertinent to technologically mediated knowledge. This involved a small group of radiologists in the hospital of a provincial New Zealand city. Engaged variously in difficult radiographic interpretation, they are teaching newly qualified doctors entering the radiological profession to successfully "see" the imagery evoked by the radiograph.

Medical practitioners, and especially radiologists, are a profession required specifically to develop skills of image and sign interpretation. Fundamental to their accountability is intersubjective agreement on what is "seen" on a radiograph and other technical equipment. The third dimension of "depth" has to be accurately imputed to a two dimensional radiograph. Radiological "objectivity" is the outcome of collective discourse.

Central to this discourse is a specific employment of particular metaphors. Metaphorical transference occurs during the process of diagnosis as the interpreter moves between what is seen on the radiograph and his or her medical repertoire. Diagnosis through the inspection of visual items involves the skilled (but often intuitive) decoding of complex systems of iconic and symbolic (conventional, arbitrary) signs. Diagnosis is sanctioned by collective agreement accomplished through dialogue.

The basis of the radiological code is an inextricable use of metaphor and metonymy in the syntagmatic construction of an image. The nature of what is seen on the radiograph is based on the notion of caricature. This implies that the person who can interpret a radiograph is able to "see" in it the embodiment of some image which may be completely obscure to the uninitiated. Caricature interpretation is fundamental to constituting the typifications of daily life. This has particular significance in what might be termed a "techno visual" life-world.

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CHAPTER ONE

Chapter 1.

Introduction.

Underpinning this inquiry is an intuitive and common sense belief that there is a change occurring in the New Zealand social order. One aspect of this seems to be in the way in which individuals are orientating themselves to their world. Many aspects of such perceived change are universal in that there is a world wide communications revolution taking place. However, some arguments and ideas offered in this inquiry are grounded in New Zealand culture, and may or may not apply elsewhere. In essence, the change suggests a shift in individual and group perceptions, which among other possibilities may be related to the increase in pictorial representation now available from a wide variety of technical sources including television.

Sapir-Whorf suggest that it is our use of language which affects and shapes our reality through the classifications employed in understanding the world. This process is particularly apparent in those languages that depend upon some technology for representation and which embody a desire for scientific exactness, i.e. operate like a code through the use of permanent shapes.

These are concerns of Illich and Sanders (1988), and Rozsak (1988), who assert that the reduction of literacy into a code is increasing. To understand this, the former argue, words like "energy" now become used in ways that are quite different from their original meaning. Owing to increasingly abstract usage, many users of such terms are unfamiliar with previous usage. Speaking of modern communication, Illich and Sanders write:

The word "energy" in this context is used neither with common sense, nor with the senseless precision of science, but almost like a sublinguistic grunt -- a nonsense word. Energy, like sexuality, transportation, education, communication, information, crisis, problem, solution, role, and dozens of other words, belong, in this sense, to the same class. (Illich and Sanders 1989:106)

Over the last few decades there has been a substantial increase in picture representation. This has been noted by Gombrich (1974), Arnheim, (1966), Novitz (1977) and many others. In the context of a life-world now characterised by a plethora of technologies capable of producing and reproducing a wide range of pictures and imagery, these technological modes of representation can no longer be ignored or treated casually by social

inquirers. There are also indications suggesting that words, are increasingly being replaced by pictures. For example, the use of pictograms to replace written road signs is becoming increasingly common, to say nothing of a multitude of pictures produced by the mass media and television. Twenty years ago the well known art historian E.H. Gombrich (1974) said:

Ours is a visual age. We are bombarded with pictures from morning till night. Opening our newspapers at breakfast, we see photographs of men and women in the news, and raising our eyes from the paper, we encounter the picture on the cereal package. The mail arrives and one envelope after the other discloses glossy folders with pictures of alluring landscapes and sunbathing girls to entice us to take a holiday cruise, or of elegant menswear to tempt us to have a suit made to measure. Leaving the house, we pass billboards along the road that try to catch our eye and play on our desire to smoke, drink or eat. At work it is more than likely that we have to deal with some kind of pictorial information: photographs, sketches, catalogues, blueprints, maps or at least graphs. Relaxing in the evening, we sit in front of the television set, the new window in the world, and watch moving images of pleasures and horrors flit by. Even the images created in times gone by or in distant lands are more easily accessible to us than they ever were to the public for which they were created. Pictures, picture postcards and colour slides accumulate in our homes as souvenirs of travel, as do private mementos of our family snapshots. (Gombrich in Olson 1974:82)

There are considerable difficulties for the social researcher who attempts to analyse any overall change in modes of representation. Following N.R. Hanson (1961), Kuhn (1962), and Feyerabend (1987) I regard observation as theory laden, depending on the see-er's background knowledge and intention.

J.S. Bruner (1966) classifies modes of representation into *enactive*, *iconic* and *symbolic*. Enactive representation originates in the reflexive acts that characterise infant behaviour, which are muscular and visceral, but which remain in adult behaviour. The child who places his/her hand on a hot surface retains in memory a modified motor response to a similar stimulus. The significance of enactive thinking is the manner in which the thought rises instantaneously. Iconic representation relates to images which are also a means of memorising and memory recall. Elaborating Bruner's theory, Horowitz (1970:204), argues that because images retain a sensory quality they are useful in solving problems requiring inner depiction of some external reality. People use images to represent conceptual problems, particularly those involving spatial relationships in architecture, geometry and radiology. Horowitz also argues that "lexical representation" facilitates a higher level of conceptualisation and reasoning, it is "thinking in words". As an infant matures, the relationship between words and what they signify is established.

In the process of symbolic development, the child progresses beyond the "use of interpretations of sounds, inflections, and tonalities to include words as a means of thinking".

In his article Seeing Sense, Burgin (1983:232), incorporating both Bruner and Horowitz's ideas in his thesis suggests, that "although photography is a "visual medium" it is not purely visual. He argues that when we look at something there is an inevitable invasion of language that emanates from our past associations. This "invasion" from memory, as he puts it, is composed of a mixture of word and image, depending on the nature of the association. This thesis uses Vygostky's (1989) notion of "inner speech", which, Vygostky argues, is fundamentally different from "externally directed communicative" speech. Vygostky's describes inner speech as: "A single word [being] so saturated with sense that many words would be required to explain in external speech". As Burgin says: "Inescapably, the *sense* of the things we see is constructed across a complex of exchanges". This occurs between various registers of representation. For example, a sculpture will tend to "stress the enactive and kinaesthetic suffusion of visual imagery", but, "photographs predominantly tend to prompt a complex of exchanges between the visual and verbal registers". Bruner's "symbolic" classification is developed more fully in chapter 8 'What is a Radiographic Image.'

The point I wish to emphasise about different modes of representation is that they are not fixed or constant but depend upon cultural, contextual and historical circumstances. The sense of things perceived in the flux of experience occurs without any clear demarcation between different modes of representation such as words and images. As Horowitz puts it,

Normal streams of thought will flow simultaneously in many compartments without clear-cut division between modes of representation. Enactions blur into imagery in the form of kinaesthetic, somesthetic, and vestibular images. Image representation blends with words in the form of faint auditory images of words. Words and enactive modes merge through images of speaking. (Horowitz 1977:77)

According to Logan (1986), a "lexical based on print" can be understood with reference to the uniqueness of the technology of the phonetic alphabet as a system of writing. A small number of letters or visual signs (22 to 40) is used to represent the basic sounds or phonemes of a spoken language. The significance of the alphabet is that the phonetically coded spoken word is a

representation that can be used independently of the language being transcribed. Illich and Sanders (1989), Logan (1986) and McLuhan (1964) stress how this feature is taken for granted in the classification, coordination and codification of knowledge in Western science.

Despite McLuhan's (1973) exaggerations, there is significance in his vision of the "global village" and stress on orality. To reiterate, today there is undeniably a revolution in communications taking place throughout the world. However McLuhan's emphasis on peoples' perceptual and sensory balance being affected by a constant exposure to some visual medium, seems much more tenable when reinforced by more scholarly work such as that of Ong (1977:305). He claims that today there is a new kind of orality, "the secondary orality of our electronic age". Primary orality, for Ong, could only be found in those cultures that did not have writing, such as pre-European Maori. He argues (1977:305) that associated with different modes of representation are particular forms of speech that reflect aspects of the medium being used. For example, compared to oral speech, writing is a closed system, but "[p]rint creates a world even more spectacularly contained: every *a* in a font of type is exactly like every other; every copy of an edition matches every other". Furthermore, Ong (1969) states that when the mode of representation changes there will follow a change in human consciousness. This change is connected to the creation of a "world view".

Further to these arguments, it is significant that the technological means for receiving, producing or reproducing images is available to a much wider spectrum of the population than was ever possible in the past. The privileged nature of knowledge is being challenged, not just because there are better educational opportunities available for everyone, but because the boundaries of educational disciplines are changing. Anyone who can use a computer can produce a standard of graphics that only a few years ago, would have demanded the best of the most experienced draftsman. This is also the case in many industrial practices from accounting to printing.

Discussing possible approaches to human studies, Rickman (1967) argues that it is imperative to eliminate any areas of weakness such as the tendency in academic research to concentrate on narrow specialisation. He says this occurs because a great deal of the research is carried out by youngish people, who understandably have limited experience and lack the time for wide

reading. Frequently this means choosing a subject which can be narrowly and precisely defined in theory and practice. As he puts it:

Human beings must be understood *as* human beings and this is a complicated business. If our approach is too narrow we only get a hold of a fragment of a complex state of affairs. Different approaches must be integrated by closer cooperation within and between disciplines. It is unsatisfactory, for instance, that depth psychologists can hardly understand each other and find it difficult to cooperate. Similarly, it is deplorable if psychological theories are not presented in such a form that they can be understood and used by, let us say, a historian. (H.P. Rickman 1967:xii)

Rickman (1967:4) argues that specialisation is inevitable, and that the social inquirer cannot be fully conversant with several disciplines or be an expert in every one; but he/she can know and locate his/her work within the parameters of human studies, which may include history, psychology, sociology, social anthropology, economics, philosophy, jurisprudence, comparative religion, criminology, management and communication and media studies.

Essentially, Rickman (1967) argues that the human studies are those that are involved with "the operations of the human mind and whatever is the product of, or has been affected by, these operations". A latent effect of the theoretical and practical success of the physical sciences has been that the moral sciences have been considered in the same methodological light. A result of this is that researchers have been intimidated, and have only attempted problems that can be solved by those respected methods that rely upon laboratory experiments, quantification and statistical analysis. He says (1967:4-5): "This has led to the choosing of the easily accessible and avoidance of the complex -- with the consequent scaling down of the scope of the investigations so that they have become trivial. We thus have precise knowledge of what is not worth knowing".

The boundaries of disciplines change as the particular interest of involved parties and their knowledge change. My enquiry is unavoidably eclectic. The subject matter is various and does not consist of phenomena that fit neatly into any one discipline or classification. The variety obliged me to select such method as was appropriate to the issue to be elucidated. For example, Feyerabend's (1987) analysis of Galileo's common sense and practical science provided some worthwhile theoretical insights -- in particular his analysis of Galileo's use of the method of *anamnesis* to convince his audience about the

existence of phenomena that could not be seen, and at the same time introduce a new observational language that appealed to the common sense of the time. Similarly, Husserl's thesis on the mediation effect of scientific "symbolic forms", epitomised by his metaphor "a garb of ideas", has relevance for understanding all symbolic forms or all language. His insistence on the importance of the life-world as the starting point for social analysis suggests that in practical terms, nothing can be omitted until the researcher is satisfied as to its relevance or otherwise, in the same way that a detective investigating a crime must eventually be satisfied that evidence is either significant or inconsequential. As Rickman (1967) points out, crime has economic, historical, sociological and psychological roots. To be effectively understood it has to be regarded from all points of view and the different approaches coordinated. Furthermore, it is also important to demonstrate how the different aspects of concrete problems relate to each other in order to understand where the work of one specialist begins, another ends, and the overlap among specialists occurs.

Advances are being made in science which force a re-think in traditional social analysis. For example, "how we see" has increasingly more relevance for sociologists as people spend larger amounts of their time looking at pictures, or considering issues presented to them in iconic form. If the current life-world is predominantly visual in character, an understanding of visual common sense, (which is the taken-for-grantedness of iconic representation), suggests that it will be necessary somehow to make more explicit that aspect of implicit knowledge that both individuals and researchers take for granted. Social researchers will unavoidably become involved in other disciplines.

Until recently, only a few aspects of perceptual psychology and aesthetics could be identified as cogent to what was known about how the brain processes different information. Research by Livingstone et al (1988) suggests that it is becoming possible to incorporate ideas from different descriptions such as art, psychology and neurology into the visual sciences. Livingstone's research is based on the premise that seeing is much more complicated than the workings of a camera, involving three separate pathways to the brain (see Fig. 1.1). She points out that some of the visual effects known and created by artists and designers have been successful because light information is processed in terms of each pathway functioning in separate ways. Nevertheless, although it is certainly helpful to understand the visual process of seeing, transposing

of concepts across different technological paradigms, with the objective of synthesizing the knowledge, requires caution. The use of technical language tends to obfuscate the fact that it is people who see, not a system. As Hanson expresses it:

Seeing is an experience. A retinal reaction is only a physical state - a photochemical excitation. Physiologists have not always appreciated the difference between experiences and physical states. People not their eyes see. Cameras, and eye-balls are blind. Attempts to locate within the organs of sight (or within the neurological reticulum behind the eye) some nameable called "seeing" may be dismissed. . . . there is more to seeing than meets the eyeball. (Hanson 1961: 6-7)

The issues of seeing also encouraged me to look back to Galileo. By discussing Galileo (chapter 2, 'Galileo: Common Sense and Practical Science') I have become able to point to a number of matters that run through this enquiry.

(1) The use of the telescope and microscope set some historical precedents regarding optical instruments that are still applicable today. For example, the development of neologisms and specific language codes, based on observation and mathematical principles, describe phenomena never seen before. Today this is occurring in mammography because minute patterns, indicating the beginnings of micro-calcifications, can now be seen with the new improved technology and observational techniques.

(2) By beginning the inquiry with the records of the early users of optical instruments, it became easier to understand basic principles of knowledge acquisition connected with the instrument itself, such as knowledge made possible by an instrument alone, and knowledge of phenomena as "seen" through some technical medium.

(3) It is my belief that there are still many misunderstandings as to what scientific endeavour is, particularly in the difference between scientific and technological activity. Related to this is Husserl's contention that Galileo's science is symbolic of modern science. Concentrating on Galileo's early use of the telescope, which Husserl does not mention in detail, illuminated for me other perspectives of Galilean achievements as distinct from those just accepted as given.

(4) By studying aspects of Galileo's life-world, that have been taken for granted by many scholars following Husserl, I hope to lend credence to Husserl's argument that the creation of social aspects of a scientific life-world is an accomplishment that depends on some key item of technology such as glass. It should also help to tease out difficult issues about the way in which mathematics, as a powerful form of symbolism becomes so embedded in scientific endeavour. I came to recognise that it may be naive to ignore the embodiment of significant techno-cultural acquisitions in accomplishing a social order.

Chapter 3 is concerned with Edmund Husserl's questioning of Galilean science, which, he says, epitomises the scientific outlook of the modern world. I have included in this chapter some of Feyerabend's (1987) analysis of Galilean common sense and practical science related to the use of the telescope. This provides worthwhile insights to the development of an observational language.

At this point in the argument, Galileo and the past become less prominent. Essentially, Chapter 4 'The Frame' is concerned about the technology of the frame (mirrors, images, photographs, pictures, etc) which, to use Husserl's (1970:26) term, are "sensible models". These are cultural acquisitions consisting of technologies that are taken for granted by those who use them, like printed drawings on textbooks, or tools and instruments which are simply understood or simply "seen" without any questioning by the user of how they came into being, and how the present use of them affects the understanding of the user.

I begin the chapter by explaining that symbols (in particular iconic metaphors) frame the world, but the intent of the chapter is to discuss the technical i.e. the artifact, rather than the symbolic, which is dealt with in later chapters. Concentrating on the technical has the consequence, to some extent, of obliging one to adopt a functionalist approach. This becomes necessary as a technical theme acts as a common denominator amongst a plethora of perspectives on representation. Such an approach tends to leave out of the discussion the intentional actor, but in the interests of clarity I found this to be necessary.

The problems that face the sociologist who attempts to understand some of the complex issues associated with representation are addressed in Chapter 5 'Problems and a Visual Life-world'. In the writer's opinion, the massive change in communications has meant that in terms of knowledge many existing theories and ideas need to be re-examined. Plato and Aristotle did not have a television set - nor did Hume, Kant, Max Weber or Durkheim! The concepts that these social commentators introduced still have relevance today, but with the proviso that the social/technical context of today is taken into consideration. Issues that could never have been considered by them relate to the technical media (T.V., radio, film etc.) and their consequences for collective life.

Heidegger's (1977) arguments on technology illustrate fundamental differences between the rather negative approach to technological rationality of modern sociologists who tend to consider technology in terms of mere means, and the perspective of Plato and Aristotle who regarded *techne* as a form of knowing. Associating *techne* with *episteme* as a "bringing forth", an opening up, or a revealing, emphasises the creative aspects of technological innovation rather than confining understanding of it to artifacts, or rational systems. Heidegger (1977:12-14) argues that there is little difference between modern technology as a "mode of revealing" and the creative techniques used by ancient handcrafts people. He argues that if modern technology is regarded in this way it will offer a much more enlightened insight to modern technological creativity. This different stance has been expanded upon by modern sociologists of technology and is discussed in greater detail in chapter 5.

In recent times, semiotics has gained in popularity and for many the study of "signs" is an acceptable way out of many of the complex issues associated with the effects of media and the nature of second order experience. The iconic sign would seem to be an increasingly important way of conveying meaning, but there are problems with the notion of "iconicity" that are related to the use of language. The difference between "picture" and "image" depends to a large degree on usage, but that is only part of the problem of representation.

It is easy to forget that there was a time before writing, and that people lived in truly oral communities. It seems necessary to consider at least some of the historical aspects involved in what Boorstin (1963) called the Graphic

revolution. Complex issues underpin pictures in the substantiation of organisation, but even though Boorstin was writing about America many of the concepts and arguments are of a universal nature. There have been many cultures whose practitioners have not had the technological means for writing and discrete image production, but who probably lived perfectly satisfactory lives by talking, dancing, reading non-linguistic gestures, and interpreting the signs of nature in the process of first hand experience. Chapter 5 concludes with an argument that states that the most appropriate way to understand the picture or image employed in the substantiation of a social order is to consider a "strong program of relevance". Hence the reasons for choosing radiology in the present time.

Chapter 6. 'Radiology: Some Historical Considerations' concentrates on the early development and history of x-ray technology. The purpose is to discern radiology as a topic that assists in comprehending radiological practices. These practices are difficult to understand through field work. The chapter also has a methodological purpose in that historical analysis is used to understand the present. For example, to use Foucault's (1973:133) phrase for describing the use of the microscope: Before the discovery of x-rays the structure of bones could not be scrutinised in a living person. With the advent of this new *technological controlled form of observation*, new taxonomic knowledge could be formulated by medical practitioners, and is now taken for granted in daily practice. X-ray technology is readily accessible to most people through their own experiences of medicine, dentistry and industry, but it is not widely known how dramatic the advent of x-ray technology was for those living during 1896, the year after its discovery by Roentgen on November 8th 1895, and what professionals did in those early years as their understanding evolved.

For the same reasons that I began this inquiry through a historical analysis in order to understand the present, I decided after some initial investigation to begin my study of contemporary radiological practices and institutions with some historical facts. Berger and Luckmann (1967) argue that it is not possible to understand institutionalised behaviour unless a history of an organisation or community is known. This is similar to etymology where the original context of a word can be used for understanding and revealing the grounds from which knowing emanates. It can also be used to investigate technological understanding.

Chapter 7 'Radiology: Some Methodological Considerations' demonstrates that all research is inevitably a social accomplishment. The chapter takes the place of the chapter on methodology at the beginning of a thesis. I considered that because the systematic aspect of what I did relates directly to the context of field work on radiology, a chapter on method at this juncture would contribute most effectively to the revealing of what this research offers. The chapter is mostly concerned with the nature of the field work and the difficulties encountered in doing it. It is at this stage of the inquiry that I introduce empirical claims based on my own first hand experience and comprehension of a radiologist's life-world. There is discussion on the use of the radiologist's gamut and radiological artifact. Organised in a particular way, the people, by practising their art and their science, revealed to me their knowledge.

After deciding that radiology was a suitable topic permission had to be obtained from the Ethics Committee at the Waikato regional hospital. At the time permission was sought, "medical ethics" were very much to the fore in New Zealand due to The Report of the Cervical Inquiry 1988 by Judge Cartwright, and its widespread publicity. This inquiry involved serious questioning of an approach to scientific medicine that took scientific objectivity for granted and had contributed to the death of some research patients. Medical personnel were understandably very sensitive, and it took a little longer than expected to gain permission to undertake my enquiry.

In Chapter 8 'What is a Radiographic Image?' there is a specific and direct focus on the "sensible model", i.e. the radiograph, which is a fundamental and taken-for-granted constituent of radiological practice. This approach is particularly relevant to media analyses which, for adequate understanding, should include details on the technology for producing representations e.g. pictures, print, motion pictures. For example, Fife and Law (1988:3) argue that a scientific journal such as *Nature*, which includes various depictions such as tables, graphs, scattergrams, maps, sketches and photographs, represents the production of a science that would be impossible without visualisation. This means that depictions are *constitutive* of scientific production. Fife and Law also cite Berger (1972), who argues that "art productions are not mere illustrations of the texts they accompany but are in themselves arguments about the originals".

This implies that pictures can be read like texts. But much more is involved. For example, the radiographic image can be thought of as a metaphor in the sense that transference is involved from one medium to another. To understand this consider Logan's (1986:26) account of the origins of early writing or notation which, he says, consisted of notches etched on animal bones to record quantitative data. Other notational devices included notched sticks, knotted strings and counting pebbles. Although these devices recorded the number of items, that was the extent of the information they provided. Later, clay tokens were developed that designated each quantity of a commodity with its own special shape. The use of such tokens for accounting purposes began at the very beginning of agricultural food production, some time before the existence of any form of writing or counting with abstract numbers.

. . . the tokens were three-dimensional miniaturised analogical models of the physical objects they designate, they were man's first full literary metaphors. They functioned as metaphors in that they translated information in an abstract form into a new medium. Tokens designated economic quantities that required accounting, translating them into a form that could be grasped in the hand and manipulated. This facilitated the new numerical calculations performed through using them. The tokens not only permitted new mathematical operations, they vastly improved record-keeping techniques because they denoted both the quantity and the quality of the objects they designated. (Logan 1986:27-28)

Eventually the tokens required some sort of container to hold them together. The most practical device seems to have been a clay envelope that sealed the tokens inside to form a permanent record of the envelope's contents. Logan (1986) argues that it was this innocent innovation which led to the development of writing and abstract numerals.

The clay envelopes or *bullae* were more or less of a spherical or egglike shape with a diameter of five to seven metres. The outer surfaces of the first envelopes were marked with cylinder seals to indicate the person for whom the accounting was being made. Because the clay was opaque, the contents of a sealed envelope could not be seen, which limited the usefulness of the *bullae*. To get around this shortcoming, a practice soon evolved of indicating on the outer surface of the envelope the tokens held within. At first an identical set of tokens were physically embedded in the outer wall of the envelope. This process was simplified later by merely imprinting or impressing the mark of the tokens on the outer surface of the clay envelope while it was still moist and hence impressionable. (Logan 1986:28-29)

Inevitably it was realised that there was no need to place the tokens inside the envelope, and this initiated a written record on a clay tablet.

Treating a mark or artifact in the same way as a literary metaphor needs to be carefully analysed within the context of radiological practice. Whittock (1990:2) suggests that many would question any use of metaphor outside literary disciplines arguing that to do so is mere license. (See Fig. 1.2). Discussing metaphorical usage in the film industry, he argues that there are two aspects to the criticism of the use of metaphors in film. The first comes "from literary critics who consider that this extension of the concept of metaphor would empty it of all its precision". For the second, Whittock (1990:2) cites Pryluck, who argues "that the photographic image in film is a literal representation of objects and events. These objects and events,. . . have intrinsic meanings which militate against the images being interpreted figuratively". Whittock argues that such views cannot be dismissed lightly as they reflect drawbacks to attempts "to apply traditional notions to new experience: The traditional terms become overextended and useless; and their employment may lead to preconceptions that hinder the recognition of the new for what it is". However, he argues what options have we but to "explore the unknown with the aid of the known, in the process modifying what we thought we knew and discovering what we did not expect to find?".

It was in this spirit that I decided to concentrate on Max Black's (1962) theory of scientific models. The objective was to compare the radiograph to the scientific model, in order to tease out tacit understandings implicit in the use of the radiograph by radiologists. Taken for granted, purposeful action is inextricably connected to the use of technology in practice, however more often than not, as Black argues, the taken for granted use of the scientific model is never considered by scientists. In the final analysis the fundamental and effective use of models is accomplished by talking in a specific way; therefore it is imperative to understand how the model is read. In this regard Susanne Langer's (1963) theories on picture representation and interpretation are considered in radiological context, culminating in a discussion of Goodman's (1985) relativist approach to non-discursive symbolism (pictures). This suggests a way in which radiological patterns may be effectively understood by the radiological community.

In a sense, Chapter 9 'Radiologist: The See-er' lies in the domain of psychology, concentrating on the individual rather than the social or the collective. Understanding of phenomena, such as perceptual ambiguity, and (in particular) depth perception, is fundamental for grasping the nature of the interpretive procedure in situ. There is some controversy over whether the phenomenon of depth perception really exists. It is argued by J.J. Gibson (1979), the perceptual psychologist, and by Merleau-Ponty (1962), that the problems connected to an understanding of what "depth" means can be related to the cultural acquisition of perspective which began during the Renaissance.

The significance of "depth" for my inquiry is that it is an uniquely individual attribute, and therefore provides a focal point for understanding the process by which the radiograph is read and thereby socialised. This is the manner in which different perspectives are combined, shared and negotiated into socially agreed meaning.

Chapter 10 'Radiology: The Code 1' involves writing about the changes in medical knowledge in the late 18th century. Foucault (1975:13) argues that medicine is quite different from mathematics. Measurement is used in medicine not to gain knowledge of mathematical form, but to gauge the intensity of pathological knowledge that comes to constitute the disease. The invention of new devices, like the microscope and the x-ray, means the fundamental goal of the medical practitioner could be accomplished by welding new alliances between words and things thereby enabling them to "see" and "say". This is an act that depends upon selective use of metaphor. I use transcripts from my field work to illustrate the use of metaphor in radiological practice.

Chapter 11 'Radiology: The Code 2' deals with a specific discussion on what could constitute a code in radiology. It questions the structuralist approach and structural semiotics. The emphasis in this chapter is Voloshov's (cited by Hodge and Kress 1988) thesis that the utterance is social.

The syntagmatic is the metonymic process by which an image is constructed in the mind. As a result of a specific and logical use of metonymy, an image in the mind is created individually by radiologists, and collectively understood as being represented by a specific radiographic pattern, i.e. a *caricature*.

Collective understanding is achieved by the radiologists through talking with each other, correlating separate ideas and disparate perspectives held by the medical practitioners involved in the diagnostic process. This is a situation which concerns individuals who rely upon mediated experience for a substantial part of their everyday thinking. In essence it is non-discursive, relying more on iconic symbolism or pictures as the dominant mode of communication and understanding. Grounded in the immediacy of perception, it is knowledge based on analogy, which is pictured rather than written.

Radiologists also depend upon knowledge that is usually represented by written and discursive language. It is the usual domain of specialists, such as accountants, lawyers, administrators and scholars, who tend to rely upon a conception of reasoning that is inextricably dependent on the visual, i.e. writing. Such knowledge also depends upon an abstract body of knowledge with clearly defined rules and procedures. Paradoxically, despite pictures being involved, radiological interpretation cannot have a lack of constancy that is associated with pictured knowledge. However, it would seem that it is infinitely more fluid than that used by modern communicators who tend to "mathematize ordinary speech", and convert language into "information systems".

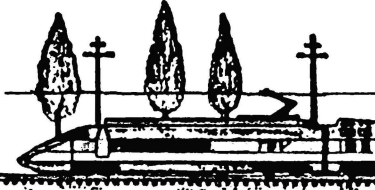
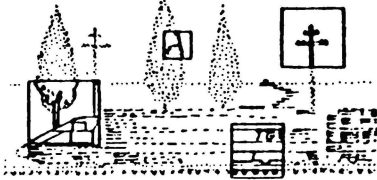
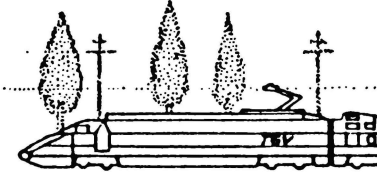
Radiology was selected as an exemplar of a techno-visual life-world, that is, a social situation whereby the individuals involved use pictures as an ongoing part of their everyday working lives in much the same way as people use books and tools. Radiologists are obliged to make an interpretation of some aspect of a radiograph which may or may not be available to the neophyte or lay person. This action is central to understanding the social processes involved in a radiologist's life-world. In essence, this involves a relativist approach in which the arbitrariness of a "sign" comes into question - that is, the essential, contextual, conventional nature of the association between a "word" and its "object". In the case of radiology this entails a connection between a word selected from the radiologist's medical repertoire and a pattern or mark on the radiograph.

Radiologists must first agree that something can be seen, despite the fact that what is being seen must vary with each person. (See Fig.1.3). Talking, therefore, is essential in achieving a consensus or social closure on whether what is seen represents something significant, such as a lesion.

The nature of a lesion grasped in the mind is that of "caricature". In this respect, the notion of caricature in the recognition of the icon as a social fact differs from what I call "representational isomorphism", which is the matching of an object with a word as prescribed in the early word/picture theory. The essence of the concept of caricature is that salient aspects of an image remain as residual traces which act as an index to memory. For example, the person who understands a cartoon is able to "see" in it the embodiment of some image which may be completely obscure to the uninitiated. In other words, without sufficient background understanding the lines and shapes of the cartoon would be meaningless. The significance of caricature/image is that it is infinitely variable between different imaginations and also varies on different occasions and contexts, and is affected by moods and feelings, in contrast to the technological and repetitively produced image. Although the caricature can be construed as a form of picture theory, it relates more specifically to what Schutz (1975:116-7) referred to as "typifications" which means that in the context of his/her everyday life the ordinary person refers to objects and things in a typified manner, unless he or she is sufficiently interested to inquire further. Schutz says "all forms of recognition and identification, even of real objects of the outer world, are based on a *generalised* knowledge of the type of these objects or of the *typical* style in which they manifest themselves". (Schutz 1975:118).

If the character of a life-world is essentially iconic, in the sense that pictures are replacing words as the prominent mode of representation, and also substituting or replacing direct experience, then it is possible that icons may be construed as social facts (or vice versa). However, it is not enough to say that a picture is a social fact because, to follow Durkheim's axiom, social facts are things. Treating them as things means that they are artifacts, and although an artifact cannot be substantiated into a human social order, an image of the mind can. It is not the picture or icon that becomes integrated into a social organisation, rather it is the image that is evoked in the actor's mind. It is the image that becomes constitutive of an order. Treating the icon as a social fact has merits, but for analysis it needs to be considered as part of a symbolic order. If iconic representation is fundamental to living effectively in a social order then the objective sense of that order must consist of some definitive patterns that influence the moral behaviour of the social actors involved. These patterns may well be construed as a "code", which is characterised by iconic symbolism. If this is indeed the case, then for those

living under its auspices it will have an objective existence, an indubitable facticity. The implication of this is that knowledge of the code is a prerequisite of being able to see; a factor which distinguishes the neophyte from the experienced. Knowledge of a code also implies membership of a community, and provides a paradigmatic perspective of the world, or a world view. The ramifications of this are that individuals "see" in a specific way. Seeing in context is literal in the fullest sense of the terms, such as psychological, physiological, and sociological.

VISUAL PATHWAY	INFORMATION	
BLOB	COLOR 	INTEGRATED VISUAL PERCEPTION 
PARVO-INTERBLOB	HIGH-RESOLUTION STATIC-FORM PERCEPTION 	
MAGNO	MOVEMENT AND STEREOSCOPIC DEPTH 	

VISION is a three-part system. Color is handled by the blob pathway, static-form perception by the parvo-interblob pathway, and movement and depth by the magno pathway. The end result is integrated so that one sees a unified, three-dimensional world.

Fig 1.1 VISION is a three part system.
(Livingstone 1988: 75).



Fig 1.2

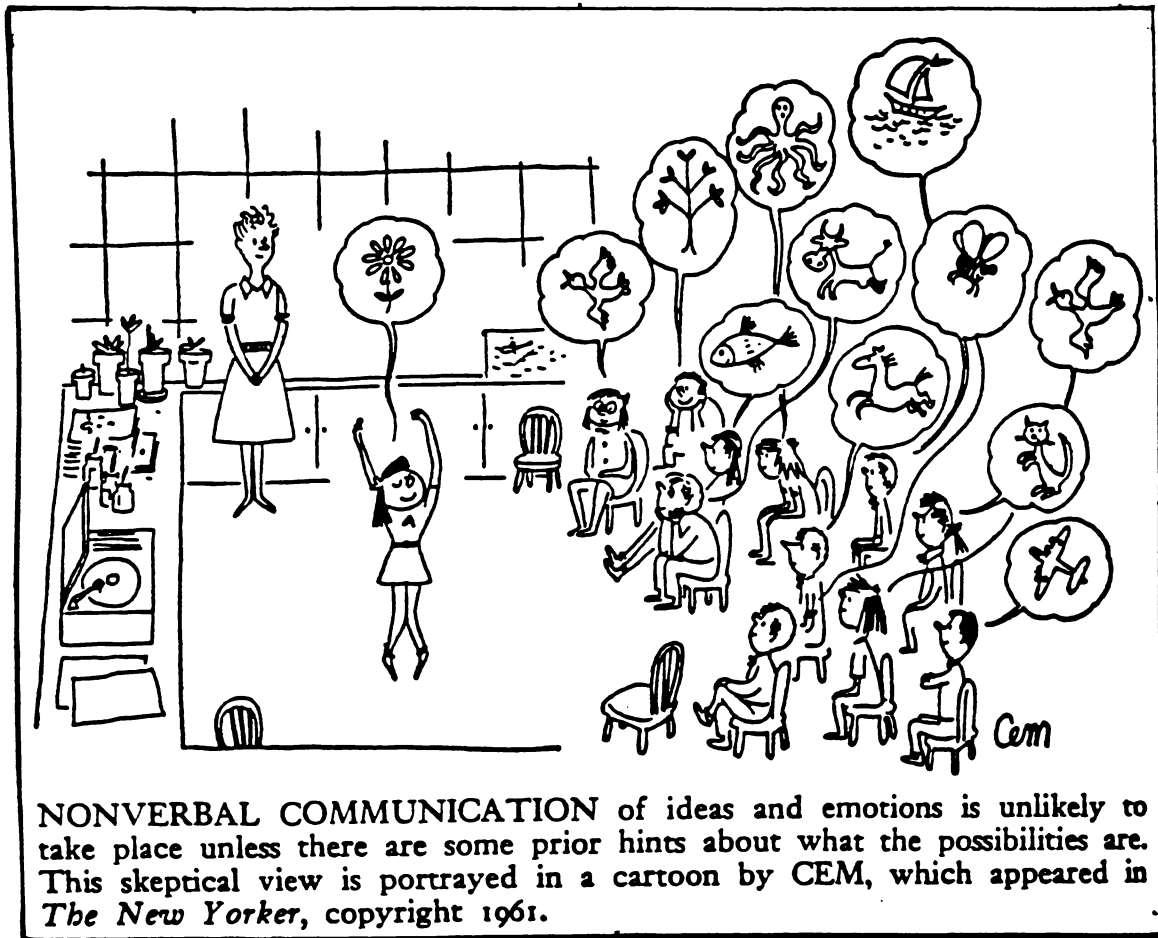


Fig 1. 3 Cited by Gombrich (1974:268).

CHAPTER TWO

Chapter 2.

Galileo: Common Sense and Practical Science.

The modern world is characterised by a plethora of technologies. Ihde (1990:2) suggests that our existence is technologically textured. He says the modern person's life is constantly intertwined with some sort of technology. For example, consider the every day life of the modern person who sleeps with an electric blanket, wakes up to the sound of an alarm clock, and then pulls back the curtains to view the day through the bedroom window made from glass.

Many technologies that people have contact with in daily life are taken for granted and therefore unseen. One of the most significant of these is glass. Clear glass exemplifies one of the puzzles in the history of technology because in many of its applications its most important function is not to be seen, and in chemistry a key quality is its neutrality while permitting observation. Only when a window breaks or a test tube shatters do people remember the extent of its insulating properties. Lewis Mumford (1962:127) cites Myres, a classic Greek archaeologist, who says that the backwardness of the Greeks in chemistry was probably due to a lack of quality glass.

Mumford (1962) writes that as early as 4000 B.C. glass beads appear to have been used. Other than as beads the earliest glass objects date from about 2500 B.C. Lenses were used as burning glasses about 424 B.C. and there is the possibility that beads of glass were fashioned into a convex lens. Seneca the Stoic philosopher, who died in A.D.65, remarked that Aristophane's glass could be used to read letters 'however small or dim'.

According to Mumford, Roger Bacon (1214-1294) regarded the eye as 'a most respected organ' (1962:127) . Referring to the superstition that diamonds could only be broken by resorting to experiment and by using goat's blood, Bacon said: 'I have seen this work with my own eyes'. This, Mumford says, was an indication of the dependency on sight that was now to come.

Despite the lack of serious technological obstacles to the manufacture of window glass and a need for better indoor light, transparent glass remained a scarce commodity until the sixteenth century. The development of glass during the Middle Ages was a gradual process. It was only from the 13th century onwards that the use of glass for a variety of purposes, such as containers, spectacles and mirrors, seems to have occurred. Glass of

indifferent quality was used as coloured panels in new churches until 1300 A.D. in Murano, where transparent glass of a reasonable quality was manufactured.

The introduction of clear window glass changed the way of indoor life in those countries that experienced long winters and cloudy skies. Nowhere was this more important than in Holland which was one of the first countries to develop a widespread use of glass. Dutch houses had huge windows which allowed the light to penetrate the interior, resulting in a cleanliness that characterized the towns and houses in marked contrast to the rest of Europe at that time. In art, Dutch painters created three dimensional vistas that demonstrated the change from two dimensional flatness of the closed order of Medieval times. The painter, Jan Van Eyck (1389-1440), was one of the first artists to place the landscape behind the window in his paintings.

Rene Descartes (1596-1650) lived in Holland from 1629 to 1649 -- a time of fascination with practical experiment and scientific logic. Although best known as a mathematician and philosopher Descartes had a profound interest in optics because, as Deric Regin (1976) argues, it revealed 'the security of facts before the eyes'. Descartes writes that when he lived in Amsterdam he visited the butcher every day to watch him kill animals; he then took some of the animals home so that he could carry out anatomy at his leisure. The eyes were of particular interest to him. Although, according to Regin (1976), Descartes's researches in optics are not rated as highly as those in mathematics and philosophy, in the history of science his work on optics, La Diotrique, is significant because of its emphasis on the practical aspects of scientific enquiry.

According to Bertrand Russell (1979:543) the importance of 17th century Holland to the rise of modern science cannot be over-estimated. In Mumford's opinion (1962:128) the widespread introduction of glass created a, "sharper eyesight: a sharper interest in the external world: a sharper response to the clarified image". Mumford asserts that among all the things possible from the manufacture of glass, in terms of knowledge two significant items stand out. These are the telescope and the microscope. According to Drake (1957:29) credit for the invention of the telescope, or spyglass as it was known then, was claimed by a Dutch lens grinder, Johann Lipperhey. In 1605 he made one from spectacle lenses and probably a piece of lead pipe. Galileo (1564-1642) describes the manufacture of his telescope in similar terms:

First I prepared a tube of lead, at the ends of which I fitted two glass lenses, both plane on one side while on the other side one was spherically convex and the other concave. Then placing my eye near the concave lens I perceived objects satisfactorily large and near, for they appeared three times closer and nine times larger than when seen with the naked eye alone. (Galileo, The Starry Messenger translated by Drake 1957: 29)

Clay (1932: 8-9) writes that Pierre Borel (1591-1689), physician to the French king, was the person responsible for collecting evidence that the first compound microscope was constructed in 1590, by a Dutch optician, Zacharias Jansen.

Like many of his contemporaries, Descartes was stimulated by Galileo's (1564-1642) discoveries with the telescope, but considered the telescope the result of an accident rather than design. There was a demand for better instruments. Galileo's telescopes, not surprisingly, had some defects. He made altogether about a hundred but could only see the planets of Jupiter with about ten of them. Descartes's aim was to determine from a scientific perspective the shape of the lenses that would be the most suitable to improve the effectiveness of the telescope. It was with this goal in mind that he applied himself to the study of the natural world and the property of light and, no doubt vicariously, to the application and practices of his scientific 'method'. His living situation in Holland must have been significant to his study of geometrical optics, possibly leading to his invention of coordinate geometry.

Although Descartes is popularly blamed or praised as the philosophic instigator of modern scientific method, Galileo's act in viewing Jupiter's planets was the beginning of a different mode of sensibility that was to become dependent on technology. Like Descartes, Galileo was a committed mathematician but, as Paul Feyerabend (1987) notes, it was not mathematical optics that stimulated Galileo's faith in the reliability of the telescope. Rather, it was the visual experience that the instrument made possible. Feyerabend (1987:105n) suggests that at that time the understanding of physics and geometry was insufficient to enable a single person to construct a telescope on the basis of mathematical optics. Even today the workings of the telescope are not completely understood.

It was on January 7th, 1610, that Galileo Galilei focussed his home-made telescope on the planet Jupiter and saw, for the first time, what seemed to be two bright stars near it. Galileo's act extended his visual sense to an

unprecedented degree. The most profound sense of the expression *out there* had been confirmed by objects orbiting that distant planet.

During that auspicious occasion Galileo may possibly have wondered if now the whole concept of the solar system would have to be revised. After all Nicolaus Copernicus (1473-1543), even without the use of a telescope, had offered evidence that the earth was not the centre of the universe. It follows logically that if two satellites were revolving around Jupiter then *all* heavenly bodies did not revolve around the earth. In his famous work Sidereus Nuncius, Galileo relates his experience of how his mind was stimulated by phenomena that no one had ever seen or conceived of before. It was only by looking at Jupiter over a few nights that Galileo saw all of its four satellites. (see Fig 2.1)

In the early 17th century many minds were stimulated to question aspects of nature. The natural world was no longer taken for granted. There was a sense of urgency in the quest for scientific facts. The new scientists began to regard 'reality' as that which could be measured. Outside the laboratory and in the streets all facets of life and the natural world were being questioned, from Galileo's swinging chandelier to a wind blown leaf. New interpretations replaced the old signs of nature, instigating a new mode of consciousness. During the years preceding and those following Galileo's sighting of Jupiter's satellites, successfully built telescopes would have highlighted the limitations of human sight, precipitating and predisposing a change in human knowledge and perception.

According to Mumford (1962), the telescope and the microscope extended the human visual field - a factor which over a long period of usage may have altered the perceived spatial dimensions of the world and universe. However factual this claim may appear, it is an extremely difficult one to determine, for example, as Poincare (cited in Miller 1986) has argued, if the world doubled in size overnight no one would know because all the measuring instruments would also have doubled in size. There is a strong instrumental sense to language; and alterations to the perceived world depend inextricably on its use. In a way the representational sense of language measures the world, not in an exact sense, but by analogy. What was at stake when using optical instruments, particularly the telescope for astronomy, was *common sense* achieved through shared discourse.

Today it is taken for granted that the telescope makes objects appear close, but before the instrument gained any reliability it was possible to make a different interpretation. In Alexandre Koyre's (1978) opinion, the instrument could be thought of as a celestial microscope which could be used to enlarge the stars to conceivable dimensions. Koyre says that both these interpretations fit the optical information equally well. In Galileo's time interpretations were still being based on philosophical reasoning as scientific reasons had not been fully developed to aid in the selection of choices.

Feyerabend (1987:115) states that there were two aspects about optical knowledge that were necessary but not sufficient at that time for understanding optics. First, *knowledge of images created by lenses*, and secondly, a *knowledge of things 'seen' through a lens*. Neither of these two aspects of knowledge had been worked out in any detail, and neither had each been synthesized into a coherent body of theory, or their connection theorised.

Galileo was aware of the Aristotelian principle that when perception is applied in extraordinary circumstances what is seen may not coincide with actuality. However, as Feyerabend (1978:73) suggests, Galileo was one of the few thinkers able to retain a reasonable measure of level headedness in his work -- neither wishing to be totally dependent on common sense, nor desiring to eliminate it completely.

In the early 17th century the appearance of a stone falling directly to the earth from a tower was regarded as evidence that the earth was motionless, and a stationary earth was also proof that it was located in the centre of the universe with all the planets orbiting it. The believers in a motionless earth reasoned that if the earth was spinning and a stone was dropped from a high tower, the stone would not land at its base but would be flung some distance out from it.

Galileo reduced the tension of the uncertainty against the concept of an earth in motion. His arguments on this issue are fundamental to understanding the development of an *observational sense* that had to accompany the use of optical instruments. In effect this meant incorporating what hitherto had been "invisible" into a new way of thinking and speaking.

Galileo did not dispute the commonsense appearance of the stone falling directly to the ground, but he said that what needs to be questioned is not the correctness of the observation but rather the question of its "reality" or "fallacy". He argues that fully to comprehend what is going on it is better to put aside "the appearance of which we all agree and use the power of reason either to confirm reality or to reveal its fallacy" (Galileo in Feyerabend, 1987:71).

To explain this he says that in every day life there are many occasions where the senses can be deceived by appearances. For instance, when walking along a street in the moonlight sometimes the moon seems to follow the walker matching his/her footsteps as it glides along the eaves of the roofs. "There it looks to them just as would a cat really running along the tiles and putting them behind it; an appearance which, if reason did not intervene, would only too obviously deceive the senses" (ibid).

This idea that "reason intervenes" is vital to the interpretation of appearances. As part of his method of argument Galileo asks that the reader begin with a sensory impression, such as the moon moving along the tops of roofs, and then consider the connection of word and appearance as experienced in the immediacy of perception. As Feyerabend (1987) says, the implications of this suggestion are so powerful that it has led to entire systems of belief and ritual such as may be found in studies of the lunar aspects of witchcraft. He says that when a person "sees" an illusion or an appearance there are not two separate acts of "seeing the phenomenon" and "expressing it in words". In an observational context we say "the moon is following me", or "the stone fell straight down". In everyday life under normal circumstances it is not usual to make an effort to separate word and appearance. They appear "glued together".

This practical unity of appearance and description can be understood by considering that young babies live in an immediate perceptual world with little guidance from memory and participation. Perception in young babies is not yet integrated into an overall context of conduct particularly that of spoken language. According to Bower (1977:50), perceptual development depends on this integration. Habitation and learning engender integration, and responses to appearances either linguistically or otherwise. For example, when seeing an apparition one can either shout "ghost" or act in some non-verbal fashion like running away.

Galileo differs from most other thinkers of his own time in his advocacy of critical discussion as to whether or not common sense interpretations should be retained. This was in contrast to the stance adopted later by Descartes: that common sense interpretations are a priori presuppositions of science or prejudices. According to Gurwitsch (1978:72), Descartes declared that the world is not as it appears to common experience, and he proposed that a reliance on perception alone was sufficient to reveal the true nature of the universe. Galileo (cited by Feyerabend 1987:73) regarded common sense interpretations as necessary, insisting that a true account consists of "the senses accompanied by reasoning". Although his approach is to argue from what has been observed, he says that it is fruitless to appeal to observation if the person cannot describe what they have seen or if the description is unclear, as though it had been made by someone new to the language. According to Feyerabend (1987:74) the process of producing an observational statement depends upon two distinct psychological events, that is, a clear and unambiguous "sensation", and secondly, a clear and unambiguous "connection" between this sensation and parts of a language. In his analysis of Galilean science Feyerabend (1987:73) substitutes the term "common sense" interpretations for *natural interpretations*. He says that, "In the history of scientific thought these have been regarded either as a priori presuppositions of science, or else as prejudices which must be removed before any serious examination can begin".

Galileo was aware that much of the everyday thought of the artisans of his time was based upon a fair measure of naive realism, particularly with respect to motion, because people were to some extent enslaved by the perceptual display of things. Despite a belief that their world was God given and God ordained, for the people of that time a stone falling directly to the ground was a sensible basis for an argument that seemed to refute the Copernican thesis that the earth was not the centre of the universe.

Galileo supported Copernicus's theory but considered that there was the possibility that there may be flaws in Copernicus's way of understanding due to the incorporation of some "natural interpretations" that were unnecessary. Therefore, in his substantiation of Copernicus's thesis, an important first step was the removal of any 'natural interpretations' that were obfuscating the theory. Galileo examined the Copernican doctrine and where necessary replaced it with a different interpretation. Significantly, this entailed the

introduction of a new language which through the use of the telescope was inextricably based on 'observation'.

The implications of this are of course complicated and profound, particularly in the case of astronomy where the development of a new language would have been necessary to describe phenomena in the skies which had never been seen before. The significance of astronomy was that it was less likely to be manipulated by controlled experimentation because of the "remoteness" of the phenomena. As Feyerabend (1987:122) says, "the stars are not known from close by", in contrast to the terrestrial sense of the telescope where it is easier to confirm the existence of "known" objects by seeing them at close quarters for confirmation. Furthermore, what was the point of seeing things with the telescope if they could not be shared by others. Although Galileo could see the satellites of Jupiter this did not mean that other people could. In fact one of the major problems he faced was convincing people that what he had seen was actually there. One can imagine how he felt when, on one particular occasion in 1612 which was reported on a public notice board in Rome, a number of prominent people gathered to view the satellites of Jupiter but, although they stayed until very late they could not reach an agreement on what they had seen.

At first glance the development of an *observational language* may not appear to be so extraordinary to the modern thinker; but considering the threat to the existing cosmology and to the established religious order, Galileo would have had to undertake extraordinary measures to vindicate Copernicus's stance and at the same time protect his own position. Quite early in his career Copernicus, who was a lecturer in mathematics, believed that the sun was the centre of the universe. Bertrand Russell (1979) says that essentially Copernicus's work was not modern as it followed Aristotle who had argued that 'all that is external is circular'. Copernicus regarded it as axiomatic that all celestial motions must be circular and uniform. As Russell (1979:513) says, there is nothing in Copernicus's theories that could not have occurred to the ancient Greeks. However, the significance of Copernicus's thesis was 'the dethronement of the earth from its geometrical pre-eminence', a factor which subsequently lessened the cosmic importance given to humans in Christian theology.

In the past all astronomers, without exception, had agreed that all the celestial motions were circular. The most beautiful of all the forms, the circle, was acknowledged as the perfect figure by Pythagoras and Plato. Celestial orbs

were deemed to be perfect bodies and therefore considered to be signs of gods. The ancients had considered that a perfect body must move like a perfect figure. However, this assumption was shaken by Kepler (1571-1639) who corresponded with Galileo, and who by patient observation and calculation of the orbit of Mars, worked out that the planets moved in ellipses. The aesthetic preference given to the circle was severely shaken.

Substituting the perfect form of a circle with the unnatural orbit of an ellipse prompted a change in thinking on a broader scale. Russell says that beginning with Copernicus the importance of astronomy and its methods cannot be over estimated in what contributed to the development of the modern mind.

The process of restoring confidence was important. For example, Mumford (1962) argues that naive concepts of space were upset when the sense of perspective was altered by increasing the vanishing point towards infinity. In 1425 an architect, Fillipo Brunelleschi, had worked out the principles of linear perspective. The essence of this technique was that areas within the frame became illusionistic extensions of perceived space, and the effect of depth was achieved by lines converging on a vanishing point. Brunelleschi's work was never written down but it influenced others greatly, including Leonardo Da Vinci (1452-1519), who considered the modern artist should be familiar with geometry, optics and perspective. Brunelleschi's conception of the vanishing point meant that space was converted to two dimensions. According to Rotman (1987:16), in terms of physical artifacts aspects of this innovation were, "the growing introduction of flat (as opposed to convex) mirrors and the optical theories they gave rise to; the rediscovery of Ptolemaic map-making with its central idea of the projection of territory on to a flat surface; the long-known but new found attraction of the camera obscura with its ability to transfer illusory, life like portrayals onto any surface".

According to Feyerabend (1987), when the first observers faced issues of confidence through the use of instruments, their existing knowledge could not be used in the interpretative process. Observing involved separating what was contributed by the technology of the telescope in the formation of the image; and what came from the object itself. The neophyte looking through a microscope with poor quality lenses does not know what to expect, as many mites, bugs and microcosms cannot be seen in daily life with the naked eye. The early makers of optical instruments encountered many problems in the

manufacture of lenses, and coping with imprecise optics was one of the reasons that it was not possible for a first time observer to separate the 'object' from the 'illusions' created by the instrument.

Faults or inconsistencies in lenses are known as 'instrumental artifacts' in scientific accounting. How to demonstrate that a phenomenon really exists, and is independent of the instrument employed, is one of the most difficult and yet important features of the scientific method. Lynch (1987) notes that as late as the early 18th century a scientific report contained erroneous evidence of minute homunculi in spermatozoa cells. Another report described bubbles in a lens as part of the constituents of the tissues. Later these instrumental deceptions were classified as artifacts that the aberrant lenses distorted. Galileo's telescope was so low-powered that when he looked at Saturn it looked like a jug with two handles. (see Fig. 2.2).

Early astronomers encountered many difficulties by taking their observations of celestial objects at face value because they lacked adequate understanding of the extent of optical illusions. It took many years for optical scientists to work through various theories about them.

Illusions encountered in direct vision were known to mediaeval writers on optics. These scholars took illusions seriously, writing separate chapters in their textbooks on them. They also regarded the images produced by lenses as psychological phenomena. Feyerabend (1987) points out that they thought that the images were the result of misapprehension, suggesting that an "image is merely an object outside its place". In this regard some early observers placed the image inside the telescope rather than perceiving it to be on the outside; something which did not happen with terrestrial objects. Others perceived double images and still others were unable to experience any magnification at all.

The early days of the telescope were therefore rather chaotic. The contradictory and spurious phenomena that it apparently produced led to doubts. There was also a wide variation in what observers could see, adding further confusion. Furthermore, some of the results of telescopic vision could be refuted by the naked eye. The circumstances were favourable for a new theory of vision. Galileo took up the opportunity in two significant ways. First, as mentioned earlier, he removed any 'natural interpretations' or commonsense assumptions that might have weakened his theorising. This is now known to be a very successful strategy in that it involves removing

extraneous material from the method of analysis. Knowledge in subjects like physics, physiology and astronomy was gained by rejecting anything that was regarded as irrelevant, non-existent or belonging to some antecedent philosophy. Many beliefs then current about witchcraft, such as demonic possession, were eliminated from analyses. This approach, by the end of the Middle Ages, had encouraged a movement away from many human considerations and concerns.

Significantly, the use of the telescope was able to resolve some known contradictions such as accounting for the perceived brightness of Mars and Venus. Galileo regarded the telescope as 'a superior and better sense', and argues that without it he would have been much more resistant towards Copernicus's theories.

The second factor in Galileo's approach was the creation of a new language based on "natural interpretations" that were produced as the result of using the telescopic image.

Phenomena were being seen for which there was no available language, or which, being outside people's experience, were treated as if they simply did not exist. Some people even refused to look through the telescope for fear of what they might see and the effect on their beliefs. In addition to naming things that could be seen only with the use of a telescope, there was also the need to conceptualise, including phenomena that couldn't be seen at all either with the naked eye or with an optical instrument.

Galileo's theories of motion were an inextricable part of the new observational language. His theory of motion suggests that the 'operative' character of all motion can be exemplified by a stone falling from a tower. He also argues that there are situations in which the 'non-operative' character, or the less obvious aspect of motion, is known to everyone but it is just that people are not aware of it. For example, he says the stone falling from the tower actually measures the tower as it falls. Today this principle is well-known and it is used in measuring instruments with a pointer or indicator replacing the stone. Describing the stone as measuring the tower is one of Galileo's new 'natural interpretations'.

Galileo introduced many different ways of experimenting in order to test ideas. This contrasted with the Greeks who relied on deductive logic. Because they did not experiment in the same practical way, the Greeks wrongly assumed that the heavier an object was the faster it will fall. In such

instances their reliance on deductive logic led them astray, whereas Galileo realised that inductive reasoning through experimental situations is the way to make discoveries in science. Add to this his knowledge of mathematics and measurement, and his use of the telescope, and one can picture the enormous potential it offered for human discovery.

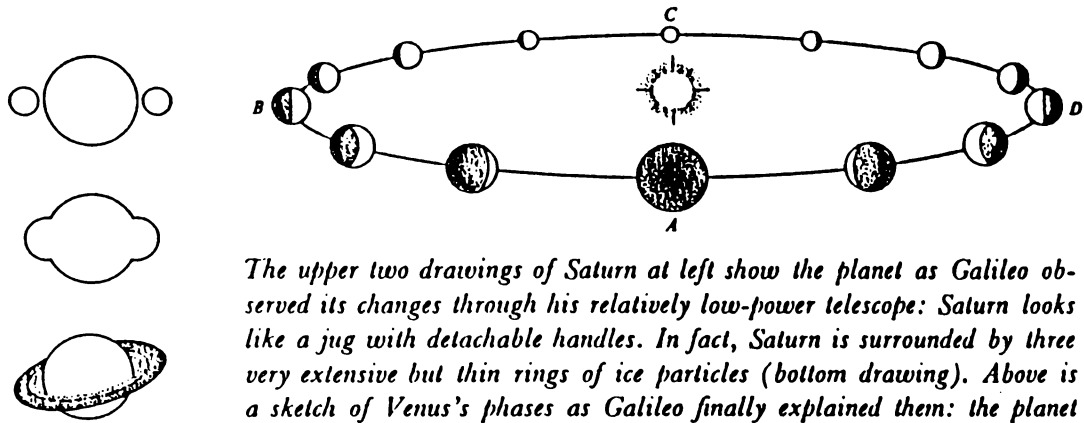
Observations January 1610

2. J. J. J.	mon H. 12	○ * *
30. mon		* * ○ *
2. J. J. J.		○ * * *
3. mon		○ * *
3. H. J.		* ○ *
4. mon		* ○ * *
6. mon		* * ○ *
8. mon H. 17.		* * * ○
10. mon		* * * ○ *
11.		* * ○ *
12. H. & J. J.		* ○ *
17. mon		* * ○ *
14. J. J. J.		* * * ○ *
15.		* * ○
16. J. J. J.		* ○ * * *
17. J. J. J.		* ○ * *
18.		* ○ * * *
21. mon		* * ○ * *
24.		* * ○ *
25.		* * ○ *
29. J. J. J.		* * ○
30. mon		* * ○ *
January 4. mon		* * ○ *
4. J. J. J.		* * ○ *
5.		* * * ○ *
6.		* ○ * *
7		* ○ * * * <i>midis omnia no. offensus in</i>
7. J. J. J.		* ○ * *
11.		* * * ○ *

Entries in Galileo's notebook record his sightings of Jupiter and the several satellites that appeared with it in various combinations.

Fig 2.1

Bixby and De Santillana (1964:56)



The upper two drawings of Saturn at left show the planet as Galileo observed its changes through his relatively low-power telescope: Saturn looks like a jug with detachable handles. In fact, Saturn is surrounded by three very extensive but thin rings of ice particles (bottom drawing). Above is a sketch of Venus's phases as Galileo finally explained them: the planet circles the sun from A to D and reflects the most light at C; but it seems no brighter at C than at B because it is then farther away from the earth.

Fig 2.2

Bixby and De Santillana (1964:57)

CHAPTER THREE

Chapter 3

Edmund Husserl and Galilean science.

Edmund Husserl (1859-1938), regarded Galileo's scientific method as the true beginning of modern science. According to Kearney (1971:63-64), in contrast to Harvey (1578-1657) who focused on the characteristics of actual blood, Galileo set up experiments of a more abstract nature removed from such actuality. Galileo's method modelled aspects of the universe, by taking into consideration mathematical categories such as, time, speed, and distance. The following is part of his account of an experiment with an inclined plane:

Salv. The request which you, as a man of science, make, is a very reasonable one; for [such experiment] is the custom - and properly so - in those sciences which apply mathematical demonstration to the study of natural phenomena, as is seen in the case of perspective, astronomy, mechanics, music, and others where the principles, once established by well-chosen experiments, become the foundations of the entire superstructure. I hope therefore it will not appear to be a waste of time if we discuss at considerable length this first and most fundamental question. I have attempted in the following manner to assure myself [about] the acceleration actually experienced by falling bodies.

.....

For the measurement of time, we employed a large vessel of water placed in an elevated position; to the bottom of this vessel was soldered a pipe of small diameter giving a thin jet of water, which we collected in a small glass during the time of each descent, whether for the whole length of the channel or for part of its length; the water thus collected was weighed, after each descent, on a very accurate balance; the difference and ratios of these weights gave us the differences and ratios of the times, and this with such accuracy that although the operation was repeated many, many times, there was no appreciable discrepancy in the results. (Galileo cited by Kearney 1971:64)

Edmund Husserl (1859-1938) recognised the practical significance of Galilean science, and argued that it epitomised the scientific outlook of the modern world. However, at the time of Husserl's writing the scientific enterprise had reached such proportions that it seemed to be overwhelming the human life-world. During the 1930's it seemed to Husserl that the worst of his fears concerning the neglect of the life-world, by the dominance of scientific technique, had been realised. He formulated his influential work during these very uncertain times. The Crisis of European Sciences and Transcendental Phenomenology, was based on his "Krisis" lectures delivered in Prague during 1935-6.

Husserl's deep sense of urgency and desire for an enhanced recognition of 'humanness' are quite poignantly reflected in this book. Writing as an old man at the end of his career, with knowledge of both his life's successes and failures, it is as though he used everything at his disposal to convince his readers of the dark spectre of the modern scientific way. Also, a trained mathematician, he recognises the merits of science and is not opposed to the successes that scientific endeavour has brought about. The thrust of his argument is an appeal for the recognition of 'lebenswelt', or life-world, which he says has been gradually neglected by scientists ever since Galileo.

The reason Husserl gives for this neglect is the creation of a 'scientific attitude' which he identifies as mathematical methods. It is symbolized as a *garb of ideas*; a cloak which surreptitiously substitutes for the everyday world that is given through perception with a "mathematically substructured world of idealities" (Husserl 1970:48-49). It is worth noting at this point in the discussion, that, according to Drake (1957:15) Galileo's first teacher in mathematics was Ostilio Ricci who was a teacher in practical mathematics rather than an academic. Drake proposes that it was perhaps Galileo's grounding in practical mathematics, rather than pure mathematics, which was responsible for his significant contribution to physics. That is, the application of mathematical concepts to observed phenomena; an interest which lacked appeal for those interested in pure mathematics. Kearney (1971:64) states that Aristotelian inclined mathematicians regarded mathematics as an escape from the problems observed in a world characterised by constant change.

Husserl argued that the substitution of the everyday world by the mathematical scientific method was passed on by Galileo to his successors in science, who followed his way in succeeding centuries. As a result, scientists seem to have forgotten that no one, including scientists, can escape the temporal context of a world that engulfs each bodily presence. In the wide awake situation of daily life, the essence of the life-world is that it is pre-given, pre-suppositionless and taken for granted by everyone. In the life-world human individuals do not usually question those aspects of their immediate environment that appear to be intrinsically enmeshed, such as the colour of an object. Each life-world has a knowable and comprehensible quality related to commonsense. Thus, in Galileo's time, the ordinary person took for granted that heavier stones fell faster than light ones to the ground.

Much of Husserl's analysis, in what is here referred to as "The Crisis", is directed at what he calls 'The Science of the Galilean Style' which symbolizes for him the spirit of modern physics. He argued that since Galileo's time the scientific method employed by scientists has developed mechanical characteristics, and this seems to have originated in the manner in which the techniques of mathematics have become embedded in empirical understanding. Following Isaac Newton (1642-1727), who built on Galileo's faith in experimentation, the material world could be thought of as an assembly of objects organised into a giant machine. Born in the year of Galileo's death, Newton was also a keen mathematician who studied telescopes and ground his own lenses. His three laws of motion outlined in The Principia established the grounds for mechanics as a major branch of physics. From the middle of the seventeenth century until the end of the nineteenth century the mechanistic Newtonian model dominated scientific thought.

At this stage in the discussion it is important to realize that although Husserl focused his attention on Galileo, he was not a historian of science and never claimed to be one. Gurwitsch (1978:74) argues that despite identifying some historical inaccuracies in Husserl's writings, Alex Koyre, the historian of science, informed Gurwitsch that Husserl's analysis of Galileo does provide an important 'key' to the understanding of Galileo's work, but the telescope was a significant constituent of knowledge that Husserl omitted to discuss in detail. Husserl's attention seems to have been taken up with geometry.

My intention is to focus on significant omissions in Husserl's analysis of Galileo. This is not with the intention of proving him wrong, but to demonstrate the role the telescope had in the constitution of what has become scientific knowledge. Husserl mentions instruments, writing, and a number of phenomena properly considered as "constituents" of knowledge. His focus was on Galileo's taken for granted use of mathematics. My intention is to demonstrate how the "garb of ideas" develops when grounded in an observational language. This involves the incorporation of Husserl's concept of the life-world by investigating contextual aspects of the early use of optical instruments. Some issues that have come to my notice are:

--- The use of optical instruments enhanced the separation of the subject from the object. As stated previously, the optical image can be perceived as being inside the instrument or alternatively seen as *out there*.

--- The frame of the lens provides a focus on phenomena within it, and this tends to exclude phenomena which appear outside its boundary. Not unlike the use of brackets in mathematics, the use of an optical lens permits a focus on selected aspects of the world it brackets. The frame assists the salience of visual aspects of reality by making objects more obvious to attention. This was a technique known to the Arabs long before Galileo's time when they used a long tube to see the stars. This was also one of the important factors which occurred with the developing use of glass, which also precipitated a tendency to view aspects of the world through a frame.

--- The frame of a lens provides an inbuilt matrix allowing the use of co-ordinates; left/right, up/down, north/south, a/x and so on.

--- Repeated use and concentrated focus on specific phenomena makes it easy to refer to the symbols on the instrument matrix, such as those on a theodolite, and consequently forget other matters adjacent.

The telescope made possible "the conception of a new idea of 'nature' as an encapsuled, really and theoretically self-enclosed world of bodies", to use Husserl's (1970:60) words. It was this, he argues, that instigated a complete transformation of the way in which some people thought about the world. For example, a mind inculcated with mathematics has an inherent sense of prediction of events in nature.

Husserl (1970:70) argues that what is denied in empirical practice but attained in mathematical practice is "exactness". He does not dispute that the mathematisation of nature resulted in valid practical knowledge; but argues that the practice relies upon the technology of measurement, and this involves the use of idealised "basic forms, shapes and relations that are grounded in the discipline of geometry". Surveying is a good example of this where the land (through the use of an optical instrument) is measured and categorised into shapes and patterns that do not necessarily conform to the uneven nature of the land.

Husserl (1970:25) regarded geometry as the foundation for the meaning of exact physics. The thrust of his argument is directed at the notion of space used by geometers and relies on the use of terms and concepts that depend on a notion of "ideal space". The practice of geometry relies on "pure" shapes which can be drawn in ideal space--"pure" bodies, "pure" straight lines,

"pure" planes, "pure" figures" (Husserl 1970:25). These idealised constructs are in contrast with the notion of imaginable space.

The use of "pure limit shapes" operates in an instrumental fashion that has become habitualised and therefore can be applied a priori to new phenomena such as are seen through the telescope. This is not mentioned by Husserl, but he emphasises other cultural acquisitions that, he says, are the result of human endeavour. Referring to the "limit shapes" of geometry, he says:

Like all cultural acquisitions which arise out of human accomplishment, they remain objectively knowable and available without requiring that the formulation of their meaning be repeatedly and explicitly renewed. On the basis of sensible embodiment, e.g., in speech and writing, they are simply apperceptively grasped and dealt with in our operations. (Husserl 1970:26)

Husserl's translator, David Carr (1970:26), notes that Husserl uses the term 'apperception' to denote a self-conscious act (but not necessarily an act of reflection) made while engaged in a certain "attitude", in this case the mathematical. Husserl argues that what he calls "sensible models" operate in the same way as drawings on paper (see Fig.2.6 Galileo's notes on his sightings of Jupiter's satellites) i.e. "printed drawings on textbooks for those who learn by reading". Similarly, certain cultural objects (tongs, drills, etc.) are understood, or simply "seen", without any questioning by the user of how they came into being. The optical instrument comes into this category as a "sensible model". An issue here is the development of specialisation.

Most substantial scholars and writers seldom become involved in discussions about their paper and pencils. In this respect Husserl was an exception with his focus on the specialised use of "cultural objects", like tools and instruments and "sensible models" such as the ideal shapes of triangles and circles of geometry. In his critique of Galileo's mathematization of nature, Husserl (1970:26) argued that the use of "limit shapes" of geometry, through practice and habit influenced a way of thinking that was embodied in their use and thereby was "objectively knowable and available without requiring that the formulation of their meaning be repeatedly and explicitly renewed". In other words, they are available as symbols and tools in the same way that the alphabet and writing are used as taken for granted technologies.

This was not always the case. According to Olson (1974:1), prior to the use of the technology of the alphabet and writing, people had to rely on what he calls "mental tools" such as a "shared spoken language, songs and rythmes to summarize experience and to aid memory, games to master the social and practical skills of a culture and so on". For example, he argues that Plato's Republic was a significant historical milestone that indicated a shift from the oral Homeric tradition of poetry towards a reliance on literacy. This development was made possible by the introduction of a phonetic alphabet. Marshall McLuhan (1967:113) noted this when he quoted Socrates:

The discovery of the alphabet will create forgetfulness in the learners' souls because they will not use their memories; they will trust to the external written characters and not remember of themselves. . . . You give your disciples not truth; they will be heroes of many things, and will have learned nothing; they will appear to be omniscient and will generally know nothing.
--Socrates, Phaedrus

Like his contemporaries, who were deeply immersed in the study of numerical patterns and mathematical reasoning, Galileo asserted that philosophy was written "in that vast book which stands ever open before our eyes - the universe; but it cannot be read until we have learnt its language in which it is written. It is the language of mathematics". Nearly all the philosophers mentioned so far, including Galileo, Descartes, Copernicus, Kepler, Russell and Husserl were trained mathematicians. The significance is that of all the symbolic systems in use mathematics is the most powerful and abstract. Susan Langer (1942:18) argues that mathematicians "deal only with items whose sensory qualities are quite irrelevant: their "data" are arbitrary sounds or marks called *symbols* " (her italics). She writes that no one noticed in the early enthusiasm of empirical fact finding that those practising the ancient science of mathematics still pursued the way of pure reason. Mathematics was easily synthesised into scientific thought. It fitted the observed world of fact so neatly that people who learned and used it never questioned that those who had invented and evolved it were mere reasoners and lacked tangible data.

Langer (1962:18) asserts that few mathematicians have ever really believed that numbers were discovered by observation, or that the relations of geometry became known through inductive reasoning. Mathematicians are concerned with symbols, and

Behind these symbols lie the boldest, purest, coolest abstractions mankind has ever made. No schoolman speculating on essences and attributes ever approached anything like the abstractness of algebra. Yet those same scientists who prided themselves on their concrete factual knowledge, who claimed to reject every proof except empirical evidence, never hesitated to accept the demonstrations and calculations, the bodiless, sometimes avowedly "fictitious" entities of the mathematicians. Zero and infinity, square roots of negative numbers, incommensurable lengths and fourth dimensions all found unquestioned welcome in the laboratory, when the average thoughtful layman, who could still take an invisible soul-substance on faith, doubted their logical respectability. (Langer 1962:18-19)

Mathematicians are concerned about symbolising "things" and also about symbolising the relations that "things" may have with each other. However, perhaps unintentionally, due to their faith in the power and truth of mathematics, scientists misunderstood their interpretative processes as they became more dependent on the mechanical aspects of calculation and less on observation. Langer (1942:20) argues that many of the facts that scientists work with are not actually observed at all. Unlike Galileo's laboratory, where observation was first hand, direct observation in physics has become relegated to mathematical technique. Instead of actually watching the objects of their curiosity, scientists watch index needles, revolving drums and sensitive plates.

Observation has become almost entirely indirect: and *readings* take the place of genuine witness. The sense-data on which the propositions of modern science rest are, for the most part, little photographic spots and blurs, or inky curved lines on paper. . . . Instead of watching the process that interests us, that is to be verified- say, a course of celestial events, or the behaviour of such objects as molecules and ether-waves - we really see only the fluctuations of a tiny arrow, the trailing path of a stylus, or the appearance of a speck of light, and *calculate to the "facts" of our science*. What is directly observable is only a *sign* of the "physical fact"; it requires interpretation to yield scientific propositions. Not simply seeing is believing, but *seeing and calculating, seeing and translating*. (Langer 1962:20)(my bold italics)

Husserl (1970:62) says that Galileo's "natural science did not come through specialists", (although of course there were specialised activities carried out by artisans), but what Husserl is referring to is the use of mathematics in a particular way. Specialisation requires a separate language in which specific phenomena can be referred to within the context of their meaning. He further states (1970:62) that "dualism" can be regarded as presupposition for specialisation.

The use of the telescope enhanced the separation of subject and object and its introduction occurred at a time in history before mathematical science, as is practised today, was developed. Needham (1972:21) says that no "mathematical works" before the Renaissance were in any way comparable in terms of the wealth and power of knowledge with what took place later.

Specialisation in the modern sense implies a specialised technology, a specific and separate methodology accompanied by a specialised language and cultural conventions. Galileo, in relative terms, was a jack of all trades. Feyerabend (1977) writes that in terms of science we can say today that Galileo provided the correct path despite early 17th century opinions seeming like "silly cosmology".

Feyerabend (1977:27) argues that theories only become clear and reasonable after a period of what seems to the rule-bound mind as "unreasonable, nonsensical, unmethodological foreplay". That is, articulation often takes place in common sense language. This, he says, is an inevitable precondition for clarity and empirical success. He makes the point that all attempts to understand and describe scientific development are dependent upon existing forms of speech, including scientific "common sense".

Common sense or idiomatic speech may simply be inadequate for describing creative, dialectical thought which frequently relies on a "misuse" of language in order to describe what is only imagined. Creative scientific thinking tends to challenge scientific common sense.

Like Husserl, Feyerabend (1987:66) suggests that the material that the scientist has at his or her disposal, such as "laws, experimental results, mathematical techniques, epistemological prejudices, attitudes towards absurd consequences of his/her acceptance of theories, is indeterminate in many ways, ambiguous, *and never fully separated from the historical background*" (Feyerabend's own emphasis) As he says, the scientist is obliged to use material which is contaminated by principles which may not only be invisible but may be impossible to test.

Referring to the use of an optical instrument, Feyerabend (1978:66) says that "the sensory impression, however simple, always contains a component that expresses the physiological reaction of the perceiving organisms and has no objective correlate". This recognition of an inextricably subjective category of human experience can be demonstrated through the experience of seeing a

star with the naked eye. The act of seeing includes the "subjective effects of irradiation, diffraction, diffusion, restricted by the lateral inhibition of adjacent elements of the retina", which are all involved in the co-ordination and totality of the act of seeing.

Copernicus's hypothesis was so laden with subjective judgements, or what Feyerabend calls "natural interpretations", that it ran counter to almost every scientific methodological rule that is used today. One of Galileo's tasks was to set about removing any "natural interpretations" from the Copernican theory that seemed to be grounded in old and inadequate beliefs. This was achieved by replacing the "natural interpretation" with a new and different interpretation; it was in this way that Galileo introduced a new observational language.

Feyerabend stresses the importance for the practical success of any observational language, whether materialistic or phenomenological, that it be spoken fluently. Although Galileo introduced new and abstract "natural interpretations", he did so in such a way they remained concealed so that it is difficult to detect the changes. He achieved this by the method of anamnesis, by recollection of the existence of some previous experience.

In effect, Galileo used methods of rhetoric to convince his hearers of his arguments by capitalising on the common sense of the 17th century artisans. He related known phenomena that emphasised the "operative" characteristic of all motion such as a stone falling from a tower. His audience was requested to "remember" the conditions asserting the more abstract notion of the non-operative character of motion, which required individuals to imagine that the distance of the height of the tower was only the end of a much longer trajectory stretching out into space:

It is likewise true that the earth being moved, the motion of the stone in descending is actually a long stretch of many hundred yards, or even many thousand; and had it been able to mark its course in motionless air or upon some other surface, it would have left a long slanting line. But that part of all this motion which is common to the rock, the tower, and ourselves remains insensible as if it did not exist. There remains observable only that part in which neither the tower nor we are participants; in a word, that in which the stone in falling, measures the tower. (Galileo in Feyerabend 1987:84)

A second perspective, which asserts the non-operative character of all motion, precedes Galileo's urging to

Transfer this argument to the whirling of the earth and to the rock placed on top of the tower, whose motion you cannot discern because, in common with the rock, you possess from the earth that motion which is required for following the tower; you do not need to move your eyes. Next, if you add to the rock downward motion which is peculiar to it and not shared by you, and which is mixed with this circular motion, the circular motion which is common to the stone and the eye continues to be imperceptible. The straight motion is sensible, for to follow that you must move your eyes downwards. (Galileo in Feyerabend 1987:84)

As Feyerabend says, this is powerful persuasion; but it was not as powerful as the use of mathematical symbolism in the years to follow. Then the integration of mathematics and observational empirical science became the basis of a new phase in the history of science and indeed of the world, exemplified in Descartes's work, Meditations on First Philosophy.

Gurwitsch (1978) points out that it can be difficult for the modern mind to grasp how bold Descartes was in proposing that the world is not as it appears in common experience, and that the nature of the universe cannot be determined by perception alone. Only the mathematical, scientific approach can reveal the true nature of the universe. The thrust of Descartes's method was to dichotomise the world into mind and matter, precipitating the outstanding success of an objective science based largely on observation.

The telescope reinforced a convention of knowledge that was based on the dualism inherent in ancient Greek thought. According to Mitchell (1987), the Greeks considered that "doxa" was knowledge of a practical and relative nature. In contrast, "episteme" alluded to a different kind of existence based on more abstract, and hence more privileged, knowledge. This was associated with the universal notion of "idea" which comes from the Greek verb "to see", and it was sometimes linked with the notion of the "eidolon", or the visual image, that was central to ancient optics and theories of perception. Unquestionably, in my view, the telescope enhanced a convention of knowledge exemplified by "episteme" with its ready built in matrix and co-ordinates. Significantly, its use reinforced seeing the world through a frame. Its use also required that the image seen through it be separated from the original visual experience.

Descartes stressed the powerfulness of mathematics and in so doing probably precipitated the transference of heavenly geometry to human awareness. In some cases the consciousness so generated becomes a new territory, albeit unwittingly. It was the mathematisation and enhancing

consciousness, rather than nature, that ultimately led to the period in the history of science that Husserl regarded as problematic. Ironically, the world that opened up for Galileo and his telescope eventually became, like the closed world it replaced, a symbolic universe that could be epitomised as a "garb of ideas".

According to Gurwitsch (1978:72-75), there were, roughly speaking, two distinct periods in the history of the philosophy of science prior to Husserl's work. The first period begins about the middle of the seventeenth century and ends about the middle of the eighteenth century. Descartes's Meditation on First Philosophy (1641) exemplifies the first historical phase. However, it is the second historical phase that highlights the impact of mathematics in the laboratory. Gurwitsch (1978) suggests that this phase begins in 1748 when Leonhard Euler, the famous Swiss mathematician, submitted a memoir entitled *Reflexions sur l'espace et le temps* to the Royal Prussian Academy of Berlin. The thrust of this work was Euler's advocacy of the separation of physics from philosophy. Euler emphasised the superiority of physics in terms of its concepts which he considered should be regarded as scientific facts. Thus a law of physics took precedence over a philosophical proposition. Significantly, from within the theoretical context of physics, there was no longer any need of validation and therefore a concept could be regarded as a "given fact".

Following Euler's example, specialisation became a trend in the 19th century. New disciplines such as economics emerged from the separation of economics from political economy. What these new disciplines had in common was a separate language and a particular version of "fact". Inevitably, facts get taken for granted in respective disciplines. As a result members easily forget that their respective accounts rely upon and are recognised as orderly only because of habitual adherence to the rules and methods of their discipline. For example, accountancy is a practice which relies inextricably on the use of mathematics to symbolise the operations of a variety of businesses, but the accountant's balance sheet can only be recognised according to the rules of accountancy practice. That is, a particular frame of reference in which the members regard the background rules as unproblematic because everyone in that community knows them. What is known in each specialised context is seen against the grounds of a particular "body of knowledge".

Specialisation leads to the fragmentation of knowledge in the sense that a community of practitioners is involved in specific and shared activity. Such involvement means that a particular language or jargon is generated and maintained through practice; and this is usually selective for the purpose at hand.

Barrett (1979) argues that Husserl's concern about this was centred on his ideas on two disciplines, *mathematics and psychology*. Both these disciplines displayed signs of confusion to him. The purity of mathematical reasoning was being subordinated to the routine of technique. With the establishment of the first experimental laboratory for research in 1870, psychology was going the same way. He felt that the essence of human personality, particularly that of consciousness, was becoming distorted by research attempting to imitate the techniques of the new science.

Wilhelm Wundt was the recognised founder of modern psychology's first perceptual laboratory. An advocate of the scientific way, he was the instigator of a school of perceptual research and theory called "structuralism".

Commenting on Wundt's theoretical formulations, Husserl (1970:232), argues that the Wundtian way, as well as being bound to empirical dualism, (that is, the world is dichotomised into subject/object but with the emphasis on the objective), "retains the naturalistic data-interpretation of consciousness in accord with the Lockean tradition".

McConville (1972:98) notes, following Wundt's concept of sensory experience, that there were several concepts that were significant in the development of modern psychology. With particular reference to observation, one was the "constancy hypothesis". McConville explains that Wundt had assumed, like Locke, "that the relationship between stimuli and sensation is direct and causal. That is, when a given stimulus excites a given portion of the sensorium, its effects are always the same". This was later labelled by the Gestalt psychologists the *constancy hypothesis*. In their view it defined the relationship between the physical world and perceptual experience as something always fixed and constant.

In contrast to the predictability assigned to the sensory event in psychological science, Husserl asserted that mundane knowledge or *common sense* was the proper foundation for all knowledge. He was also cautious of scientific practice because scientists had ignored their life-world, which was anything but fixed or constant. As a result they had failed to secure the fundamental properties of science itself. This implied, in his view, that science did not have rigorous foundations.

Husserl had centred his analysis of modern science on Galilean science. He considered Galilean science to be full of errors and anomalies and, as a consequence, empiricists had called for theories that were verifiable. Such a stance involves adopting a method which incorporates the logic of hypothesis, test and verification, and, almost inevitably, leads to the subject/object dichotomy. In contrast, Husserl asserted that phenomena are constituted by theories and attitudes, not the reverse.

With regard to the significance of experimental techniques in modern science and enhanced specialisation, Barrett (1979) writes that the situation has become aggravated since the publication of Husserl's work:

Discoveries upon discoveries have piled up, but the unifying conceptions seem lacking. And the rate of discovery seems constantly accelerating. Each decade knows immensely more than the preceding, and seems just that more confused than its predecessor. Is it possible for the scientist to escape the fate of the technician in our technical era? The technician is called upon to handle the instrument he is assigned to without having necessarily to know how it works. The man who comes to repair your television set is able to spot what's wrong and fix it without having to know the theories of electromagnetism. So the biologist need not know the laws of optics on which his microscope has been constructed. The characteristic of technical organization is the subdivision of labor and the specificity of the task assigned. Within science this begets the situation where one scientist borrows and uses the results of another scientist without having to know clearly on what they are based, or what their finer meaning might be. Now imagine this procedure carried to the farthest degree. Each link in the chain does what it does without knowing what the whole chain is about. We would end by building a tower of Babel where each layer of the structure cannot communicate with the next. (Barrett 1979:135)

Barrett's descriptive overview of modern science illustrates the complexities involved for anyone attempting to synthesize perception and technical language. For example, medicine is a scientific practice which has numerous specialist branches. On one hand, knowledge of each particular practice

depends upon what is formulated or framed in scientific language, and represented in journals and textbooks. However, framing the world is also intrinsic to common sense. Situational aspects inherent to specialist practice have to be integrated with what is considered to be formal science. A dilemma emerges involving training and education. According to J.J.Gibson (1979:112), the drawing in figure 3.1 is an update of one made by Ernest Mach in 1880 entitled the "Visual Ego". Gibson stresses that the significance of this field of view is its boundaries. In other words, observation (or what we see) as a taken for granted act of framing the world, is also a crucial unifying factor in the acquisition of knowledge.



The ego as seen by the left eye. The temporary field of view of the left orbit of an observer.

(From *The Perception of the Visual World* by James Jerome Gibson and used with the agreement of the reprint publisher, Greenwood Press, Inc.)

CHAPTER FOUR

Chapter 4

The Frame.

It is important to realise that the "symbolic" as discussed previously also acts as a way of framing the world. This is exemplified by metaphors, such as Husserl's (1970:51) "a garb of ideas or a garb of symbols". He argued that "it is through the garb of ideas that we take for *true* being what is actually a *method*" (1970:51). Similarly, the "Jew" Black argues, was not considered by Hitler "as a creature of flesh and blood, but was abstracted as a principle or idea. The Jew was the shorthand symbol of degeneration" (cited in Edge 1973:62).

Discussing metaphor, R.H. Brown (1977:85) states that an *iconic* metaphor demonstrates what a thing is, and tends to be auto-referential within a single frame. He explains:

In this broad sense, a statue is an icon of the person portrayed, at least in terms of certain features. A photograph may be an icon of even greater abstraction, for it translates spatial dimensions into two dimensions, and color into black and white. Organisational charts are even more abstracted because they represent fewer dimensions, and what they do represent - organisational processes - is conveyed in static form. Likewise sociograms. Mathematical representations of sets of phenomena are probably the most abstract iconic metaphors in that they represent synthetic, contextually embedded statements about conduct in terms of wholly tautological analytic or logical truth about numbers. (Brown 1977:85)

The reason for dealing with the technical is in keeping with Husserl's advocacy that the naive taken-for-grantedness of the everyday world should not be ignored by social inquirers. This approach has now been adopted by the ethnomethodologists and the sociologists of technology. In the interests of clarity I will discuss the technical/historical aspects of the frame separately.

Since Husserl was writing in the 1930's the ways and artifacts of science have increasingly permeated almost every aspect of our daily lives. For example, there is increasing chemistry in the bathroom and kitchen, measurement in sport, and a source of visual imagery in the lounge. The extent of technology in general is almost too overwhelming to comprehend. Technologies that were once confined to the laboratory and the factory have

extended into all the major dimensions of our lives. The propensity of the modern person to see the world through some sort of frame, can be considered as a phenomenon unique to the contemporary world.

The "ubiquitous frame" is probably the most unseen and taken for granted aspect of modern visual living. Like the technology of invisible glass, the frame is almost an unnoticed technology that surreptitiously affects the way people see. Even a piece of broken glass, as the painter Magritte has demonstrated in much of his art, frames aspects of visual reality. Glass and frame are the main constituents of the mirror which has played a prime role in the formation of the modern notion of self. As Mumford (1962:129) explains,

The use of the mirror signalled the beginning of introspective biography in the modern style: that is, not as a means of edification but as a picture of the self, its depths, its mysteries, its inner dimensions. The self in the mirror corresponds to the physical world that was brought to light by natural science it was the self *in abstracto*, only part of the real self, the part that one can divorce from the background of nature and the influential presence of other men. (Mumford 1962:129)

In terms of notions of "self", the ordinary snapshot photograph, like the mirror, has had considerable influence. Susan Sontag (1979:161) stresses the belief that increasingly "reality has come to seem more and more like what we are shown by cameras", suggesting that people distrust their own perceptions until verified by the camera. The recent revolution in Romania is an example of this; where proof that the dictator and his wife were actually dead was a film of their bullet ridden bodies shown on TV to the nation. The Chief Traffic Inspector of the Auckland City Council said recently that it is very rare for people to argue against the photographic evidence of the red light camera as they feel the evidence is so overwhelming. Discussing the social definition of photography, Bourdieu (1990:74) argues that:

Photography is considered to be a perfectly realistic and objective recording of the visible world because (from its origin) it has been assigned *social uses* that are held to be 'realistic' and 'objective'. (Bourdieu 1990:74)

Sontag confesses to having an obsession about photographs and compares the presence of the photograph in the modern world to the shadows in Plato's cave. She writes that the "photo eye" has an insatiable appetite, meaning that photographic technology is available to almost everyone. The result of this is

an incessant production of photographic images that can be found from family albums to newspapers. She profoundly declares that,

In teaching us a new visual code, photographs alter and enlarge our notions of what is worth looking at and what we have a right to observe. They are a grammar and, even more importantly, an ethics of seeing. . . . To collect photographs is to collect the world. (Sontag 1979:3)

Sontag argues that unlike the moving pictures and television which "flicker and go out" photographs remain to be pinned to the wall, stored, exchanged and looked at in years to come. For Sontag photographs are the "most mysterious" of all the objects that proliferate in the modern world. Unlike paintings and drawings which are interpretations, "photographic images do not seem to be statements about the world so much as pieces of it". (Sontag 1977:4) This probably prompted Mitchell's (1987:8) wry remark that Sontag's book On Photography should be titled "Against Photography".

Central to Sontag's argument about the manner in which photographs have proliferated, the modern representational environment is its "narcissistic use for self-surveillance". In this act the photograph provides the technical means for self-scrutiny. Her thesis is the basis of Lasch's theme in his The Culture of Narcissism (1985), in which he expresses a concern about the proliferation of "images" in modern American society:

We live in a swirl of images and echoes that arrest experience and play it back in slow motion. Cameras and recording machines not only transcribe experience but alter its quality, giving to modern life the character of an enormous echo chamber, a hall of mirrors. Life presents itself as a succession of images or electronic signals, of impressions recorded by means of photography, motion pictures, television and sophisticated recording devices. (Lasch 1985:47)

In the modern commercial environment, the dominant character of street imagery is iconic and ideographic. Everyday life is saturated with ideographic material found in newspapers, television, sport, politics and architecture, all of which provide some framed view of the world.

A picture provides a framed view of the world (hence its limitations), but there are many different frames of the world that are formed by different media. Perhaps today television is the most powerful window on the world, but the possibilities of framing the world are endless, from television and

newspapers to car windows and microscopes. For many individuals a major part of their contact with the environment consists of seeing the world through some sort of frame. The well known perceptual psychologist, J.J. Gibson (1979), said visual awareness is panoramic as animals are mobile creatures able to turn their heads in many directions:

We modern, civilized, indoor adults are so accustomed to looking at a page or picture, or through a window, that we often lose the feeling of being *surrounded* by the environment, our sense of the *ambient* array of light. Even when outdoors under the sky, one is apt to be driving an automobile and looking through the windshield, or travelling in a vehicle where the window to the outside world is constricted to a small angle. We do not look *around*. (J.J.Gibson 1979:203)

It is important to recognise that Gibson was to some degree generalising. People do look, but in a different way from what Gibson refers to. For example, an act of attention is a deliberately focused look.

Apart from the telescope and microscope for use in science, according to Herbst (1974), it was the development of the shop window in the 18th century as an "aesthetic lure" for buyers that precipitated a trend to vignette aspects of the world. He argues that the introduction of window glass made it possible to frame aspects of actuality in an eidetic form, by enlarging or by creating a situation where the looker's attention was focused on more sharply defined visual boundaries. A proficient window dresser can produce a surrealistic effect by translating esoteric stimuli into forms that can be understood by potential buyers as they walk past a window.

Advertising, which proliferates in a variety of media, is the most influential attempt at framing realities. Now advertisements have to be designed to attract an observer's attention in the very short time span of 15-30 seconds. Hence the propensity for designing specific symbols in the form of logos and signs which provide easily remembered concepts that help to keep a company and its products known.

Merleau-Ponty (1968) argued that "It is a remarkable fact that the uninstructed have no awareness of perspective and that it took a long time and much reflection for men to be aware of the perspective deformation of objects". It is now well known that perspective drawing, which was a

Renaissance innovation, has had a marked influence on the perception of those who live in Western cultures. Indeed, Bourdieu (1990:74) makes the point that the social acceptance of photography is related to perspective drawing which had been in use since the Renaissance. This had the effect of preparing people's perception for the acceptance of photography as a "natural language".

Ihde (1986:61) argues that to *observe* is to observe from a particular point of view. He says that it is "not possible for human embodied observers" to emulate the perspective of the philosopher's God. Nearly all descriptions that supposedly emulate God's eye always turn out to be panoramic or distant viewing. "Even the descriptions subtly include latent phenomenologies of position. Thus from above "all encompassing," and other such terms applied visualistically, silently presuppose a distant panorama and the hidden embodiment of a possible position". He speculates that the bird's eye-view is intrinsically connected to the phenomenon of reading: "The reader is positioned 'above' the text and the text becomes the immediate field which is perceived, a mini 'world' as it were". He substantiates this thesis by proposing that if one wishes to represent a garden, this can be done either by displaying the garden as seen from above, as in the map perspective, or it can be seen as in ancient Egyptian drawings where there is a mixture of both the map perspective and a side view which depicts a person standing upright in the garden among the plants. In contrast to mediated experience, such as that gained from looking at pictures or reading books, this suggests a more natural perspective as it relates more to the experience of being in the garden.

Hodge and Kress (1988:175-76) use the page in figure 4.1 taken from the comic "Wonderwoman", to illustrate social relations which constitute this form of expression. Each frame represents a point of view and this is clearly indicated. Page 1 is the introduction and begins with the caption "observe", which they say places in a subordinate position the reader/consumer, who is required to obey without questioning or understanding. The second frame positions the artist and the reader even higher than the first, emphasizing more viewing power. This emphasizes a semiotic transaction between the comic's authors and its target audience of English-speaking adolescent women readers. Hodge and Kress say that the authors are "primarily males, self-transformed to occupy a female-viewing position in an all female world, offering a female fantasy to females". Because Hodge and Kress are male, they asked an 18 year old female to read these two pages and to comment. She said;

Oh I don't like it, Wonderwoman being degraded. Being dutiful's alright but she shouldn't grovel! But after that [i.e. page 1] I'd just pass on, forget it [i.e. the opening] because that's how Wonderwoman really is you know, dominant and all that. (Hodge and Kress 1988:179).

Wilson cited by McLuhan (1962:36-37) argues that people from literate cultures often assume that no training is required to view photographs or film. His experience in Africa was the result of using film to teach people to read, and it demonstrates the difficulties involved for those people unaccustomed to three dimensions or perspective.

The next bit of evidence was very, very interesting. This man -- the sanitary inspector -- made a moving picture, in very slow time, very slow technique, of what would be required of the ordinary household in a primitive African village in getting rid of standing water -- draining pools, picking up all empty tins and putting them away, and so forth. We showed the film to an audience and asked them what had they seen, and they said they had seen a chicken, a fowl, and we didn't know there was a fowl in it! So we very carefully scanned the frames one by one for this fowl, and, sure enough, for about a second, a fowl went over the corner of the frame. Someone had frightened the fowl and it had taken fright, through the righthand, bottom segment of the frame. This was all they had seen. The other things he had hoped they would pick up from the film they had not picked up at all, and they had picked up something which we didn't know was in the film until we inspected it minutely. Why? We developed all sorts of theories. Perhaps it was the sudden movement of the chicken. Everything else was in slow technique -- people going forward slowly picking up the tin, demonstrating and all the rest of it, and the bird was apparently the one bit of reality for them. For them there was another theory that the fowl had religious significance, which we rather dismissed.

Question: Could you describe in more detail the scene in the film?

Wilson: Yes, there was a very slow movement of a sanitary laborer coming along and seeing a tin with water in it, picking up the tin and very carefully pouring the water out and then rubbing it in to the ground so no mosquito could breed and very carefully putting this tin in a basket on the back of a donkey. This was to show how you disposed of rubbish. It was like the man in the park with the spiked stick, picking up the bits of paper, and putting them in the sack. All this was done very slowly to show how important it was to pick up those things because of mosquitoes breeding in standing water. The cans were all very carefully taken away and disposed of in the ground and covered up so there would be no standing water. The film was about five minutes long. The chicken appeared for a second in this kind of setting.

Question: Do you mean that when you talked with the audience you came to believe that they had not *seen* anything else but the chicken?

Wilson: We simply asked them: What did you see in this film?

Question: Not what did you *think* ?

Wilson: No, what did you *see* ?

Question: How many people were in the viewing audience of whom you asked this question?

Wilson: 30-odd.

Question: No one gave you a response other than "we saw the chicken"?

Wilson: No, this was the first quick response -- "We saw a chicken."

Question: Did they see a man too?

Wilson: Well, when we questioned them further they had seen a man, but what was really interesting was that they hadn't made a whole story out of it, and in point of fact, we discovered afterwards that they hadn't seen a whole frame -- they had inspected the frame for details. Then we found out from the artist and an eye specialist that a sophisticated audience, an audience that is accustomed to the film, focuses a little way in front of the flat screen so that you take in the whole frame. In this sense, again, a picture is a convention. You've got to look at the picture as a whole first, and these people did not do that, not being accustomed to pictures. When presented with the picture they began to inspect it, rather as the scanner of a television camera, and go over it very rapidly. Apparently, that is what the eye unaccustomed to pictures does-- scans the picture-- and they hadn't scanned one picture before it moved on, *in spite* of the slow technique of the film. (Wilson cited by McLuhan 1967:36-37)

Wilson's reply to the last question correctly states that the objective of showing the film hadn't been achieved as "they hadn't made a whole story out of it". Nor had they apparently seen a whole frame. This analysis was based on the evidence of an eye specialist and an artist.

McLuhan concludes from this that non-literate people have not acquired the habit of focussing a little way in front of the image. This implies that they do not look at objects in the same way as those that are literate, i.e. they do not take in the whole object or image at a glance. Suggesting that they do not have a detached point of view, he argues the eye is not used as in perspective but by "tactually" scanning the object segment by segment. This might be so, but, there are other factors involved in assigning meaning to experience. To be fair to McLuhan, he does mention them, but he seems more interested in

selecting aspects of the chicken example to support his thesis that somehow there is a major perceptual difference between so called primitive people and those in the west. Contrasting perceptions seem based more on the difference between "natural" perceptions, and those based on a "technologised" perspective. The latter requires specific knowledge of such details as "panning shots" for example, in order for anyone to make sense at all of what was going on.

Wilson (in McLuhan 1967:37) states that after further research into the use of these films it was found that, although it looks very real, a Western film is a "very highly conventionalized piece of symbolism". For example, he says that if one was "telling a story about two men to an African audience, and one had finished his business and he went off the end of the screen, the audience wanted to know what had happened to him. . . . They wanted to know what happened to this fellow, and we had to write stories that way, putting in a lot of material that wasn't to us necessary".

It is not only so called primitive people that experience difficulties in watching films. Such an experience is illustrated by the anthropologists Bellman & Bennetta (1977) who used video recorders in their field work. On their return to America, when they showed some video film on the Kpelle from Africa they were astounded by the fact that their sociology students could not *see* what was being described. Again, like the African people in McLuhan's chicken story, the students would attempt to come to grips with many different events and ritual of the Kpelle all at once. The students' attention would be directed at picking up clues of very diverse kinds in order to comprehend what was being shown in the film. For example, despite hearing a baby crying, (an every day event among all people), as it was being held and fed some rice by its mother who was accompanied by two other women, Bellman had to put the tape on "still pause" and point to the baby before people in the class could see it.

Although some editing may have been done by Bellman & Bennetta and their assistants, essentially the film was made by Kpelle. One of the reasons the class couldn't see the baby was that the film was made and coordinated by people from a different culture. The montage sequencing may have allowed only a very short time space for students from western culture to identify some things like the baby. Attention may have been diverted by some other culturally relevant stimuli. Non-recognition of the baby in the video picture

demonstrates that, in this particular situation, how we see or recognise is a significant factor in the social process of defining a situation. Also that the recorded image cannot be taken for granted as it may only reflect an interpretation by an encoder of what is occurring, rather than presenting a unique cultural perspective.

McLuhan was responsible for the hypothesis that the information potential of each medium or mode of representation is different. For example, although there are features which are common to "film" and "print" there are marked differences between them. Olson (1974:13) points out that "various media are presumably characterised by their own unique range of limitations". He cites Carpenter who says, "Each medium if its bias is properly exploited, reveals and communicates a unique aspect of reality". Discussing the significance of writing as a cultural technique, Raymond Williams (1981:93) argues that from the very beginning it had a very radical status as a technique. This status centred on specialisation, and he points out that "while anyone in the world, with normal physical resources, can watch or dance or look at sculpture or listen to music, still some forty per cent of the world's present inhabitants can make no contact whatever with a piece of writing, and in earlier periods this percentage was much larger". Therefore, he says that it is no wonder that the most difficult problems in the social relations of cultural practice frequently centre on the question of literacy.

These difficulties are perhaps best exemplified in the work of Paulo Freire, the Brazilian educator, who was able to teach non-literate individuals to read in about thirty to forty hours of teaching time. According to Brown (1974:35), Freire recognised that reading is a political act, and that learning to read is a fundamental step in the process of decision making and that of acquiring power. Freire knew that many of the Brazilian non-literates were so caught up in the struggles of their daily lives that they had little awareness of how they could change their situations. They believed that their deprived lives were due to fate or depended on the will of God.

Freire addressed the problem of literacy by attempting to change people's passive attitudes. Success was achieved by introducing to non-literate people the concept of "culture", which, in turn, facilitated the concept of a distinction between "nature and culture". Such a distinction enabled the understanding to be extended so that non-literate people could be just as involved in the social construction of their lives (their culture) as the literate. His technique was to

use a series of pictures (see Fig. 4.2) representing familiar images for those living in north eastern Brazil.

Brown (1974:26) describes how the coordinator begins a discussion with the question: What do you see in the picture? She says that this naming is important because people unaccustomed to graphic representation may not easily identify what is being shown. The pictures were also painted in one dimension without the conventions used by school artists for illustrating perspective. Questions were asked that highlighted the differences between nature and culture such as: "who made the well?" "Why did he do it?" "What materials did he use?" "How is the tree different from the well?" "Who made the pig, the birds, the man?" "Who made the house, the hoe, the book?". Gradually the discussion moves to the conclusion that people use natural materials to change their situation, to create culture". The discussion gives people the words and the means to name and clarify the differences between natural phenomena and those cultural phenomena created by members of a community.

Print like pictures is a visual modality. Ong (1958) has demonstrated how a century after Gutenberg's invention of printing about 1450 with movable types, Peter Ramis (1515-1572) led a reform movement towards increasing a dependency on printed books. Under Ramis's direction schools were regarded as agents of the press, and printed books became the medium through which all experience had to go before intelligent action could be put to use. Ong (1969:643) argues, that although there were other agents of "visualisation" that could be traced to Ancient Greece, it was during the Middle Ages through medieval scholasticism, that quantification and visualisation were fostered in an unprecedented way. He says that although people in the middle ages were much more textually orientated than those in antiquity, by today's standards they remained attached largely to oral means. For example, "the testing of intellectual achievement was never by writing but always by oral *agonia* or dialectical debate". However, he says:

Script, and particularly the alphabet, converted the dynamic event-world in which oral-aural man stored his knowledge into a world of static visual record. Many, perhaps even all, primitive peoples make much of sight, but the alphabet warped sound itself into a visual mold. The alphabet triumphed only slowly and never entirely, but inexorably. Print, by locking words into the same place in thousands of copies of a book and thereby making indexing and retrieving information possible to a degree utterly unknown in pretypographic manuscript culture, consolidated the work of the alphabet in reducing evanescent sound to the repose of space. (Ong 1969:643)

It was not just printed letters that were produced by technical means. Until the late 15th century printed pictures had usually served as decoration or edification, and not necessarily for conveying information. Olson (1974:3) states that "the first known use of printed pictures for the deliberate communication of information and ideas was in Valturius's Art of War, printed in Verona in 1472, which showed by means of many woodcuts the construction and use of machines of war".

Ivins (1881-1961), in his book Prints and Visual Communication, offers the seminal thesis that a culture without exactly repeatable prints is different from one that has them. He notes that a few years after Valturius's book on war the first illustrated book on botany with repeatable prints appeared. The implication of this is that it was these repeatable statements that made the science of botany possible. (see Fig 4.3). Ivins (1953:3) argues that "far from being merely minor works of art, prints are among the most important tools of modern life and thought". According to McLuhan (1967:77-79), probably because Ivin's work was in a sense outside the mainstream of literary circles and he had a specific interest in the form of a representation, i.e. the print, he became more involved in understanding the significance of repeatability and the quest for exactness in botanical science. Those educated in the technology of print take for granted its form. The central focus is on the content, i.e the meaning embodied in the printed words, not the actual technology of the printed word, as are those involved in calligraphy. Ivins became aware of the difference between prints and the printed word, in a manner similar to that argued by Husserl (1970) about the ideal and repeatable forms of geometry as used in practical science. Ivins explains:

Although every history of European civilization makes much of the invention in the mid-fifteenth century of ways to print words from movable types, it is customary in those histories to ignore the slightly earlier discovery of ways to print pictures and diagrams. A book, so far as it contains a text, is a container of exactly repeatable word symbols arranged in exactly repeatable order. Men have been using such containers for at least five thousand years. Because of this it can be argued that the printing of books was no more than a way of making very old and familiar things more cheaply. It may even be said that for a while printing was little more than a way to do with a much smaller number of proof readings. Prior to 1501 few books were printed in editions larger than that hand written one of a thousand copies to which Pliny the Younger referred in the second century of our era. The printing of pictures, however, unlike the printing of words from movable types, brought a completely new thing into existence-- it made possible for the first time pictorial statements of a kind that could be exactly repeated during the effective life of the printing surface. This exact repetition of pictorial statements has had incalculable effects upon knowledge and thought, upon science and technology, of every kind. It is hardly too much to say that since the invention of writing there has been no more important invention than that of exactly repeatable pictorial statement. (Ivins 1953:2-3)

On January 7th, 1839, L.J. M. Daguerre announced that he had made a way of making pictures with light. The term photography, or "writing with light", was coined by Sir John Herschel. The latter was also the first to use hyposulphite to arrest the action of light, and, like the technology of print, permanently to fix an image.

According to Daniel Boorstin (1963), the first reproduction of a photograph in a newspaper appeared on March 4th 1880 when a picture entitled "Shanty-Town" was printed in the New York Daily Graphic. Boorstin in his book The Image (1962) expresses concern about the various forms of mechanically reproduced imagery that proliferated throughout American culture in the 19th and 20th centuries in the form of prints, posters, drawings and advertisements. He argues that prior to the telegraph and its application to news reporting in the 1830's and 40's, newspapers lacked the sophistication in disseminating news that was acquired by people in that industry by the mid-1850's. The increase in the volume of news was due to a number of factors, one of which was the invention of the rotary press which could print on both sides of a continuous sheet of paper at the same time. In the 1870's the New York Tribune could produce 18,000 papers per hour. Some of the events that provided the raw material for the newspaper industry were the American Civil War and the Spanish-American War. The newspaper industry

was dominated and driven by such people as James Gordon Bennet, Joseph Pulitzer and William Randolph Hearst. Boorstin argues that,

These events were part of a great but little-noticed revolution- what I would call the Graphic Revolution. Man's ability to make, preserve, transmit, and disseminate precise images - images of print, of men and landscapes and events, of the voices of men and mobs - now grew at a fantastic pace. The increased speed of printing was itself revolutionary. Still more revolutionary were the new techniques for making direct images of nature. Photography was destined to give printed matter itself a secondary role. By a giant leap Americans crossed the gulf from the daguerrotype to colour television in less than a century. Dry-plate photography came in 1873; Bell patented the telephone in 1876; the phonograph was invented in 1877; the roll film appeared in 1884; Eastman's Kodak No 1 was produced in 1888; Edison's patent on the radio came in 1891; motion pictures came in and voice was first transmitted by radio around 1900; the first national political convention widely broadcast by radio was that of 1928; television became commercially important in 1941, and colour more recently. (Boorstin 1961:24-25)

Commenting on Boorstin's notion of the Graphic Revolution, Postman (1988:35) argues that "painting is at least three times as old as writing, and that the place of imagery in the repertoire of those involved in communication was quite well understood". What was new in the mid-nineteenth century was the sudden and massive intrusion of the photograph and other iconographs into the symbolic environment.

Currently a vast amount of pictures continues to be reproduced by various mechanical and electronic means. Television, video recorders, computers with visual display units and graphic capabilities, sophisticated photographic equipment, remote satellite sensing, radar screens, electronic microscopes, facsimile machines, x-ray and C.T. scanners and photocopiers are some of the major sources of pictures in the contemporary world.

Today, video recorders and cameras are readily available for use by the general public. Individuals not only watch pictures; they can make them as well. They can alter and edit films to suit their own purposes according to their own particular cultural bias. The possibilities of using film-making in order to understand more about cultural perceptions was first realised by Worth and Adair in seminal research with members of the Navaho community. Referring to this, Worth remarked:

Imagine a world where symbolic forms created by one inhabitant are instantaneously available to all other inhabitants, where "knowing others" means that others frequently know us and we know them through the images we create about ourselves and our world, as we see it, feel it, and choose to make it available to a massive network hungry for images to fill the capacity for its coaxial cables.

Imagine this place -- so different from the society which we nourish our middle-class souls -- in which symbolic forms are not the property of a "cultured," technological, or economic elite, but are rather ubiquitous and multiplying like a giant cancer (or, conversely, unfolding like a huge and magnificent orchid) and available for instant transmission to the entire world. (Worth 1974:298)

It is nearly twenty years since Worth wrote this, and there are signs of change. For example, the owner of a picture theatre said recently in Auckland that a young man asked if the foreign film about to be shown had written captions. When told that it had, he replied; "This is the twentieth century, no one reads today".

According to King (1990), the axiom that a picture is worth a thousand words may be more than just a trite saying in computer technology. It would seem from a result of research carried out in the United States on the comparison between pictures (Ikons in computer jargon) and text (character in computer jargon) that there is a preference for the icon mode of communication. Icon interface users were much more efficient and were less tired than those operators who used character.

To reiterate, on the roads and motorways pictograms are rapidly replacing written road signs. A pictogram of a cow means that cows may be on the road. A pictogram of a car skidding (see Fig. 4.4 below) means that the road is slippery ahead.



Fig 4.4 Skidding Car. (C.E. Moorhouse 1974:1)

Such a picture would be meaningless to people from another age and culture who had neither cars nor roads. It requires the experience of looking through a windscreen or frame to be able to recognise what the rear end of a skidding car looks like. More importantly, it emphasizes the significance of context in the manner in which meaning is assigned.

Possibly without the technology of the frame the idea of perspective may not have occurred. Unquestionably, the technology of the frame facilitated the development and expansion of perspective drawing. Bourdieu (1990) argues that the development of perspective drawing, and its subsequent widespread embodiment in architecture were instrumental in preparing social perceptions for the advent of photography. As he explains:

Photography was predisposed to become the standard of 'realism' because it supplied the mechanical means for realizing the '*vision of the world*' invented several centuries earlier, with perspective. (Bourdieu 1990:192)

To summarise this chapter, I have focussed on the widespread use of the technology of the frame in the contemporary world. Frames are technologies created for specific purposes. However, frequently an unintended effect of their use is that they can give an impression of an autonomous boundary. This is also argued by Goody (1986:4-5), who maintains that those religions such as Islam or Christianity which are based on alphabetic literacy, seem to "have some kind of an autonomous boundary".

Similarly, Ivins (1953) argues that the repeatable nature of permanent shapes made the science of botany possible, but the use of such technology was also instrumental in creating another closed system of knowledge, whose practitioners became involved in specific conventions of symbols inextricably tied to that technology and the context of its use. Addressing the taken-for-grantedness of the frame is also a way to begin understanding the nature of problems associated with representation which are also closely connected to the use of the frame.



Fig 4.1

Hodge and Kress (1988:179).



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5

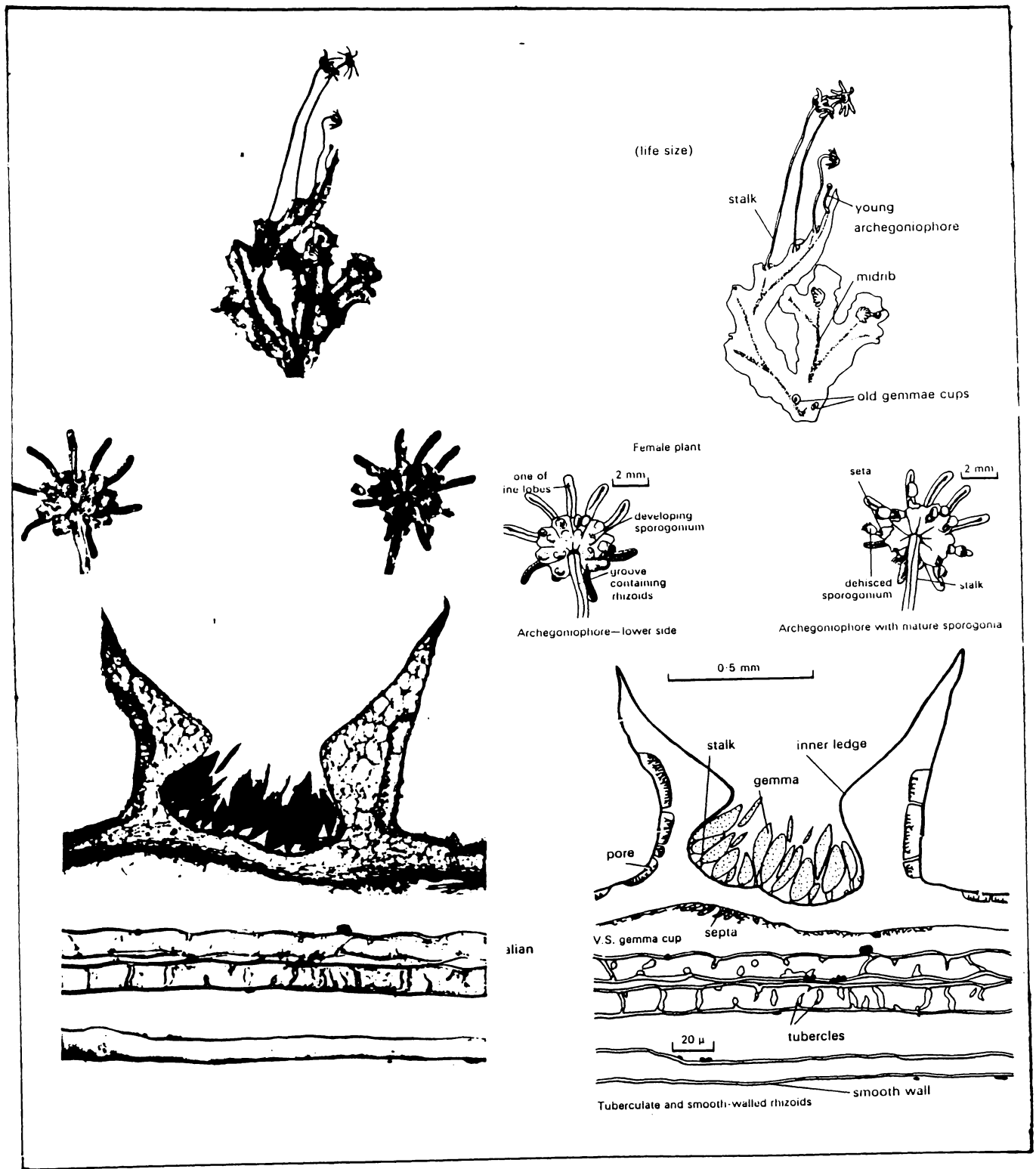


Fig 4.3

Photomicrographs of the Non-Flowering Plant

CHAPTER FIVE

Chapter 5Problems of A Visual Life-World.

The prime objectives of this chapter are, firstly, to demonstrate some recognition of the puzzles and difficulties associated with "representation" in sociological analysis. As a consequence of the proliferation of the technologised picture, second order experience is increasingly common. Therefore in my view aspects of media and their associated technology may have to be integrated into sociological analysis.

Some of the difficulties associated with representation are tied to the methods used by various media writers. For example, many capable scholars fail adequately to account for the role that the picture plays in the acquisition of knowledge because the medium employed for analysis is mono-linguistic. The iconic dimension is not usually recognised as having a significance that differs from the symbolic.

In terms of sociological understanding Esland et al (1975:28) write that Bruner's (1964) three forms of mental organisation (*iconic*, *enactive*, and *symbolic*) do not necessarily remain distinct or constant in a particular set of circumstances. For a variety of reasons the individual may break into the flux of enactive and iconic experience by symbolising parts of it. Not all sensation is symbolised and neither is all symbolising verbal. Pointing, for example, is an important non-verbal form of symbolising. The significance of this in terms of sociological understanding is that many individuals forget or don't know that social organisation, for example, though usually represented in terms of language, is in actuality constituted by other factors as well.

Novitz (1977:16) argues that: "Like many practices, the practice of producing and using pictures embodies a range of conventions and conventional devices which, if properly exploited, direct an audience's attention to certain aspects of a picture in virtue of which resemblances are standardly asserted".. However, Novitz (1977:21), argues that "Puzzles about the conventionality of pictures have produced little more than a Babel-like profusion of claims and counter claims". He suggests that:

A picture can be used to explain and clarify a written passage; and there are occasions when a written passage is used to explain a picture. I can imagine someone being puzzled by this, and asking how we can tell, in any given case, whether the passage explains the picture, or whether the picture explains or clarifies the passage? (Novitz 1977:108)

Novitz argues that one of the reasons for the difficulties associated with pictures and text is that there has been a failure by many adequately to account for the term "convention". This failure is connected to the second objective of this chapter, which is to explain and justify my choice of radiology as an appropriate social setting in which to examine the use of pictures in the substantiation of organisation.

The choice of radiology is connected to the third objective of this chapter, which is to incorporate into sociological analysis technological considerations not usual to sociological analysis. Recent studies in the sociology of technology exemplify a different approach from the traditional. Sociologists of technology now assume that technological artifacts are open to sociological analysis, not just in how they are used, but with reference to the intention of designers and their technical content. They are concerned about the processes of human negotiation whereby a particular design becomes finite, that is, becomes manifested in the form of an artifact. The Gestalt concept of "closure" has been used to describe a social process called the 'stabilisation of an artifact.' Pinch & Bijker (1989:1-2) argue that closure occurs in scientific practice when a consensus has been reached "that the truth has been winnowed from the various interpretations; it occurs in technology when a consensus emerges that a problem arising during the development of technology has been solved".

Although "closure" and "stability" are probably universal phenomena, the sociologists of technology focus on technological developments where they are ongoing events. Closure occurs when various social groups decide that technical problems have been solved which then means the "technology" can be stabilized. The bicycle, as Pinch and Bijker (1989) have shown, is the result of a series of debates, negotiation and even ridicule during the course of its development. Not all designs are successful or survive. Sociologists of technology are now concerned with both success and failures as well as the entire range of human experience and purpose.

Bijker, Hughes & Pinch (1989) point out that an historical account, which is primarily concerned with actual circumstances in which success is recognized at a finite point in time (such as Roentgen's discovery of x-rays on Nov 5 1895), fails to generalise beyond the success and is usually an account which is characterised by its orderly and sequential form. This is particularly true of the work of economic historians who have tended to focus on successful innovations. The factor which seems to influence such scholars is that "the success" of an artifact is an 'explanation of its subsequent development' (Bijker, Hughes and Pinch 1989:22). In other words, this sort of history only includes descriptions of those technologies deemed to be successful and therefore, selectively, only they are entitled to a history. This is an approach which frequently leads to the 'black box' syndrome, i.e. in engineering a complex part, such as the electronic control system, is treated as something that functions but is taken for granted without any knowledge of electronics. It is, in effect, the same concept as Husserl's "sensible models".

Debunking the "black box syndrome" suggests a focus on perception, embodiment, and life-world. Furthermore, it includes the subjective perspective, and recognition of what Husserl (1970:26) called "cultural acquisitions". This is the role which tools, papers and instruments, (and in my view pictures), have in the management and constitution of knowledge.

The concept of a life-world is Husserl's (1970). Metaphorically speaking a life-world can be thought of as a communicative environment comprising a totality of human involvement in daily living. Put succinctly, this includes knowledge, interpretation and responses by social actors, and the organisation and coordination of experience. It also takes into account the iconic, enactive and symbolic dimensions of human experience.

The notion of a "visual life-world" was inspired by Walter Ong's (1969:634) seminal thesis that increasingly the dominant sense mode is *sight*. Ong suggests that there is a marked tendency in a technological age "to think of actuality as something essentially picturable".

Images or pictures are one way in which individuals acquire tacit knowledge through which they *sense* (bodily sense and spatial orientation), *know* (common sense and ordinary language), and, significantly, *see* the world (vision). The situation in mind concerns the ubiquitous nature of mediated

experience. Increasingly the icon seems to be the dominant symbol in the communicative environment. An indication of this can be demonstrated by Haines' (1988) estimate that by the time New Zealand teenagers leave school, most of them have watched 20,000 hours of television, including 250,000 commercial advertisements. Unquestionably, on the surface at least, the overwhelming symbolic character of such a communicative environment is *iconic*.

In terms of human consciousness the development of the visual media, the written word, print and more recently the electronic media in all their forms have been, and still are, instrumental in generating perspectives that differ from those that can be gained from direct or first hand experience. In Walter Ong's opinion, the dominance of the visual sense mode has led to the idea that the world has become something you can draw a picture of (or, one could add, manufacture a picture of). Hence his argument, in his paper World as View and World as Event (1969), concerning the significance in the modern world of the concept "world view". He says that this concept "reflects the marked tendency of technologized man to think of actuality as something essentially picturable and to think of knowledge itself by an analogy with visual activity to the exclusion, more or less, of the other senses" (Ong 1969:634). From a sociological perspective, "world view", as Ong uses it implies a unifying element in the coordination of individual perception and social order. He says the term "suggests some sort of major unifying perception, and it presents the unification as taking place in a visual field" (Ong 1969:635).

Ong (1969:634) states that "world view" is an elusive term which does not imply that the world somehow impresses itself upon a passive mind. An individual is not given a world view but rather creates one. A world view is something the members of a culture both individually and collectively construct. Each individual's world view is part of an organising interactional process between consciousness and what is perceived to be actual. In the contemporary world, as a result of what Boorstin called "the graphic revolution", this process has become complicated by the replacement of direct experience by various forms of representation, by what he calls "images". Boorstin (1963:197) argues that the word image comes from "the Latin verb *imitari*, which means " 'to imitate' . . . an "image" is an artificial imitation or representation of the external form of any object, especially of a person".

Boorstin (1963:190) makes a distinction between "ideal" and "image". By ideal he means thinking that is intrinsic to "justice" and "ethics". Arguing that "images now displace ideals", he says that the

Differences between "ideal-thinking" and "image-thinking" are the differences between our thinking before and after the Graphic revolution. An ideal, contrasted to an image is not synthetic. When we think of an ideal, we think of something already there. It was created by tradition, by history, or by God. It is perfect, but not simplified. . . . An ideal is what we actively strive towards, not what we fit into. Credibility is irrelevant. Charity, justice, equality, mercy, are no less ideals because no man or society ever lived up to them. Ideals are needed *because* in their perfect form they are somehow hard to believe. (Boorstin 1963:201-202)

Boorstin argues that as a result of mass media production and reproduction technology, "images" have been multiplied and vivified. The American system of manufacturing, which began in the early to mid -19th century, was based on interchangeable parts. "For the first time, every musket or clock or lock could be an image of every other of the same design. Dies and jigs, calipers and machine tools" and infinite replacements made each item indistinguishable from others of its kind. Echoing Ivin's thesis about the impact on science of repeatable prints, Boorstin claims that advertising in America flourished because so many basic commodities, such as soap, beer, and cigarettes etc, looked and functioned the same and therefore could not be distinguished from one another, a factor which may have confused the assessment of demand. This meant that there was a great effort spurred by competition to "produce apparent distinctions" (Boorstin 1963:198).

According to Boorstin (1963:190) advertisers and public relations people create and plan images that are synthetic to serve a particular purpose and to make a certain kind of impression. Trademarks and brand names are common illustrations of images that have become dominant icons of the modern environment. Although the various uses of the image such as I.B.M, "Coke", "His Masters Voice" (The dog listening quizzically at the horn of a primitive phonograph), "I'd walk a mile for a Camel", have become popularly significant, Boorstin argues that a more abstract kind of image has become the peculiar product of our age. Unlike ideals such as "charity" or "justice", which are significant because in their perfect form no one can ever live up to them, the *image* is not simply a trademark or design, slogan or easily remembered picture. " It is a studiously crafted, personality profile of an individual, corporation, product or service. In two words it is a "fictive entity".

Boorstin (1963:191) says, "When we use the word "image" in this new surrogate sense, we plainly confer a distinction between what we see and what is really there, and we express our preference in what is to be seen". All this results in "image thinking" as opposed to thinking in ideals.

A major characteristic of a consumer society is the deliberate production of images designed to appear right in the mass market. This is a process which, Leiss et al (1986) argue makes the "image" synonymous with "icon" as used to describe a picture of some venerated figure, usually found in a religious setting. There is a preference by modern advertisers to use the iconic mode of representation as it requires little effort to read or understand; or it can be understood by those who cannot read.

The production of constant high quality images is vital to those involved in a plethora of industries from fashion to cars and politics. This is exemplified by the well known car manufacturer, Lee Iaccoca, who stated chauvinistically that the quality of an image is so important that it compares to the bad girl in town who changed her ways but no one would believe her for a couple of years. If a product gets a bad image there is an unspecified time before its image will improve despite efforts to change it. These efforts frequently centre on activities that Boorstin (1963) called "pseudo-events". These are happenings that are prearranged for specific purposes with the intention of fulfilling someone's prophesy. They are usually coordinated by and with members of the media present or organised to catch media attention.

Boorstin (1963:208) argues that "the momentous sign in the rise of image-thinking and its displacement with ideals is . . . the rise of advertising" : in terms of American history advertising is the outstanding exemplar of the pseudo-event. "It was the prototype of made news".

In the communicative environment of today it is almost impossible to avoid the symbols, logos, and icons of major multinational companies and their franchise agents. As Aldous Huxley (1965) argued in Brave New World-Revisited, the initial concern of those studying propaganda was centred on the level of truth or falsity. They did not envisage the vast communication industry that covers the world today almost fulfilling McLuhan's prophesy of the "global village". Huxley argued that advertisers are not so much concerned about truth or falsity, but with the production of the *irrelevant* where the prime purpose is distraction.

One of the first to study advertising using a semiological perspective was Roland Barthes (1977). According to Mann (1983:350), semiology, or semiotics is, "A projected science concerned with the use of signs in animal and human life. The term 'semiology' originated with the French linguist Saussure, and 'semiotics' with the American philosopher C.S. Peirce (1839-1914)." Its proponents aim at a generalised logic governing all types of sign use, both linguistic and non-linguistic. Like the structuralist approach it involves the coding and decoding of meaning. Language and conventional symbols probably represent most prominent aspect of signification, but the semiologist is concerned with many other forms of signification including dress, gesture, decor and on. These are studied in a manner analogous to studies of linguistic structure. Mann (1983) writes that although semiology can be traced back to Vico (1668-1744), its present form in the social sciences derives from Barthes' reinterpretation of Saussure.

Barthes (1958) describes how, in contrast to the sea which he says offers no message, the beach is a rich source of material for semiology in the form of flags, slogans, signals, surfboards, clothes, suntan and so on. These are the source of so many meanings that are assigned by the people looking at them. Barthes' version of semiology centres on his notion of "myth" as a type of speech, which is not connected to oral discourse, but consists of modes of writing or representational discourse. He treats myth as a second-order system of signification underlying the overt structure of language. For example, "myth" has a source in photography, cinema, sport, shows and publicity, all of which serve as ways of upholding the communicative process of analytical speech.

The notion of modern life being mediated and complicated by electronic images has been explored and investigated by many writers. Their aim has been to extrapolate a concept or model such as "narcissism" (Lasch 1985) "sensory balance" (McLuhan 1964), "myth" (Barthes 1958) and "image" (Boorstin 1963), into a wider understanding and application in terms of societal changes. However, in terms of rigorous sociological analysis the use of such metaphors can obfuscate understanding. For example, Barthes' thesis suggests that there is an increasing tendency to substitute words and pictures with "images", a practice which has compelled Leiss et al (1986:241) to contend that "metaphor is the very heart of the basic communicative form used in modern advertising". They say that people and products are placed side by side

in advertisements in an attempt to convert this contiguity into a meaningful relationship. Use of metaphor is fundamental to this thesis, and will be dealt in detail in chapters 9 and 10. Suffice to say at this point in the discussion, mixing the composition of metaphors by combining text and image, is one source of complication and misunderstanding.

In what follows I want to demonstrate a use of pictures that firstly, supplements codes, e. g., printed text, discursive language or numbers. The intention is to demonstrate and comment on what Novitz (1977) has called the "perlocutionary dimension of pictorial representation". (See chapter 8 159). The "frames" or pages are taken mostly from The New Zealand Herald the largest circulation morning paper in the country. They offer a specific frame of the world which to a significant degree mirrors significant aspects of the New Zealand life-world.

The chronological beginning to this series of frames is October 21st 1987. (See Fig. 5.1). This was the day of the stockmarket crash. It was the beginning of what one writer called a programme of "orchestrated negativism", which constituted a particular economic world view. In this picture the headlines, "Dive into the Unknown" are supplemented by a picture of individuals who have clearly lost money. It is also supplemented by a graph entitled the "great drop". It is almost self evident that readers are encouraged to equate bad news with a natural disaster.

The second picture in this series (Fig. 5.2) is dated February 4th 1988, approximately four months after the stockmarket crash. This is a significant "icon" as it exemplifies Barthes (1987) notion of myth.

On Thursday, February 4th 1988, the day that figure was published, I telephoned the local representative of The New Zealand Herald to protest at the presentation of the front page which seemed to me to be unnecessarily dismal. At first my comments were received angrily by the reporter who stoutly defended the paper, stating that not only were each of the news items genuine and factual, but it was the essence of a free press in a democratic society to tell the truth. Interestingly, he did tell me that the front page layout had been inadvertently changed due to another "real" news story about a young boy who was trapped and drowned under a waterfall interfering with the original intended layout. The representative said there was no particular intent to arrange the front page in the

published format. It doesn't take much imagination to work out that unintentionally the whole page constitutes a "sign" signifying disaster. The "economy", the butcher shop and the dismantled coat of arms with New Zealand quite clearly discernable present the gloomiest of pictures.

The newspaper page is a frame that lends itself to the intentional and unintentional manipulation of stories and pictures by placing them in contiguous relationships. Mitchell (1987) argues that in some situations "contiguity" is tantamount to causality. Figure 5.3 demonstrates such a contiguous relationship between the picture of the man holding his head and the headlines, "Shockwaves spreading . . .".

Contiguous relationships which are either intentionally or unintentionally made by juxtaposing sometimes disparate themes, are demonstrated in figure 5.4 from The Waikato Times December 27th 1990. Juxtaposed are a picture of a laughing couple and the headline "250,000 in poverty".

The use of pictograms to enhance contiguous relationships between the picture and a text seems to be increasing and can be quite effective in communicating some message. In figure 5.5, "Moore rolls his election dice". "Wage Gamble in a bid for lower bank rate".

There is a variation in the use of the pictogram in Figure 5.6 where the picture of the sacked Minister of Finance, now Sir Roger Douglas, includes an exit sign in parliament's corridor. The picture of Douglas leaving his office is adjacent to the text "As Douglas gets dumped".

A much more dramatic use of the pictogram for enhancing communication is demonstrated in figure 5.7. The headline "Ruth's Recipe", has above it an illustration entitled "cuts and cures" placed beside a drawing of a cut-throat razor. Beneath the headline there is "slashing of. . .".

The format of those pages relying upon a mixture of text, picture and pictogram, constitute a form of representation that parodies selected aspects of the everyday world. These are one way communication. All the illustrations presented from figure 5.1 to 5.7 are a kind of television. Indeed, many of the same images were presented on television on the same day the papers were printed, reinforcing a particular "world view".

A significant reason for difficulties connected to understanding the work of media writers is the level of abstractness inherent in discerning their models. To comprehend this I cite three media authorities who have made significant contributions to the study of media. For example,

(1) McLuhan (1964), while demonstrating the increasing significance of the visual media for daily life, left many people confused and bewildered. Arguing that "the medium is the message", he stressed that constant exposure to a visual medium, such as television, was in effect a change in human environment. He claimed that when there is a change in the media environment human sense perceptions are somehow altered. He alluded to a process of osmosis taking place when a person is exposed to a visual medium for long periods of time, but did not offer any evidence on how this process actually works.

(2) Postman (1985:10) suggests that McLuhan's aphorism that "the medium is the message" is in need of amendment, because as it stands it may lead to confusing a message with a metaphor. Postman argues that a medium does not work in a literal fashion, but rather the forms of our media and their symbolism are like metaphors operating by "unobtrusive but powerful implication to enforce their special definitions of reality". This might be so; but how does it happen?

(3) Perhaps the most extreme stance yet taken, on the effect of the media on modern culture, is the argument offered by Baudrillard (1983). He develops McLuhan's arguments to such an extent that he seems to be testing the limits of linguistic and metaphorical expression. For example, he doesn't just argue that the map has become the territory, which implies that a society is a mere reflection of its symbolic order, but says,

Abstraction today is no longer that of the map, the double, the mirror or the concept. Simulation is no longer that of a territory. It is the generation by models of a real without origin or reality: a hyperreal. The territory no longer precedes the map, nor survives it. Henceforth, it is the map that precedes the territory (Baudrillard 1983:2).

Mitchell (1987:7) points out that throughout history there have been many times when the question "What is an image?" has been a matter of some urgency. He cites the English Civil War which, he says, "was fought over the issue of images". This was not a disagreement over material symbols, such as

statues and other materials used in religious ritual, but was a concern about "less tangible matters such as the "idol" of monarchy, and beyond that the "idols of the mind" that the Reformation thinkers sought to purge from themselves and others".

Many difficulties at the centre of effective media analysis (and/or semiotics) are connected to the concept of "icon". For example, Culler (cited by Mitchell 1987:56n) says that the icon is " more properly a concern of the philosophical theory of representation than of a linguistically based semiology". Mitchell (1987:56) states that semioticians like Barthes argue that language is the most appropriate model for *all* symbolic systems, including the pictorial. The argument against this, as Mitchell suggests, is the recognition and incorporation of the "icon" as a sign-type into a general theory of semiotics. The icon is generally recognised as the "traditional contrary to the verbal sign". However, Mitchell stresses that there is more to semiotics, or to the notion of iconicity, than just providing a description of images or pictures. He points out that the "icon", as C.S. Peirce defines it, is any sign that "may represent its object mainly by its similarity" -- a definition that Mitchell argues "expands to include everything from diagrams to maps to algebraic equations to metaphor". The license Mitchell takes with this definition rather implies that Peirce did not recognise the difficulties associated with the icon. Peirce did; categorising the icon into images and diagrams, but was more concerned with symboloid features as the dominant aspect of the sign. Nevertheless, given the plethora of icons available today from visual technologies, Mitchell's stance seems justified.

According to Mitchell (1987:56), Peirce recognised the world of signs as fully described by the trilogy *icon* (by resemblance or analogy, e.g pictures, statues), *symbol* (by convention i.e words, numerals and other arbitrary signs), and *index* (by "causal" or "existential" connection, a trace that signals its cause; a pointing finger, symptoms of a disease, smoke and fire) .

The icon presents a problem for semioticians to define because almost everything can be construed as one. In a life-world having a proliferation of graphic and photographic representation, everything may be seen to a degree to be similar to everything else. However Goodman, (1968) argues in his Languages of Art, that resemblance is not a sufficient condition for most types of representation whether they are iconic or pictorial. "An object resembles itself to the maximum degree but rarely represents itself . . . while a painting

may represent the Duke of Wellington, the Duke doesn't represent the painting none of the objects of the assembly line is a picture of any of the rest; and a man is not normally a representation of another, even his twin brother". (Goodman 1968:4 my italics)

Mitchell (1986:58) argues that "The problem with the notion of icon is not just that it embraces too many sorts of things". It is that the "concept of "sign" drawn from linguistics seems inappropriate to iconicity in general, and to pictorial symbols in particular". Semioticians haven't really come to grips with the inherent difficulties involved with "doubly natural signs", for example, the iconic/indexical character of a photograph. This phenomenon is exemplified by suggestions that the photograph can be regarded in the world of signs in a similar way to what the empiricists called "impression" in the world of ideas or mental signs. He says, " The idea has a double connection with the object it represents: it is a sign by resemblance, a picture painted on the mind by sensory experience; it is also a sign by causation, an effect on the object printed on the mind".

In the modern world Mitchell (1986:62) argues that "signs are everywhere; there is nothing that is not potentially a sign or actually a sign. The honorific title of "significance" is given from everything from the Highway Code to the Culinary Code to the Genetic Code. Nature, Society, the Unconscious all become "text" riddled with signs and figures that refer only to other texts".

The problems associated with the study of imagery are the countless concepts that can go by the name picture. Naming some phenomenon is an arbitrary act that usually depends on common sense. In terms of sociological analysis it becomes obligatory to examine closely the manner and context in which the language referring to imagery is used. Mitchell points to the problem of understanding the idea of imagery in terms of recursive thinking, as the notion of "idea" is closely associated to the notion of "imagery". To overcome the dilemma of tautology he suggests that it is useful to replace the word "idea" in discussions of imagery with words like "concept" or "notion", or to stipulate at the beginning that the term "idea" is to be understood as something quite different from imagery or pictures. He says this was the strategy of those who followed the Platonic tradition, which distinguished the "eidos" from the "eidolon" by conceiving of the former as a "suprasensible reality" of "forms, types or species"; the latter as a sensible impression that provides a mere "likeness" (eikon) or "semblance" (phantasma). Furthermore, consider the

complexity and confusion that can be created when different levels of abstraction are used by media writers who rely upon metaphors such as "sea of images", "swirl of images", and "pool of images". In the context of a visual life-world, Mitchell (1987) argues, language and images have become enigmas, problems to be explained and prisons to trap understandings of the world.

Mitchell (1987), in attempting to identify the nature of "image" and its difference from "text", suggests two fundamental approaches to the study of imagery, apart from considering it as a kind of language. The first is based on Wittgenstein in which the intention is to examine the *use* of images in institutional discourse such as literary criticism, art history, theology and philosophy. This could mean focussing on what the neophytes have to learn in order to qualify. He advocates examining the manner of theoretical understanding in cultural practices.

The second is based on Foucault's (1973:17-20) concept "the order of things". Here the image is not just a sign but "The image is the general notion, ramified in various similitudes (*convenientia aemulatio*, analogy, sympathy) that holds the world together with "figures of knowledge"." Putting aside the idea of imagery as a kind of language, Mitchell's advocacy of "use" and "order" is appropriate for sociological inquiry. This is especially so if an inquirer wishes to gain a greater contextual understanding of the process of interpretation involving transformation from one mode of representation to another (e.g pictures to text, or orality to literacy).

Despite my criticism of the media writer's language and the difficulties for interpreters from their particular use of metaphor, some of the concepts do require further analysis. For example, in terms of defining the situation, McLuhan's notion of "sensory balance" deserves investigation. If sight has become the dominant sense, does this mean that somehow touch is almost redundant in terms of information? Edge (1973:56) interprets McLuhan's notion of sensory balance as a shift in terms of a transition from one dominated by touch and hearing to a sight-dominated culture. This suggests that the concept is inextricably related to "common" sense (i.e. a sense held in common), an idea that McLuhan obtained from Aristotle who argued that there was one special "sense" which somehow coordinated all the others. For those living in the context of a visual life-world, that coordinating sense would seem to be "sight". The dominance of sight upsets the sensory balance because other senses, like touch and hearing, become less important. In a literate

culture it is necessary for individuals to learn to fix the eyes (or rather keep the head still) necessary for reading a printed page; a skill that is less needed when looking at a picture.

McLuhan (1967:73) also argues that in the modern world the dependency upon prints and the written word involves the tendency to translate "all aspects of our world into the language of one sense only". To substantiate this thesis he quotes Ivins:

Thus the more closely we can confine our data for reasoning about things to data that come to us through one and the same sense channel the more apt we are to be correct in our reasoning, even though it be much more restricted in scope. One of the most interesting things in our modern scientific practice has been the invention and perfection of methods by which the scientist can acquire much of their basic data through one and the same sensuous channel of awareness. I understand that in physics, for example, the scientists are happiest when they can get their data with the aid of some dial or other device that can be read by vision. Thus heat, weight, lengths, and many other things that in ordinary life are apprehended through senses other than vision have become for science matters of visual awareness of the positions of mechanical pointers. (Ivins in McLuhan 1962:73)

Connected to the notion of "sensory balance" is "sensory extension" which McLuhan (1969:29) popularised when he said that "all media are extensions of some human faculty, psychic or physical". This suggests that the book is an extension of the eye, and the wheel an extension of the foot. Joshua Meyrowitz (1985:342) notes that "although McLuhan expounded at length on the idea of media as "extensions", the notion of technological extension was discussed by many others before McLuhan, including Samuel Butler, Ralph Waldo Emerson, Henri Bergson, Sigmund Freud and Lewis Mumford".

This use of "extension" is mechanical in character, thereby obfuscating the notion of the whole person, or what people believe themselves to be when they are engaged upon the use of their limbs or senses. Where sight is the predominant sense this difficulty would seem to be pronounced, due to the taken for grantedness of seeing and of its integration into sensibility. To use Polanyi's term it is a complex task to incorporate the "tacitness" the concept implies. In terms of visual common sense it is necessary somehow to make more explicit those aspects of implicit knowledge that the human individual takes for granted.

The work of perceptual psychologist J. J. Gibson (1979) demonstrates the complications involved. Gibson argues that despite the success of optical scientists, anatomists and physiologists in curing disease and prescribing spectacles they could not explain vision, as these specialized fields are based on descriptive facts that are not pertinent to the study of perception. He writes:

I used to suppose that the way to understand it [vision] was to learn what is accepted as true about the physics of light and the retinal image, to master the anatomy and the physiology of the eye and the brain and then put it together into a theory of perception that could be tested by experiments. But the more I learned about physics, optics, anatomy and visual physiology, the deeper the puzzles got. The experts in these sciences seemed confident that they could clear up the mysteries of vision eventually but only, I decided, because they had no real grasp of the perplexities. (Gibson 1979: xii, parenthesis added)

Influenced by Gestalt theory, Gibson's prime concern was "how we see". His wholistic approach to perception almost abandons the traditional Lockean concept of sense in which a two-stage process of perceptual experience and meaning are explained. Instead, Gibson (1979:54) concentrates on the initial and direct act of seeing, that is direct visual perception. He argues that traditional theories of classical optics relied on the comparison of the eye to a photographer's camera which meant that all that could get into the eye was either light waves or wave particles. The only alternative to this notion seemed to be "the naive theory that little copies of objects got into the eye". It was Gibson's experience with young pilots in World War II that made him realize, in his view, the problems with the then accepted theories of perception. They were theories which psychologists were attempting to apply to the problem of landing an aircraft where the speed of the aircraft and the relationship of the pilot to the ground created "estranged" vision. Gibson's work highlights the problems associated with the manner in which perception has been construed in the past; as a process which begins with sensory impressions or data as separate entities.

Polanyi (1983), in his discussion of "tacit knowledge", outlines a much more scholarly approach to the notion of "sensory extension" than did McLuhan. He addresses the phenomenon of the use of tools and instruments in a different way from the usual mechanistic approach to technology when he says:

I have described how we learn to feel the end of a tool or a probe hitting things outside. We may regard this as the transformation of the tool or probe into a sentient extension of our body, as Samuel Butler has said. But our awareness of our body for attending to things outside it suggests a wider generalization of the feeling we have of our body. Whenever we use certain things for attending from them to other things, in the way in which we always use our own body, these things change their appearance. They appear to us now in terms of the entities to which we are attending from them, just as we feel our own body in terms of the things outside to which we are attending from our body. In this sense we can say that when we make a thing function as the proximal term of tacit knowing, we incorporate it in our body - or extend our body to include it - so that we come to dwell in it.
(Polanyi 1983:16)

Polanyi (1984:13-14) suggests that his concept of tacit knowledge can also be applied to visual perception. The way a person sees is, to a large degree, dependent on the level of awareness of certain 'efforts' that stem from within the body, such as an 'awareness of position, size, shape and motion', to which we are attending. These, he argues, are features of tacit knowledge which the individual may be incapable of controlling or be aware of in themselves.

Bijker, Hughes & Pinch (1989) argue correctly that in the early days of the sociology of science, knowledge pertaining to aspects of physical science and technology was treated in the black box fashion. This meant that everything was included *except any discussion of the technology itself*. Again, to emphasise Barrett's (1979) point, most people living in this technological age, including technicians and engineers, tend to experience technology in the black box fashion. In the modern world there always seems to be at least one component that can be repaired or replaced without an intimate knowledge of the actual technical process. This was inevitable as separate and specialised languages developed and different industries required separate physical places in which to work.

The problem for the sociologist interested in social/technical order is the inclusion in his/her analysis of those constituents that inextricably constitute that order. This means that in addition to the people involved, attention should be focussed on what they say and do when referencing the particular technology in question. This requires including social and technical phenomena often considered trivial and therefore left out of the formal reporting process. To use an analogy, adding sugar to tea is constitutive to the taste of sugared tea. To the extent that an "image" is

constitutive to the production of a social order, this suggests that it is a detail integral to the process. Capra (1988:141) cites Roland Fischer's argument on perception, which stresses that what we perceive is achieved through interactional processes, explaining that the "sweetness we taste in a piece of sugar is neither a property of the sugar, nor a property of ourselves. We are producing the experience of sweetness in the process of interacting with the sugar". This does illustrate the difficulties involved when analysing the integration of the technologies of visualising into a social order.

The special difficulties faced by semiologists, or difficulties that any social inquirer faces when addressing the issue of images and icons and the manner in which they are integrated into a social order, may be overcome by heeding Mitchell's (1987) advice:

- (1) Examining the use of images in institutionalised discourse.
- (2) Focussing on what the neophytes have to learn in order to qualify.
- (3) Examining the manner of theoretical understanding in cultural practices.
- (4) Because it is not possible to talk about the extensive types of imagery all at once, *a starting point is required.*

After some thought I considered the social situation of technical specialities such as radar operators, computer operators and radiologists, all of whom are involved in working situations involving pattern recognition and interpretation. Radar operators and radiologists are only two examples of an emphasis on iconic understanding, but radiologists are obliged, like many scientists using instruments such as a microscope, to be able to make a transformation from the iconic to some lexical code in the process of diagnosis. "Diagnosis is the process of finding the appropriate name for a set of symptoms" (Wardhaugh 1987:224). Being embryonic theorising, classification is at the heart of diagnosis. This attribute of classification is perhaps the most significant reason for my choosing radiology as the area in which to focus my research. Radiologists are a community of individuals who use visual technology as an ongoing part of their working lives.

There were a number of other reasons for the choice of radiology as the object of the field work:

(1) Radiologists have been established as a community of medical practitioners for nearly a hundred years. X-rays were discovered by Roentgen on November 8th 1895, and since then have, with other and more recent visual modalities (Computerised Tomography (C.T.) and Ultra-sound) become indispensable to the practice of radiology.

(2) The radiograph is a photograph, albeit of a special sort, that shows things that are not usually seen without the aid of a visual technology, but radiographic production techniques are similar to other forms of graphics.

(3) Radiologists depend upon a specific understanding of their particular world in order to see what is significant on a radiograph. Without a medical background they would not know what to look for. This suggests that there may be a correlation between the "iconic" and the "symbolic", or expressed differently, there may be a correlation between "how they see and how they talk". In this respect radiological accounts must offer an important perspective on what is constituted as factual in the interpretative process of pattern recognition.

(4) For the map to become the territory, as is claimed by some media writers, means in effect the substantiation of Wittengstein's word/picture theory. In this respect medical metaphors are an indispensable tool for translating from the pictorial to the symbolic.

(5) "Social closure", reflected in radiological accounts, may be a significant way in which to reveal aspects of the interpretative process in making a correct hypothesis. This may be achieved by analysis of the group processes involved in verification.

(6) Most importantly, no matter what symbolic mode or system of representation is utilised in any social context involving technology, the most vital element, in terms of understanding, is the social actors' (radiologist's) *common sense* and also the researcher's. In the end it is the common sense approach to phenomena in the world that guides the intentions of the social actors. Metaphorically speaking, common sense cuts across all sorts of boundaries between disciplines and allows people to come to decisions regardless of the mode of representation being used.

Loftus's (1988:129-130) study of the imagery used in Northern Ireland between 1968-88 is a recent example of a relativist approach. She suggests that by drawing on the "work of Austrian art historians and their successors, of media-analysts like Barbara Rosenblum, of the anthropologist Victor Turner, and of sociologists like Basil Bernstein, Mary Douglas, Norbert Elias and Janet Wolff, it is possible to construct a theory about the relationship of visual images to society which fits the present situation in Northern Ireland". The intention in the following outline is to take the propositions that she proposes for a theory of visual images and relate them to radiology. Loftus says:

(1) *"that in order to understand the relationship of visual images to (the members of a) society it is necessary to abandon the traditional, hierarchical, evaluative separation of them into categories of fine art, popular imagery and the mass media, except insofar as that evaluation and categorisation is part of those 'image's' real existential function".*
(Loftus 1988:129)[My Brackets and italics]

There are two points that can be taken from this. First, there is the suggestion that a life-world or social context can be thought of as a "seamless web"; that is, any *a priori* judgements formed from a particular perspective should be questioned or avoided when making descriptions. In phenomenological terms this means the use of "bracketing". Secondly, following on from this, is that the notion of "existential function" is of fundamental importance to a radiologist involved in the process of diagnosis. This simply means that when a radiologist is involved in the processes of pattern recognition he/she needs initially to suspend any judgement until all possibilities are checked.

(2) *that any specific image is the product of a maker or group of makers whose work is conditioned, though not completely determined, by overlapping social, political, economic and religious factors, by virtue of their personal context, the technology involved in the production of their work, its location within institutional structures, and its use of visual conventions.* (ibid)

Radiographs are made, and their production is organised by radiographers, film makers, technicians and so on. The visual conventions are usually determined by the radiologists, who are also medical doctors, and they are the

interpreters. They are the experts who decide the course of action beyond the radiograph. Radiographers are usually only concerned with quality of radiographs and processing the patients.

(3) that the private and public significance of visual images are interlinked; (ibid)

As I understand this statement, visual images are public property like the words of a language. In terms of the radiological context it means that although there are differences between the radiologists and radiographers in the roles they perform, there has to be a shared and a common understanding between all parties regardless of function and hierarchical position.

(4) that an image is not static, but is further developed each time it is used or reproduced, and that in the course of these processes it both acquires additional layers of meaning (Loftus 1988:129-130)[my italics].

The process of radiographic imagery is not static for a number of reasons - including the differences in people's anatomy, differences in the technology quality, type and age.

(5) that this living, developing image is not isolated, but in the various stages of its production both derives meaning from the overall visual language of its producers/users, and is appropriated by them to the specific visual language codes with which they shape their view of the world; and that those visual language codes can be seen interacting in a kind of dialogue in which opposition and overlap are both important. (Loftus 1988:130)(my italics)

The intention behind both the thesis as a whole and the field work concerned in an explanation of how a technology of depiction could be integrated into social analysis. This involves the manner in which the radiographic picture is incorporated into the working-life situation of a radiologist i.e. the interpretative process *in situ*.

The x-ray medium, construed as an artifact, contains its own inherent order. For example, what is seen on a radiograph is not the actual body of a patient, but rather the patient's body as presented by those involved in the technological process of producing radiographic films. This involves an understanding of medical complaints suspected as present, and which the radiologist and the radiographer have the knowledge and technique to address.

Without the means to produce radiographs this specialised practice of medicine would not be possible. The constitutive nature of the radiograph (formerly called a skiagraph which refers to the art of shading in a drawing) was exemplified very early in the technological development of x-rays. The following letter was printed in the March 7th, 1896, issue of the British Medical Association by an Edward Gray.

Dislocation of Elbow, by Edward Gray, M.B., C.M., London

On February 22nd a young man was brought to me having slipped while playing football that afternoon, and fallen on his closed fist while the arm was outstretched. On examination the elbow was found very swollen, especially on the inner aspect. No crepitation could be felt, and the forearm could be freely flexed, proated and supinated without causing much pain. I came to the conclusion that there was no fracture, and was inclined to think there was no dislocation; but owing to the considerable amount of swelling I could not be certain. I deferred putting him under an anaesthetic as I thought it would be a good case in which to test the value of Roentgen rays, so evaporating lotions were temporarily applied until the arm could be skiagraphed by Mr Sydney Rowland. This was successfully done on February 29th (by which time the swelling had subsided considerably), and showed a rare form of dislocation at the elbow-joint, namely, of both bones of the forearm outwards. Erichsen states that the only instance with which he is acquainted is one reported by Nelaton.

The accompanying skiagraph (Fig. 5.8) represents the condition. No time was lost in reducing the dislocation under chloroform.

This case is one of great interest both because it is a step in advance towards obtaining skiagraphs of deeper and thicker structures than hitherto *and because the diagnosis cannot be obtained by any other means.* (Gray B.M.J.,1896:620; my italics. Figure number amended as appropriate)

Gray's letter gives an insight into the constitutive and widespread nature of the radiograph in the diagnostic process that was to come. In the practice of radiology pictures in the form of radiographs are not just marginal arguments , but are in themselves concept representations intrinsic to radiological practice. In what sense, then, are conceptual variations in the form of pictures relative to a social or cultural context? To what extent does the picture as a concept influence the ordering of experience?

THE GREAT DROP
The New Zealand Sharemarket's
last 14 days

950
900
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1 2 3 4 5 6 7 8 9 10 11 12 13 14

AFTER 14 DAYS

The "unbridled panic" in world sharemarkets continued in Tokyo last night and stormed into the early morning trading in London.

The New York Times reported that the company had received a letter from the U.S. Justice Dept. last week, asking it to provide information on its operations. The company said it was cooperating with the government.

Game Won As Millions Lost



to the remarks of
dread, the Washington
Post took to the
court for some photo-
to the art dealer he
W. Sloane and
of him, it thought
to the commercial
efforts to bring
out right out of
the hand company.
James Thompson

Wheat prices were rising in London, and in the United States, and in Australia. The price of wheat in London was 10s. 6d. per bushel, and in the United States, it was 10s. 6d. per bushel. In Australia, the price of wheat was 10s. 6d. per bushel.

CTU Chief Accepts Loss Of Limelight

for the Douglas Company



Job Loss Fears if

Economics Reporter
After recession has edged
over yesterday's record
and the price of oil has
dropped, but economists
doubt it will be as good as
the recovery of the 1930s.
The price of oil has fallen
and jobs are both likely to
be restored in the near
future. The price of oil has
fallen and jobs are both
likely to be restored in the
near future.

Fading Fortunes

[illegible]

Prices Stay Down

In the past two years or so, as investment in borrowing and manufacturing has been hit by high interest and exchange rates, a major part of business investment in New Zealand has been in new office blocks and other facilities for a burgeoning

These effects are still uncertain. Some economists believe that Government in the 1980s has to invest from the past, and will not give in to the self-defeating protectionism that their predecessors did 30 years ago. But the market provides another view: the real value of their assets has to be changed to reflect to other countries based on those exchanges.

But to Dr Lepper's view, the should have little effect on real economic activity outside the



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Fig 5.2 "New Zealand Teetering On the Edge of Recession"

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Moore rolls his election dice

Wage gamble in bid for lower bank rates

By JOHN ARMISTONG
Wellington Political Editor

The Prime Minister, Mr Moore, has unveiled his promised "fresh direction" and gambled that a deal with trade unions to limit wage rises to 2 per cent will prompt a cut in interest rates before the election.

The "three-way" agreement between the Government, the Labour Party, and the New Zealand Federation of Labour, announced last night, is a landmark in New Zealand's economic history.

The deal, which was announced after a long and arduous process, is a landmark in New Zealand's economic history.

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● PAGE 2: Once on the national stage, says National Reserve Bank, the deal is a landmark.

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● PAGE 21: The deal is a landmark, says National Reserve Bank, the deal is a landmark.



Mr Moore outlining yesterday's deal between the Government and the unions at Mr Douglas's (left) site in the New Zealand Press conference.

Inmates may field league team

Inmates at Paritutu maximum security prison are planning to field a team in the Auckland rugby league competition next season.

A group of inmates at Paritutu maximum security prison are planning to field a team in the Auckland rugby league competition next season.

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Speed leaves unions wary

By MATTHEW DEARNALEY

The Government's latest wage agreement with the New Zealand Federation of Labour (NZFL) has left unions wary of the speed of the process.

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Bus change meeting

By MICHAEL HOLLAND

Auckland Regional Council officials will meet the Auckland Regional Council officials to discuss the proposed changes to the Auckland Regional Council's bus services.

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CORE RAIL BUSINESS SEPARATED

By MICHAEL HOLLAND

The New Zealand Railways Corporation (NZRC) has announced that it will separate its core rail business from its other activities.

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Mr Douglas.

Bloom fades on money market

The New Zealand money market has seen a significant drop in interest rates, with the 12-month rate falling to 11.75 per cent.

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Fig 5.5 "Moore Rolls His Election Dice"

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Fig 5.6 "As Douglas Gets Dumped"

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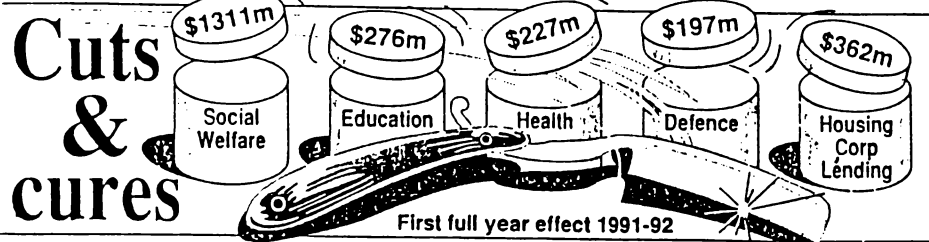
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RUTH'S RECIPE

Well-off to pay for social services
by TIM HENRY
of Wellington

Slashing of benefits only the start

By JOHN ARMSTRONG
Wellington Political Editor

Up, down

A headline slashing of benefits and payments to help back the "welfare state" has been revealed by the Government. The cuts, which will be implemented from 1991-92, are the first of a series of measures designed to reduce the cost of the welfare state. The cuts are part of a broader strategy to reduce the size of the public sector and to encourage private enterprise to take over some of the services currently provided by the state.

The cuts are being implemented in a number of areas, including social welfare, education, health, defence, and housing. The total value of the cuts is estimated to be \$1.3 billion in the first full year of implementation.

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Smaller portions...

Weekly benefits details pg 3

THE DOLE Single 20-24yrs Cut \$35.40	WIDOWS & D.P.B Women alone Cut \$27.04
SICKNESS Single 2 children Cut \$26.04	THE DOLE Married / 2 children Cut \$25.20
SICKNESS Married Cut \$24.58	WIDOWS & D.P.B 2 children Cut \$26.04

Govt still \$2b short of goal

The Government has not yet reached its goal of reducing the budget deficit to \$1 billion by the end of 1991. The deficit is currently estimated to be \$2 billion, which is \$1 billion more than the target.

The Government has announced a number of measures to reduce the deficit, including cuts in social welfare, education, and health. However, these measures are not expected to be sufficient to reach the target.

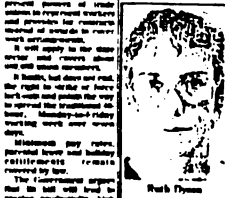
The Government is expected to announce further measures to reduce the deficit in the coming months. These measures may include cuts in defence and housing, as well as new taxes.

Industrial relations all shook up

From ANTHONY STONE in Wellington
New Zealand's century-old industrial relations system faced a radical shake-up under a new Labour law introduced by the Government last night.

The Government has announced a number of measures to reform the industrial relations system, including the introduction of a new Labour law. The law is expected to be implemented in 1991.

The measures are expected to have a significant impact on the industrial relations system, which has been a source of controversy for many years.



Ruth Thomas

The Government has announced a number of measures to reform the industrial relations system, including the introduction of a new Labour law. The law is expected to be implemented in 1991.

The measures are expected to have a significant impact on the industrial relations system, which has been a source of controversy for many years.



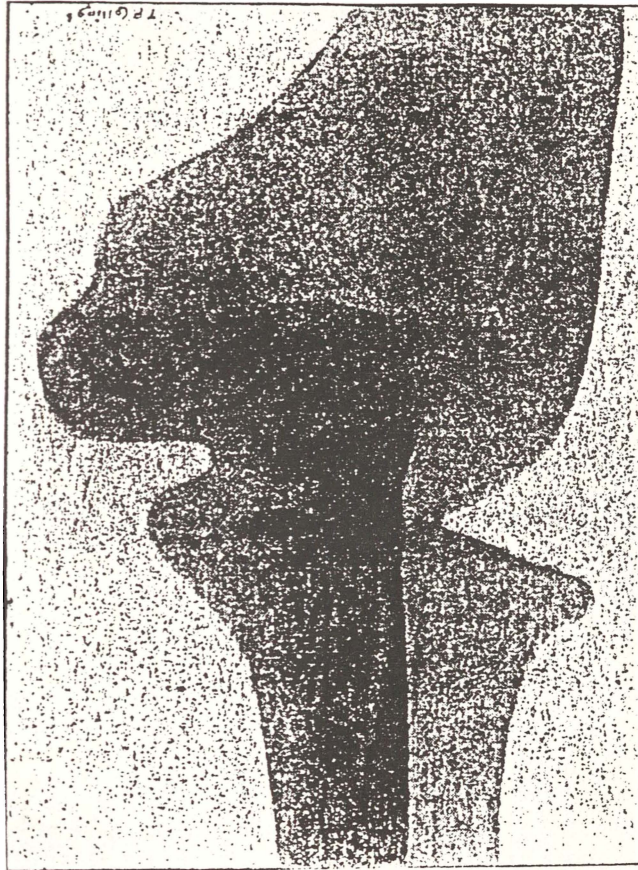
Margaret Wilson

ROLEX

The Rolex Lady-Datejust and the Datejust Chronometer for men.

Fig 5.7

"Ruth's Recipe"



-Skiagraph of elbow of Dr. Edward Gray's case showing displacement of radius and ulna outwards.

CHAPTER SIX

Chapter 6.Radiology: Some Historical Considerations.

This chapter involves a historical analysis with the same methodological purpose as those previously used in this thesis, that is, with the intention of understanding the present. A reason for this is related to Husserl's recognition that, as the role of the technician increased in scientific endeavour a measure of unity would be lost that had existed among disciplines. This was, in a sense inevitable as separate and specialised languages developed, and different industries and sciences required separate physical places in which to work.

The early days of 1896 - some months after Roentgen's discovery on the night of November 8th, 1895, - is a useful starting point because terms created for the practice of x-ray would at that time have been incorporated into medical jargon.

In his laboratory at the University of Wurzburg, the fifty year old Professor of Physics, Wilhelm Konrad Roentgen, discovered the presence of X-rays. His laboratory by modern standards was not pretentious, and he considered that "experiment is the most powerful and the most reliable lever enabling us to extract secrets from nature, and the experiment must constitute the final judgment as to whether a hypothesis should be retained or discarded". (Cited in J.F.Brailsford 1946:454).

Roentgen's life-world was a social setting that would have gladdened Galileo's heart. A high profile was given to empirical science and discovery. This is exemplified in an address he made in 1894, a year before his discovery, when he quoted the well known German engineer, Werner von Siemens, who said:

If some phenomenon which has been shrouded in obscurity suddenly emerges into the light of knowledge, if the key to a long-sought mechanical combination has been found, if the missing link of a chain of thought is fortuitously supplied, this then gives to the discoverer the exultant feeling that comes with a victory of the mind which alone can compensate him for all the struggle and effort, and which lifts him to a higher plane of existence.(Brailsford 1946:454).

Roentgen had been for some time interested in Hertz and Lenhard's study on the phenomenon of cathode rays in a vacuum. Roentgen had difficulty in finding the time to do his own research, but eventually was able to do this about a month before his x-rays discovery. Late at night, when he was using a

Crooke's tube and encased within a cardboard box to exclude visible radiations, (see Fig 6.1), Roentgen saw fluorescence on a piece of barium platinocyanide paper which lay on the bench. This was entirely unexpected and at first seemed like a new kind of *invisible light*. It seemed certain that something new and unknown was occurring. The invisible light, he felt, could not be coming from the cathode ray because it was too far away. However he confirmed that it was due to radiation from the tube, and it persisted even when moved two metres from it. He experimented by placing paper, books, wood and cloth between the tube and the fluorescent paper, but the luminosity was scarcely impaired. Later, when substituting various metals, he found that aluminium hardly lessened the fluorescence casting a light shadow on the paper. Heavier metals however such as lead, gold, and platinum, which inhibited the radiation to a much greater extent, cast much darker shadows. This suggested that the shadows that were produced on the fluorescent paper were dependent on the density of the metals. He also placed a box of weights between the tube and paper and saw the denser shadows of the weights within the box. Finally, for some compelling reason, he interposed his hand between the tube and screen and saw the bones of his living hand beneath the flesh. All that was required now was to substitute photographic plates for the barium platinocyanide paper to obtain photographic records of the shadows of anything that was interposed.

On January 6th, 1896, Roentgen's discovery, as it was now defined, became known throughout the world. Brailsford (1946) notes that two things stand out. First, his choice of a hand was a spectacular demonstration which thrilled everyone who saw it (Fig 6.2). The potential for diagnosis was recognised immediately by almost everyone. The Vienna Press reported:

At the present time we only wish to call attention to the importance this discovery would have in the diagnosis of diseases and injuries of the bones if the process can be developed technically so that not only the human hand can be photographed, but that the details can be shown without the flesh. The surgeon then could determine the extent of a complicated bone fracture *without the manual examination which is so painful to the patient* : he could find the position of a foreign body such as a bullet or a piece of shell much more easily than has been possible heretofore and *without any painful examinations with a probe*. Such photographs also would be extremely valuable in diagnosing bone diseases which do not originate from injury and would help to guide the way in therapy. (cited in Brailsford 1946:455)

Brailsford (1946) noted that the potential for the avoidance of pain still persists in news about health.

The second feature of Roentgen's discovery that stands out was his refusal, despite many offers, to make any money from the new technology. He feared that patents, licences and contracts might end up being dominated by one group. It seems that those manufacturers who could have gained a monopoly declined to do so resulting in relatively modest costs being charged for the equipment. In June 1896 a portable set could be bought for the modest price of 15 American dollars.

The imagination of both the lay public and the medical profession throughout the world was stimulated to an unprecedented state by the potential of X-rays and probably by the fact that the components of the X-ray equipment could be acquired easily and cheaply. Medical practitioners made an almost immediate start. In Birmingham, the day after the discovery was announced, a Dr Ratcliffe met a colleague, Dr Hall Edwards, and asked him what he thought about the discovery and the claim that the rays could penetrate opaque substances. Having together had previous experience in photography they decided to put some equipment together during daylight, and that night, after surgery, x-rayed a purse with a key and some coins inside it. Using his own hand, Dr Ratcliffe claims that, despite the poor quality, his hand was the first to be radiographed in Birmingham. In the Moseley Society Journal for February, 1896 there is a photograph taken by Dr Hall Edwards of Dr Ratcliffe's hand with a small piece of needle embedded in the muscle of the thumb. Dr Hall Edwards was appointed to install a number of units for use in the war in South Africa. However, unaware of the risks associated with x-ray, Hall Edwards required the removal of some of his fingers that had become cancerous due to the way he exposed his hands when holding a patient's hand or arm on the plate. In the years to follow there were many x-ray martyrs in Hall Edwards position, and throughout Europe in the years to follow. Most cities had someone in this category. In Germany a memorial was erected to their memory.

The year 1896 was a period in which rapid developments in the practice of radiology took place. Radiographs of all bones of the skeleton were made showing not only injuries, such as fractures, but also congenital deformities and pathological changes. A host of foreign bodies from glass to needle fragments and bullets were recorded on the radiograph. Similarly, records

were made within the dimension of soft tissues, including the heart, lungs, mediastinum, head, neck, and teeth with defects and fillings which were taken from post mortem subjects. The opportunity for specialisation at this stage of the development of the technology was enormous with such specialised techniques as fluoroscopy, stereoscopy, photofluoroscopy, sinneradiography, and flash radiography being developed. Indeed, as Brailsford (1946) suggests, a large proportion of the investigations carried out in 1896 into the use and application of the new technology were still in use fifty years later.

Radiographs were also used as early as 1896 in legal proceedings. In Nancy, in France, a surgeon was charged with negligence when he mistook a dislocation for a fracture. The accusation was substantiated with evidence from a radiograph and the surgeon lost the case.

An examination of copies of the British Medical Journal published in the early months of 1896 reveals the social processes involved. All manner of people who surrounded the advent of x-ray photography appear.

There are a number of reports by a Mr Sydney Rowland who was engaged by the B.M.A. to conduct and organise the research findings on x-ray. In one report by him, in the February 15th issue, he wrote in the concluding paragraph:

To sum up, then, with regard to the tube: It is little more than a matter of chance at present whether any given tube will produce results or not; having a tube the current must be adjusted to it, and even then it may not give results. New light on these points is most urgently needed before the new method can become an accepted means of clinical diagnosis, and can be shed only by accurate and laborious physical experiments. It is only hoped that the many workers now engaged in investigating Professor Roentgen's rays will soon tell us something on these points. (B.M.J. Feb, 15, 1896: 431)

Also in this February 15, 1896 journal, there are numerous letters from various people outlining their particular experiences with the new technology. Both agreement and disagreement about the findings of the various experiments are recorded. Medical doctors experimented with various tissues from cats and other animals to find out their relative transparency to Roentgen rays. The following extract is from a paper by E. Waymouth Reid who wrote:

The tissues used were bone, cartilage, fat, liver, muscle, kidney, cerebrum, and cerebellum. Of these, bone was the most, and cartilage the least, opaque. (B.M.J Feb, 15, 1896:433)

The mood of expectancy these novel experiences with x-ray generated can be gauged by the following extract from a letter by G.M. Keevil, who also supplied photographs of various x-rayed objects such as a metal button and silver stud. The publication of the letter was delayed for a week because of the difficulty of reproducing the photographs.

In the course of some experiments on the Roentgen rays I have hit upon a series of such extraordinary effects that I hasten to place them on record without further loss of time, believing them to be of the utmost importance.I beg here to call particular attention to the position of these articles in view of the outstanding nature of the result Neither I nor those with me at the time can venture to explain these astonishing results, but we are convinced that there has been no discoverable fallacy in the experiments. (B.M.J. Feb, 15 1896:433-434)

In the March 7, 1896 B.M.J. Rowland states that:

A very great advance has been made this week, in the introduction in the form of a tube by the use of which it is possible to do work with ease that before was difficult or impossible. This particular form is the result of the work that has been done in London, and is perhaps the greatest advance that has been yet made in the new art. It has been named the "focus tube". (B.M.J. March, 7, 1896:620)

Mr Rowland published a paper entitled "Possibility of Skiagraphing the Foetus in Utero". This involved attempts at x-raying a pregnant cat.

With the idea of seeing if this were possible Mr Rowland made several attempts to obtain a skiagraph of a pregnant cat. There was some difficulty in keeping the cat at rest, and an anaesthetic was rendered impossible by the fact that during a trial of ether and another with chloroform the cat showed signs of danger, so much so that Mr. Hobday, of the Royal Veterinary College, who kindly managed the operation, and at whose suggestion the cat was tried, deemed it inadvisable to proceed. The difficulty was, however, partly overcome by the use of hobbles and bandages, and an exposure of eight minutes showed clearly the pelvis and vertebral columns, and faint traces of the uterine cornua and their contents. Had it been possible to maintain the animal quiet for a longer time, Mr. Rowland had no doubt the experiment would have succeeded perfectly. As it was it showed that intestine and other abdominal viscera transmit x rays with fair facility.

The other cases Mr. Rowland had to record this week are suspected fracture of lower third of radius, tuberculous dactylitis in a child, lesion of wrist (nature doubtful), dislocation of wrist and fracture, search for bullet in leg of man (skiagraph successful, but bullet not found). From this list it will be seen that the deeper structures are at last yielding to the new process. (B.M.J. March 7, 1896:621)

The following week, on March 14th, 1896, Rowland reported his findings with the improved tube he described the previous week. He said that the results indicate that the "new process is becoming a definite instrument of diagnosis, and how the deeper structures of the body are fast yielding to its penetrating influence" (B.M.J. 1896:683). In the same report he outlines the following case entitled "Foreign Bodies in The Larynx".

By the kindness of Mr. Waggett I have again had the opportunity of attempting the skiagraphy of foreign bodies in the larynx. Mr. Waggett himself again sat for experiment. A French nail and a fish bone were attached by plaster to the side of the neck, in the exact projected position of the ventricle. Exposure was made for six minutes, and both the nail and fish bone showed clearly on the plate, thus demonstrating conclusively the possibility of discovering foreign bodies impacted in this region. The rest of the structure of the neck showed very faintly or not at all, with the exception of the vertebral column and the hyoid bone. Being mostly cartilaginous, they are very transparent to the x rays. For the practical working of the method it will be necessary, therefore, to draw up a projected chart of the region so as to localise with greater exactitude the actual position of any body. I am at work on such a chart, and hope to have it ready shortly. (B.M.J. March 14, 1896:683)

Another case indicating the progress towards deeper penetration of x-rays in the body was reported in the same issue entitled, "Case of Impacted Gall Stones".

By the kindness of Mr. F.C. Abbott, Resident Surgeon at St. Thomas's Hospital, I have had the opportunity of investigating and experimenting upon some cases of great difficulty. In one of these the diagnosis rested between malignant cystic disease and a mass of impacted gall stones. The skiagraph showed clearly the outline of the ribs, so it is certain that the rays had penetrated the thickness of the body, the greatest thickness ever recorded. No evidence of any opaque body was, however to be seen on the plate. Of course it is not possible to say as yet with any certainty that there were no gall stones present, as this is the first case of its kind that I have tried. It is, however, of great interest, as showing that it is possible to get the x rays to pass through the entire thickness of the body, a result hitherto not attained as far as I am aware. (B.M.J. March 14, 1896:683)

In the April 4th, 1896 edition of the B.M.J. Rowlands reported a significant advance in the mechanical aspect of the new technology. This was a technology that was much more sophisticated than that used by Roentgen in his original experiment. Professor Salvioni of Perugia had constructed an instrument which he called a cystoscope. (see Fig. 6.3). The big advantage of this instrument is that the object being x-rayed is seen at once without the trouble or skill of having to develop sensitive plates.

Rowland's report to the B.M.J. published in the May 16, 1896 issue contains a extract from a note sent by a Mr Parker which states:

Taken from a boy suffering from what appeared to be a tuberculous elbow-joint. The skiagraph revealed disease of the upper end of the ulna. The subsequent operation confirmed what the skiagraph indicated, namely, a defect in the bone of the size of a large almond, filled with carious *debris*, exactly in the position shown; the joint was apparently free. The important points in this case are (1) that the presence of the defect in the bone was not suspected; (2) that the diagnosis was indicated entirely by the skiagraph, and that subsequent operation entirely confirmed this. (B.M.J. May 16, 1896:1225)

By May 16th, 1896, Rowland was in danger of becoming overwhelmed by the number of reports. He writes that there are so many workers engaged in investigating the properties of x-rays that it is becoming difficult to select significant papers from the ever increasing literature. He expresses concern over the danger of important papers being missed.

The Roentgen Society of London, established in 1897, was the forerunner of the British Institute of Radiology; eight years later, in 1905, the German Roentgen Society was founded. These institutions enabled the bringing together of a range of specialists from physicists, manufacturers, technicians and medical personnel that emphasised the extreme importance of X-ray technology to the practice of medicine. They were not established solely for the enhancement of radiological practice, but also as a means of insulating medical personnel from the almost hysterical public reaction to the new technology.

The Electrician, of January 10, 1896, seemingly indignant at some of the claims, stated: "We cannot, however, agree with the newspapers in regarding this discovery as a revolution in photography: there are few persons who would care to sit for a portrait which would show only the bones and rings on the fingers". In the July issue of The British Journal of Photography there

was a suggestion that the production of radiographs could be a profitable exercise for any one who took it up. Perhaps capitalising on the fallacy that X-rays could be used to see through doors and clothing, the suggestion led to ideas of producing X-ray proof underclothing. As one could imagine, the writers for Punch magazine had a field day!

Roentgen, always the scientist, was averse to the dabbler. He recognised that although the production of the radiograph is relatively simple it does not carry an obvious interpretation. In fact there was an early realisation that the ability to interpret can be achieved only after considerable study as the tissues of each individual are unique and as different as finger prints. This suggested that the manifestation of any disease is surrounded by many variables.

For those in the medical profession, interpretation carried great responsibility in terms of the life and well being of a patient. Interpretation from a medical point of view required training. Anyone who did not have the requisite skills could be accused of charlatanism. A disease may not produce any radiographic evidence for some time after its onset, and therefore the potential to mislead was great. During these early days, X-ray technology was still a novel method of visualisation which implied that the "normal", and any variations from it, had still to be learned and experienced. The production of x-rays and effective application had to be standardised. This, for the purpose of this thesis, is the process that carries significant sociological significance.

In a sense, the practice of radiology is a concern about "concept application" or "classification". To limit the extent of my enquiries I focused on chest x-rays and the social processes associated with the development of classifications that pertain to the x-ray image. Like many aspects of the technology, these had to be devised and learned over quite long periods of time. It was not an easy matter and had to be undertaken while the technology was being developed. Furthermore, it would have been difficult for some medical people to change their ways and, understandably, as the potential danger of x-rays became recognised, many would have been reluctant to become exposed.

Chest x-rays of the lungs required a much more extensive learning than fractured bones and foreign bodies, such as lodged bullets and swallowed pins. Unlike an object, such as a bullet or nail, lung patterns are much more subtle. Lung patterns vary considerably and the detection of pulmonary shadows are much more difficult to learn. For example, consider the difference between

an identifiable lesion as manifested on a body as *sign* of a particular disease, and a shadow on the radiographic film as an *index* of some disease. It took about forty years before many of the patterns could be recognised as firm *signs* and relatively standardised.

One of the first to use chest X-rays was a French physician, Oddo, who in 1899 reported a case of anthracosis relying on radiographic evidence to show multiple shadows in both lungs. Throughout the world in the late 19th and early twentieth centuries there was concern about tuberculosis. This was not successfully treatable until the 1940's, but it wasn't just tuberculosis that dominated chest ailments. In Great Britain the importance of occupational diseases of the chest was recognised as far back as 1862. There were many occupational dangers in the form of a wide range of dusts that threatened workers from a plethora of industries. X-ray examination of the chest offered a technique to demonstrate physical shadows of pathological changes to the lungs produced by some dusts.

In 1901, F.H. Williams published a book entitled The Roentgen Rays in Medicine and Surgery as an Aid in Diagnosis and as a Therapeutic Agent. Nearly a third of the book was devoted to chest diagnosis. E.P. Pendergrass (1945), a leading American radiologist writing on the history of chest x-rays, argued this was an indication of Williams's foresight in those very early years of the technology. Williams said in the book that:

All who are experienced in making physical examinations of the thorax recognise the necessity of controlling one method of examination with another. Not infrequently we understand best the conditions present, as just suggested, by taking into consideration the information obtained from inspection, percussion, and auscultation together, and if we fail to do this we may err in our diagnosis. The X-rays give another and valuable method for controlling the results obtained in other ways, and also add to them. We may, by their use, not only control one method by another, but with the eye supporting the ear we also control one sense with another. (Williams, cited in Pendergrass 1945:596)

Pendergrass (1945) argues that for some time after Roentgen's discovery there were few clinical reports that emphasised the importance of radiographic examination. Throughout the world from 1900 onwards, there was an increasing recognition of the use of X-ray for the detection and monitoring of occupational illness. It was not until 1934 that a radiologist, practising in the coal fields of South Wales noted that coal miners in this area had more chest x-rays than in any other area in Britain and of this part of the body. The x-rays were required because of the high incidence of silicosis in the area.

Use of the radiograph in the United States developed later than in other countries. However, when medical practitioners began to use the new technology, investigations were extensive. In that country the industrial process was extremely varied. Many dusts capable of modifying the action of silica and silicates meant that the medical practitioner needed to be familiar with different types of industrial operations to be able properly to interpret the patterns of change produced on a radiograph. There was an enormous effort involved in the recognition and classification of the prevailing patterns of lung diseases.

Mining represents a particular health risk which means that the incidence of silicosis could be identified more readily among people with a common feature than in isolated cases. The identification from radiographic patterns that varied from the "normal" or "healthy" had to be learned and recorded over time. Even terms like "normal" and "healthy" needed to be discussed and examined with the aim of achieving consensus on some standard nomenclature. For example, in the United States the National Tuberculosis Association Committee described the lungs as healthy rather than normal, the members considered that a perfectly normal human being was a rarity!

During the period from 1910 to 1920 there were concerted efforts to classify and standardise the shadow complex of various lesions especially tuberculosis and after 1920 many publications appeared which described (to use the American term, the "roentgenopathologic" manifestations of lesions in the lungs which have resulted from occupational hazards. In essence, this entailed an extensive system of classification- from a whole range of gases that are injurious to the lungs, such as the halogens (chlorine, bromine, iodine) and including their combinations with hydrogen, and of course the various combinations of gases found in smoke.

The classifications of dust reflect the level of industrial activity at the beginning of the twentieth century. Involved were the insoluble inorganic dusts of flint, silica, sand, carbon, coal, soot, brick, marble, granite, terra cotta, cement, asphalt, enamel, etc. There were soluble inorganic dusts from arsenic, mercury, lead and silver compounds etc. There were also organic dusts and fibres which came from the manufacturing of wood, bone, and shell, from fur, skins hides and leather, feathers, brooms and straw, flour and grain, etc, etc. It would seem with each new industrial process there was a new dust hazard.

These were not always easy to detect due to the mixed origins of the dust. Radiographic technology was to become extremely useful in the monitoring of changes in the respiratory tract as a result of tissue reaction to inhaled dusts.

Unquestionably, the introduction of x-rays into the practice of medicine precipitated an examination of the then current classificatory systems as well as the invention of new ones. Fraser (1938:432) writes that radiographic studies in anatomy proved to be valuable for studying osteological details that previously could only be illustrated by long and laborious dissection or by preparation by mascerating. Radiographs proved useful in locating the position of small and inconspicuous bones. More generally, the range of descriptions covering many specialised activities would have required some sort of alteration or even the abandonment of terms that proved to be inadequate.

Thus, although the use of x-ray technology amplifies the visual sense, more significantly it was instrumental in extending the symbolic understanding of the time. Michael Foucault (1973:133) argues that in the case of the microscope, its significance was not just the means to go beyond the threshold of human vision but "to resolve one of the problems it posed: The maintenance of visible forms from generation to generation. . . The use of the microscope was based upon a non-instrumental relationship between things and the human eye - a relation that defines natural history".

Foucault argues that Carl Von Linne, usually known as Linnaeus (1707-1778), the recognised founder of the classification of plants defined naturalism as that which is transmitted directly to the senses. According to Foucault (1973:134), observation in term of naturalism was to be "content with seeing--with seeing a few things systematically". It was also concerned with assigning a name to salient features. Explaining how seeing and naming was fundamental to the practice of botany, Foucault (1973:133-134) cites Tournefort who "thought that, in order to gain a knowledge of plants (rather than scrutinise each of their variations with a religious scruple), it was better to analyse them as they fall beneath the gaze".

Early botanists were concerned about the recognition and legitimation of what constitutes structure. For example, "roots, stem, leaves, flowers, fruit -- specify the extension available to representation well enough for us to articulate it into a description acceptable to everyone" (ibid). These parts of the plant are available to the seer in such a way that the relationship between them can be

easily described, that is, structurally represented in a specific language that "makes possible the description what one sees" (ibid). Foucault also argues that the recognition of structure requires "limiting and filtering the visible" and it is this that enables it (the visible) to be transcribed into language.

All this is of great importance for the definition of natural history in terms of its object. The latter is provided by surfaces and lines, not by functions or invisible tissues. The plant and the animal are seen not so much in their organic unity as by the visible patterning of their organs. They are paws and hoofs, flowers and fruit, before being respiratory systems or internal liquids. ... In the seventeenth and eighteenth centuries anatomy lost the leading role it had played during the Renaissance..... It was not that curiosity had diminished in the meantime, or that knowledge had regressed, but rather that the fundamental arrangement of the visible and the expressible no longer passed through the thickness of the body. Hence the epistemological precedence enjoyed by botany:.... in so far as there are a great many constituent organs visible in a plant that are not so in animals, taxonomic knowledge based upon immediately perceptible variables was richer and more coherent in the botanical order than in the zoological. (Foucault 1973:137)

According to Foucault (1973:137), the intense interest in botany during the seventeenth and eighteenth centuries occurred because the constituent parts of a plant were far more accessible than those of animals. Knowledge based upon taxonomy was richer and more coherent in the botanical order than the zoological. This meant that the knowledge and classification of the constituents of botany became far more extensive than that of animals.

The use of x-ray technology had a similar effect on medical taxonomy. Before the discovery of x-rays the structure of bones could not be scrutinised in a living person. With the advent of this new "technological controlled form of observation", (to use Foucault's phrase for describing the use of the microscope) a new taxonomic knowledge could be formulated by medical practitioners. As Fraser puts it, commenting on the use of x-rays in zoology:

The most important part of the systematist's task is the classification of animals with reference to the natural system now admitted to exist by nearly all zoologists. The classification of today is an attempt to grasp organisms in accordance with their natural affinities and to trace out their pedigrees. (Fraser 1938:432)

Foucault (1973:138) defines structure as "that designation of the visible which, by a kind of pre-linguistic sifting, enables it to be transcribed into language". The use of x-rays exemplifies this notion of a pre-linguistic sifting, by limiting and filtering visible flesh and marking precisely the skeletal form that exists within a human body. Significantly, a lesion on a

lung is described as a "shadow", which suggests that the process of knowing and interpreting is not based on just what one sees, but upon elements that have been a priori introduced into discourse on structural features. The shadow is a *sine qua non* of the x-ray process, and to be medically useful *requires to be transcribed into a secondary language*.

This can be demonstrated further by citing the development of classificatory systems for the disease of silicosis in the United States. These were based on radiographic evidence. In the description that follows there is a marked distinction between histological and radiographic appearances for simple silicosis.

Histological Appearances.

1. Circumscribed nodules of hyaline fibrosis located in the parenchyma of the lung. Occasionally some of these nodules may show microscopic foci of central necrosis.
2. The result of coalescence of discrete nodules are closely packed and most of the intervening lung is replaced more or less by hyaline fibrous tissue. The lung architecture is partially obscured. No demonstrable evidence of infection. Emphysema is a compensatory dilatation of the air spaces with or without thickening of the septa.

Radiographic Appearances.

- 1 Nodulation.-- Discrete shadows not exceeding 6mm in diameter, tending to uniformity in size density, bilateral distribution, with well defined borders surrounded by apparently normal shadow. The outer and lower lung fields characteristically show fewer modules.
- 2 Conglomerate shadows that appear to result from a combination or consolidation of nodulation usually associated with emphysema manifested by
 - a. Localised increased transparency of the lung with a loss of fine detail.
 - b. Intensification of the trunk shadow by contrast.
 - c. Depression of the domes with possible tendency toward individualisation of the costal components of the diaphragm.
 - d. Lateral view: Increase in the preaortic and retrocardiac space with exaggerated backward bowing of the spine. Widening of the spaces between the ribs -- may not be present. (E.P Pendergrass 1945:602-603)

Apart from much more detail, number and length of description in the radiographic appearances, the language is different. Mention of different types of shadows such as "discrete shadows", "trunk shadows", and "conglomerate shadows", have an uncanny resemblance to Roentgen's laboratory experiment where shadows were inadvertently produced on the barium platinocynide paper on the night of November 8th 1895.

"Shadow " refers to a pattern on the radiograph and not to the actual lung where the clinical or pathological appearance and description will be quite different. Reference to "shadows" suggest the beginnings of a new language which makes sense in respect of, and is peculiar to, the radiograph in its developed use for practical purposes. This resembles what Feyerabend (1987) argued about Galileo needing to develop a new observational language for use with the telescope. The separation of radiographic appearances from histological and clinical appearances marked off the beginning of one specialised discipline, with its own language, from others. The people practising each, though recognising their affinities in several aspects important both to themselves and the wider public, now tend to generate a discourse and practice unique to themselves.

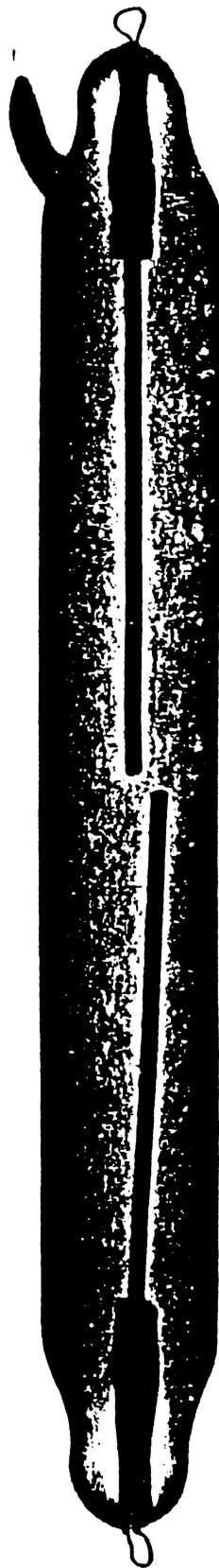


Fig 6.1

Radiograph of First Crookes' Tube used for x-ray production in Birmingham.

Cited by J. F. Brailsford (1946:458)



Radiograph of Frau Röntgen's hand (1895).

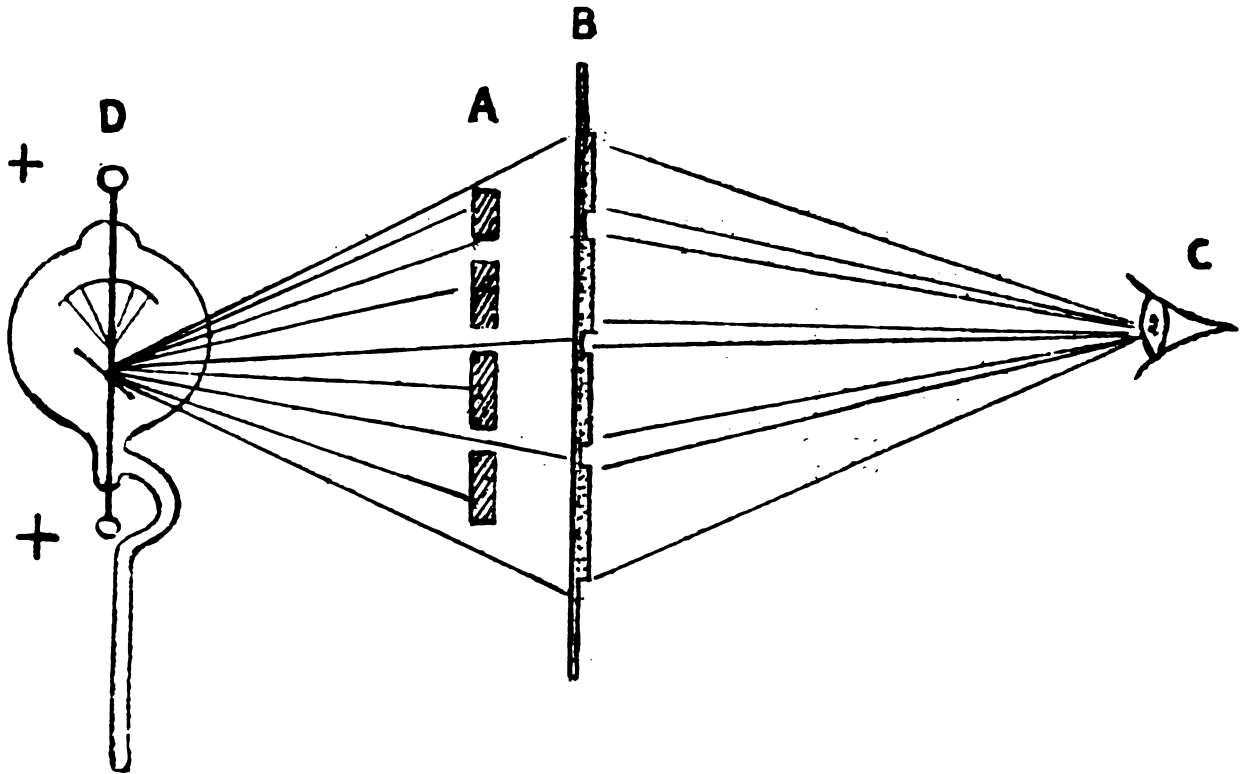


Fig 6.3 Cystoscope.

When a prepared screen is placed in the path of the x-rays, it is seen to light up with a vivid green light. Given that some object capable of obstructing the rays is placed between the source of these rays and the screen, it is obvious that a dark shadow of the object is cast on the screen, and is seen as such by the eye, the screen having converted x-rays into light rays, as evidenced by its fluorescence....For rapid and easy diagnostic purposes in medicine and surgery it will certainly take the place of the far more cumbersome photographic method.

(Rowland British Medical Journal April 4 1896:874)

CHAPTER SEVEN

Chapter 7

Radiology: Considerations of Method.

Modern ethnomethodological researchers have been able to demonstrate that any research is, and has to be, a social accomplishment. This has meant that there is now intensive interest in how any research came to be accomplished. My field work was carried out over several months by attending a number of formal radiological reporting sessions. Discussions and informal sessions took place over three years. My approach is based on aspects of ethnomethodology. However, there was no attempt to formulate the research in terms of rigorous technique, such as an elaborate use of conversational analysis. Rather the aim was to concentrate on "documentary interpretation". This "interpretation" was first developed for ethnomethodology by Garfinkel (1967) in his Studies in Ethnomethodology (1967), but the concept was developed originally by Karl Mannheim and incorporated in the Essays on the Sociology of Knowledge, Published in 1968,

Garfinkel suggests that "documentary interpretation" involves different ways of construing a series of homologous patterns of meaning. Documentary interpretation is a particular kind of reasoning which includes ways in which all people make sense of their environment. According to Benson and Hughes (1983), it is a process that

consists in identifying an underlying pattern behind the series of appearances such that each appearance is seen as referring to an expression of, or a 'document of', the underlying pattern. However, the underlying pattern itself is identified through its individual concrete appearances, so that the appearances reflecting the pattern and the pattern itself mutually determine one another . . . (Wilson in Benson and Hughes 1983:90)

In terms of research, these patterns are based on different imputations of meaning generated as the research proceeds, thus enabling the researcher (to use (Benson and Hughes 1988:90) words to "see other's actions as expressions of patterns, the patterns enabling them to see what the actions are".

Patterns are perceived in interactional context, and the context is assigned meaning through these same actions. For example, my initial experience with a group of radiologists was to silently observe them at work. Later this provided background visual orientation to the first tape recordings made for me by the staff radiologist, but in my absence. Later the modes of experiencing were to change further.

The modes of people's consciousness, their patterns of experiences, and the way in which each experience is structured and modified through a variety of social situations and interrelationships, constantly present a challenge for the social inquirer. Different perceptual settings will tend to evoke different configurations of what is seen and understood. Schutz (1975:23) emphasised that "It is important above all to stress that the orders of reality do not become constituted through the ontological structure of their Objects, but rather through the meaning of our experience".

Schutz (1975:23-24) believed that there was more than one realm of consciousness and experience which he termed "finite provinces of meaning". He outlined a variety of experiences which he argued constituted particular provinces of meaning. These included the everyday world, the world of dreams, the world of science, and the world of religious experience, fantasy and insanity; and, he argues, it is within consciousness that each person creates the meaning of an experience. He also argues that each "finite province of meaning" has a specific and unique *cognitive style*. This is because each one has its own particular character which is made up of concerns, language, objects and actions, etc.

Despite an infinite range of possibilities for multiple realities, Schutz recognises the most significant is the one he considered as the "archetype of our experience of reality". This he refers to as the "world of working". Dominating all the others, it is the *paramount reality*. It is a world dominated by pragmatic motives which the wide awake person experiences in a dynamic orientation to his/her world and its things, including the body perspective. For example, both the experienced radiologist and the neophyte are fully trained medical doctors but differences between them were exemplified in their manner of orientation to the radiograph. This is because the action of a specialist using a particular technology is a procedure concerned with knowing what to select or what to search for. The astronomer looks through a telescope and concentrates on stars, and the biologist relies on repeatable

prints copied from what he/she saw through the microscope; and radiologists are utterly dependent upon radiographs which display selected parts of the anatomy. Details of this are considered in chapters 10 and 11.

Documentary interpretation is carried out by an analyst who deliberately distances him or herself from the subject matter in order to reformulate the research material. This is an ongoing hermeneutical process. Mannheim pointed out:

imagine oneself sharing the life of an artist, spending every living moment with him, taking part in all his moods and every wish of his, constantly occupied with all the things that occupy him, all this without ever bothering about documentation. In such a case we would understand the artist's work in the "expressive dimension" and we would have more or less an adequate picture of the latter's stream of experience in which we would be a partner -- and yet we would lack insight into the artist's personality, his Weltanschauung, his ethos. And conversely another analyst with scant familiarity with the artist's work and actions, but with an acute documentary sense, could build upon the little factual material at his disposal a complete characterisation of the artist's personality and outlook, not in the psychological but in the cultural sense. (Mannheim 1968:55-56)

Sharrock & Anderson (1986) point out that much more so than other branches of sociological inquiry, ethnomethodologists tend to be sensitive to the problem of operationalising studies as they strive to avoid methods which may lead to the disappearance of the phenomena. For example, the tactic that I employed in my relationship with my key informant (who was a practical radiologist), was not sharing any of my research findings until I considered that disclosure would contribute to my understanding process. I had many discussions with my key informant, many of them informal, and some were by telephone. He was not really sure about what I was attempting in the research, he obviously had enough faith in me in the early stage to ask me to attend some special sessions that were designed to assist his colleagues who were having some difficulty with their radiological work and also to provide practice for neophytes and others.

In essence, the process of documentary interpretation entails the gathering of hints and clues over a wide range of the cultural phenomena in question.

In the case of radiology, to use some key words and concepts, this would include the radiograph (see chapter 8 What is a Radiographic Image?), radiological history, radiologist's talk, perceptual ambiguity, mental set, sensory dilation, the use of metaphor and so on. The type of artist that I was

researching was the technical, specialised expert, involved not so much in artistic creations but in the specialised care of people who have had radiographic films taken of them. Although I had personal contact with the individual artist working together in the "expressive dimension", it is important to realise that this relationship was in effect also "collective" as my key informant routinely arranged sessions with other radiologists to which I was later privy. This revealed the "cultural sense" that a field anthropologist seeks to obtain from a key informant, i.e. given expert entry into the technical detail and "problems" faced by radiologists at work.

Many understandings are obtained from reading material, but sometimes there are unavoidable omissions due to the sparse nature of technical description. Detailed knowledge of tacit skills is not normally available in literature as such skills are usually taken for granted in common sense use. Listening to tape recordings made by the staff radiologist, I was able to formulate some of the questions that I had to ask. After hearing the first tape recording he expressed a concern about its poor quality. There was a babble of voices with people talking over the top of each other making it difficult to decipher. Significantly, he said:

"If I say don't all talk at once' --- you will know I am making it easier for you to hear".

I asked him to delay doing this, because, as far as possible while making tape recordings, I did not wish to interfere in the spontaneous process of their interpretation. It was also essential for me to form my own impressions at times without his input. I asked him if he thought the microphone interfered with the group's concentration, and he replied that they probably didn't realise it was there. Later, when we had sorted out the sound problems, everyone could see the field microphone, but it was placed amongst all the other equipment, and I doubt if it inhibited anyone.

There is always a dynamic process of transformation when meanings change because individuals remember different things, and explain them in different ways. This process of transformation that radiologists experience was concurring in my own mind. It is the experience of researching itself, when re-defining the situation occurs. It is the usual influence on the researcher when re-defining the situation in different terms from how it was originally perceived. After hearing the first tapes, it seemed reasonably straightforward that my field notes were an adequate description of the social setting and the events that had occurred. However,

I came to realise that these descriptions were inadequate. The reason for this was that the radiologists were focusing their attention on what was seen on the radiograph. Each mind was focused on the problem at hand, which was stimulated by what they saw, or thought they saw, through the radiographic window. I was unable to see the things that they could see, which meant that I could not observe the radiological situation until I understood more about their interpretive process. While the researcher remains as an outsider, it was possible to identify what Garfinkel (1981) calls the "foliage", i.e. those embedded features of radiologists' discourse and practice that remain hidden to the members of that community. The more experienced, competent and knowledgeable the researcher becomes in the practice of observing radiologists, the more likely it is that aspects of the foliage will disappear.

As mentioned previously with reference to the introduction of my tape recorder to the professional radiological setting, it so happened that the first tape recording was made by the staff radiologist (my key informant) in my absence. It is technically imperfect and is quite difficult to discern in places. The microphone was positioned too close to the place where the films were clipped to the screen resulting in a noise like clapping thunder every time a film was changed. (Each film is clipped to a lighted screen which enables a number of people to view it together). I had attended one previous session with the radiologists in order to see the context of the situation. On that occasion I introduced no technical equipment of my own and had drawn few conclusions. When listening to the imperfect tape, the original experience did enable me to renew the background visual orientation to the sounds and conversation recorded in the tape.

My first impressions on listening to this tape were that it sounded as though it had been taken from the T.V. series Mash where everyone laughs and jokes. When I first listened to it I could hardly understand it. In my confusion I had let the tape run on in the hope of being able to catch up with events through some familiarity. On trying again the following day I was able to give it some coherence. Later, further discussion with the key informant led me to realise that I had been listening to the end part only! This discussion then enabled me to hear the whole tape right through, and I found that the tape did provide useful first insights for my understanding of the social context of radiologists at work while reading films.

Although I considered that I had reasonable background and common sense knowledge, it was fascinating, after hearing this tape right through, how my understanding had come to change. For example, initially I had considered that the formats and conventions devised for conversational analysis by (H.Sacks, E.Schegloff and G.Jefferson (1974)) would be an appropriate means for the display of invisible aspects of the social world of radiologists in their working situation. Significantly, I had visualised the form of "talk" as that which is laid out neatly in Sacks et al's arrangement. However the tape revealed an oral life-world in which people sneeze, whistle, cough, talk together, interrupt, break off conversation and interrupt their own speech with new thoughts as they arise; and all of this was punctuated at times by quite long silences as people think. It seemed to me as I listened to this tape for the first time, that the comic strip picture of conversation and thought bubbles coming out of the actor's mouth and head would be a more appropriate way of representing radiologists' talk.

Ironically, in my opinion, the use of conversational analysis can also lead to the disappearance of the phenomenon. Conversational analysis is a mode of representation which, like all representations, is bound to its own rules in order to make sense. The intention behind the use of various signs is to preserve the sense of timing and, to some extent the ambience of the speakers' utterances; in many situations the method is quite successful. In the inquiry I was engaged in I felt that being bound by the conventions of conversational analysis might well threaten my ability to discern the conventions that were binding the conversations of expert radiologists whom I was observing. Interpretation in a literal or discursive sense alone was likely to prove inadequate due to the fluidity of this interpretive process.

As one means of arranging the mass of evidence and observations coming through to me, I used field notes through abbreviated statements. These outlined what I perceived to be the main points of a situation. These were supplemented by the tape recordings. When I wrote up my early notes I sensed a tendency to assign some recent theory or concept that I had just read into my writing. I became very aware of the need to suspend any desire to jump to a theoretical conclusion, and instead, like an ethnomethodologist, to treat any theory as a contingent to the hermeneutical process.

An early first tape included a recording of a session where a radiologist required assistance from her peers and colleagues. The recording was of first hand medical diagnostic practice by experienced radiologists intent, under pressure, to find out exactly what was going on. The radiologist requiring assistance aimed at obtaining some consensus from her colleagues about a case of hydrocephaly where a shunt tube had blocked and seemed to have caused the fluid space in the brain to enlarge.

Not surprisingly, first impressions that I got indicated that the group's conversations were dominated by "indexical" and "objective" expressions. To elaborate these terms: an indexical statement is one that is pointing to something as an index to the underlying reality of the given context and is, therefore, inherent to the context. For example, "what is this little round thing here?" Objective expressions are those pertaining to medical jargon and or physical attributes denoted on the radiograph. An example would be "globules of calcification". The sense of objectivity being used here relates to the "hard facts" that are indispensable to the practice of medical science. They are expressions, which, like mathematical symbols, are recognised as being clear and consistent in meaning regardless of the linguistic context in which they occur. Objective expressions are taken to be understood as having the same reference by anyone familiar with the language system in which they are used, such as chemistry or radiology.

Some of the objective expressions can be traced to the radiologists' "gamut", that is, the list of possible causes of diseases. (see Fig. 7.1). Gamuts are usually built up from a variety of sources, ranging from books and articles to individual experience. Sometimes members of medical institutions organise a short gamut session each week. This is an occasion when a medical practitioner displays on a blackboard a gamut of his/her creation or one obtained from the literature. Everyone attending the session adds or deletes items throughout its duration. The edited gamut is then made available to others within the institution. A pocket book gamut is a readily available tool to assist the radiologist to avoid errors involved with relying on memory; although it would seem that experienced radiologists do rely on their memories a great deal (This will be discussed later). The gamut acts as a check list of all possible causes; but all the pertinent data must be analysed to locate the appropriate radiographic sign. As Reeder and Felson (1975) warn: to identify a pattern incorrectly will land you in the wrong gamut, which could

be a disaster! This implies that it is the responsibility of each radiologist to maintain and keep up to date their own gamuts.

Using the gamut requires an ability to distinguish and move between indexical and objective expressions. The movement inward (so to speak) to thought or imagination is an intending to the memorised gamut: While the indexical movement is an attempt to label a radiographic sign by pointing to it or naming it, for example, "see the fuzzy lines around the jargon tumour". The gamut conveys to the radiologist a sense of objectivity that is grounded in various conventions such as pathological findings; although, according to my key informant, reference to pathology, although useful, is not a practical option.

David Bloor (1976:86) recognises that "objectivity is social", suggesting that the level of facticity or the objective sense of a term could stem from origins, or historical landmarks, associated with the existence of particular institutions. The most significant landmark is the development of a language used to describe radiographic appearances. Other landmarks could be any occasion where a gamut is altered, in the same way that the etymology of a word is frequently determined by its use in a particular historical context. The radiologist who sees and correctly identifies something which is abnormal, and hence real, reflects Bloor's definition of reality in the sense that it is inherent in the radiological conventions of visual interpretation. This suggests that this "objectivity" is socially and collectively constructed as members are dealing with a symbolic representation, i.e., the radiographic image and not the real thing. Objectivity is also maintained and legitimated through informal and formal gamut sessions.

Like the collective construction of gamuts, the process of documentary interpretation is a synthesis of disparate evidence coming to constitute a whole or totality. However, it is not sufficient merely to learn the jargon of a discipline, such as radiology, to comprehend a particular pattern of social order. This is a point made by Sharrock and Anderson (1986) who say that the difficulty for a researcher centres on the style of "operationalism" that is adopted. Like Cicourel (1964), they argue that the problem of operationalism is very much a matter of the way that theory and research are connected. This is usually achieved through various techniques employed in data collection, acquisition and analysis. Nevertheless what emerges as the finished product,

or report, is frequently represented in a language which does not capture the ambience and experience of the actual occasion. Lynch (1985) puts it like this:

Almost without exception, philosophical accounts, biographical stories, historical interpretations, and "empirical studies" in the science studies literature address the practices of science as achievements to be explained in a language disengaged from any laboratory task at hand. It is not as though these accounts *deny* that science is accomplished in laboratory settings, but that they do not provide detailed access to the practical achievement of day-to-day inquiries. They instead give decontextualised versions of methodic production and logical reasoning, reconstructions of citation networks and historical lineages, after-the-fact interpretations of historical records, remembrances of prominent figures in science, and abstracted "social aspects" of science's institutional and administrative organization. (Lynch 1985:3)

One aspect of my own field enquiries that came persistently to confront me was the integration of concepts and language that typify disparate disciplines. I found myself frequently having to confront the issue of the languages of other disciplines. For example, the concepts of "seeing", "vision" and perception in general, which have been well developed by writers in psychology and physiology needed to be considered in the light of sociological analysis. (See chapters 8 and 9.)

Cicourel's (1964) work demonstrated the consequence of practical organisational management in terms of preserving the appearance of the phenomenon. He argued that efforts to obtain objective data through the use of measurement systems can easily precipitate replacement of the phenomenon by artifacts of method. In a sense, this was one of the almost inevitable consequences of Galilean science, i.e. the embodiment of abstract mathematical concepts into practical science.

The concern of ethnomethodologists over the manner in which a social order is arrived at influenced my early awareness of a tendency to theorize over research material. Ethnomethodologists regard indexical expressions as fundamental to the "self organizing" of a social setting. In contrast, those who use logical languages find indexical expressions become a problem to integrate into their language system. Cicourel warns that

it is important to ask whether claims to knowledge are based on methods in correspondence with the theories and data collected, or whether the research techniques and measurement scales on which these claims are based have little more than a metaphorical or synecdochal relationship to the same theories and data. (Cicourel 1964:7)

He suggests that synecdochal usage, that is, where only a part is used but the whole is understood, has ramifications for the practice of sociology. There is a danger of misconstruing evidence when theoretical and empirical statements are allowed to stand for a larger whole without specifying how the part fits with the overall theory or findings. He contends that this frequently happens with 'measurement theories' which are used as analogous to data collected, rather than by demonstrating how correspondence between theory and practice is constituted. It seems to me that the same argument applies if sociologists leave out factors that are intrinsic to the social setting, such as the technology for producing a mode of representation or explanations on vision and seeing. However, the social researcher is always faced with the dilemma of what to leave out while retaining what is perceived to be significant.

I was concerned with radiologists reading and learning to read radiographs and this involved me in aspects of their synecdochal usage. However, learning the language and jargon of their practice is insufficient to comprehend their conduct. Current radiological journals and textbooks are written in scientific language, and as a consequence, the ambience of a radiologist reporting on films in context is largely missing. Ordinary aspects of radiological community practice have become lost or left behind in the scientific description, and it does require a reasonable level of background knowledge in order fully to comprehend these specialized technical descriptions.

I had noted in my literature search that recent journals on x-ray technology provided very little discussion on the subject of artifact. The only one I found was concerned with CT scanning which is a much more recent technology. This led me to conclude that between 1895, the date of Roentgen's discovery, and the present day, certain fundamental knowledge of artifact had been sorted out by early radiologists and incorporated into their body of knowledge. The exercise involving understanding the nature of radiological artifact held my attention for several months. The result was Chapter 6 'Radiology: Some Historical Considerations' where I identified how the early users of x-rays developed and used this technology.

Radiologists bring to their current practice taken for granted attributes that generations of them have worked out in establishing their current practice. For example, what is so interesting about the advent of x-ray technology is that it was available to almost anyone who had a basic workshop. As shown in chapter 6, the early months of the 1896 publications of the British Medical Journal are full of reports by various medical and technical people that demonstrate the processes of social/technical "closure" and "stability" with regard to x-ray technology. Technical closure was achieved through open discussion in the various well documented journals and informal meetings. The important point about technological closure is that the newness of the technology provides the opportunity for new designs. These may change quite rapidly, fostering the evolution of new artifacts or systems of operation. Sometimes it takes years, in practice, for a particular design to stabilise. The following samples are taken from letters published in the May 16, 1896 issue. They demonstrate the dialogue involved in social/technological closure.

Winkelmann and Strausell of Jena have found that by backing the plate with an expensive material they are able to obtain negatives of the finger bones in about ten seconds, using a 3-inch spark. It is very difficult to judge from this report how far the observers have succeeded. (Sydney Rowland B.M.J. 1896:1225)

Sir,- In the British Medical Journal for February 29th, 1896, p.559, in a letter on 'Therapeutic Use of Roentgen's Rays,' Professor Sheridan Delapine concludes that the x-rays have not much germicidal action, because various organisms in test tubes were not affected by them. Does this evidence warrant the conclusion, considering the fact that the glass of which the tubes are made would almost entirely prevent the transmission of the rays? - I am, etc.,
T.Wakefield (BMA 1896, May 16:1226)

The earliest report I found on the phenomenon of artifact was in the June 6th, 1896, issue of the British Medical Journal entitled, 'Errors in Interpretation'. Outlined in the paper is the case of a patient who was x-rayed for stomach pains. From the radiographer's point of view it appeared as if he had swallowed a buckle which seemed to be lodged in his intestine. After investigation by an observant physician, it seems that for some obscure reason a batch of x-ray plates had somehow been impressed with the image of a buckle. This early paper contained a warning to other practitioners on the potential dangers of artifact.

From a technological perspective the most illuminating part of the 1896 papers was the richness of the social and technological experience at that time. Only when I read Roentgen's report on his accidental discovery of x-rays on a piece of barium cyanide paper, did I fully appreciate what the historical and technological significance of the 'shadow', in terms of radiologists' descriptions, might be for this inquiry.

Although it had been pointed out to me by radiologists including my principle informer that there is significance in the use of the metaphor "shadow", it is my opinion, after reading the first hand descriptions (that were printed during the first part of 1896 in largely non-technical language) and from my own experience in a radiological setting, that although metaphor is extremely significant (and will be discussed later), the original "shadow" in Roentgen's laboratory was an actual shadow, and his experience in producing shadows provided the grounds for later speech.

When I first mentioned the subject of artifact to radiologists and radiographers everyone seemed puzzled. Then, with some humour, they began to point to deficiencies in the film, where it had been crimped for example, and exclaimed: 'There's an artifact'. On one tape, during a teaching session, an exasperated staff radiologist exclaimed "Don't poke the film", and someone responded "Scratch in the artifact". When I inquired what was going on I was informed that it was considered bad manners to poke the film, and to scratch in the artifact was a standard joke among radiologists when someone had difficulty in seeing a lesion or in reading a film. It seemed, therefore, that the theory of scientific artifact was not only well known, but known to such an extent that it is contingent to disciplined practice.

The talk of practice, under normal circumstances, is able to continue without a concern for artifact; the quality of the artifact and the ability to discern artifacts therefore becomes a discipline for the practice and in consequence silently governs the talk. Unless of an unusual nature, or related to new technology, or when equipment is being refurbished, artifacts in current day x-ray practice are treated almost without thought. This is not because radiologists and radiographers are blasé about them, but because there are built-in checks and balances in their organizational systems and methodology for producing quality film. To suggest a film is imperfect is done only very

hesitantly in practice. Their organisation and talking together is "regulated" by the quality of the radiograph and their skill in discerning both lesions and artifacts.

My theoretical interest in artifact was influenced by Michael Lynch Art, and Artifact in Laboratory Science, (1985) in which he outlines the way in which researchers attempt to record and identify neurological phenomena using electron microscopic photography. In this situation one of the most important tasks the researcher faces is making these records suitably presentable to other scientists. The crux of the work depends upon a person's ability to distinguish between 'real structures' and 'artifact' of method.

Based on this activity, Lynch's work on artifact is an outstanding example of an ethnomethodological study. A former pupil of Garfinkel's he has taken the practice of ethnomethodology to a high level of effectiveness. However, attaining the rigour he finally achieved took more than four years, and although he said he never reached the ability of practiced interpreters, i.e. the level of competence of the professional interpreters, he did achieve a reasonable standard in this activity.

Lynch's study, and another he carried out with Garfinkel and Livingstone (1981), entitled The Work of a Discovery Science Construed with Materials from the Optically Discovered Pulsar, demonstrated the effectiveness of an ethnomethodological approach in recovering facets of what scientists do but facets which are not usually the subject of the scientific inquiry. The researchers were able to obtain some tape recordings of scientists' conversations made some years earlier as they located optical signals that were subsequently verified as Pulsar NP 0532. In essence, the marks and lines on the recording charts that indicated the presence of the pulsar were also reflected in the conversation of the scientists watching the charts as they realised that they had discovered something of significance.

The following transcription uses conversational analysis developed by Gail Jefferson: *Numbers* in parentheses indicate elapsed time in tenths of seconds. *Colons* indicate that the prior sound is prolonged. The more colons, the longer the sound.

Disney: (We've got a little bit *shape* now)
(0.4)

McCallister: We::ll,
(1.0)

McCallister: (It's) about like I saw in that sky: over there, t'tell you the truth.
(0.5)

McCallister: Ther's a nice di(hh)p on the si(hh)de of that sky.
(0.5)

McCallister: I'm gonna turn this thing down.
(2.5) (machine-- sound probably gain switch))

Disney: We've got a bleeding *pulse* here.
(Garfinkel 1981:149)

In their analysis, what Garfinkel et al (1981:137) did, was to construe the "independent Galilean pulsar" as a "cultural object". That is, the cosmic source of regular and rapidly pulsating radio signals reflected on the recording paper was recognised as a specific form existing in space. Having done this they incorporated *it* into their understanding of scientific night work.

Central to understanding this process of work is the notion of how a potter gradually shapes an object till he or she is satisfied that it is complete. To describe further this fluid process of interpretation and identification of the "cultural object", Garfinkel compares it to Merleau-Ponty's (1962a) phrase: the intertwining of worldly objects and embodied practices. Also significant to Garfinkel et al's study is that most of the social process of understanding they documented was left out of the original scientific paper that announced the discovery.

Holton (1981:159), commenting on Garfinkel et al's (1981) paper, says that "it is no use looking to scientific 'papers', for they not only conceal but actively misrepresent the 'reasoning' that goes into the work they describe ... only unstudied evidence will do - and that means listening at the keyhole."

This vicarious listening is not as easy as it may appear. When I attempted to evaluate current ethnomethodological inquiry with the intention of pursuing that course of action, I soon recognized that any neat and smooth report would simply exemplify Cicourel's (1964:7) warnings about the difficulties inherent in any social research. Although I was allowed almost total access to the radiology department, was not restricted to whom I could talk, and had full cooperation from everyone, it was very difficult to get people to engage in conversation without being constantly interrupted. It was like being allowed into a popular restaurant kitchen at peak times and trying to interview the staff about their work. Indeed, I came to realise later that the interruptions and seemingly chaotic nature were an inextricable part of "normal radiology" being carried out in a large hospital.

Another aspect of synecdochal usage that I was confronted with in the field work was how best to re-present the social situation of x-ray interpretation. The social situation consisted of individual and collective interpretation of "marks" on a radiograph: a knowing that was achieved by collective agreement.

Ethnomethodological enquiry has shown that there is much more to a social setting than the actors talking, despite talking being the fundamental constituent in most social situations. In the social situation of x-ray interpretation, it seemed to me that the talk was often stilted, like a form of shorthand, i.e. much of what was seen (the obvious) was left unspoken. Tape recordings did not give me sufficient evidence of the actors background understanding in terms of how they actually saw and interpreted radiographic patterns. An example of this was provided by a tape in which experienced medical registrars were discussing a case from the intensive-care ward mentioned previously. The radiographic film had just been processed and the registrars were discussing among themselves what action should be taken on the case. Again, the striking thing about this tape was that the speakers' language was reduced to "indexical" and "objective" expressions. There was no reference to anything else, no humour, no chatting on the side. It was serious, technical talk which gave very little away about what lay behind the actors' conversation. The tape exemplified the theoretical attitude of a scientist using technical language in a collectively understood situation.

I noted when perusing recent books for radiographers and radiologists that the authors tend to take for granted the efficacy of the technical aspects of the x-ray practice. They also seem to take for granted the organisation behind the practice. This may come about from the increasing efficiency and sophistication of the technology. Just as the pilot of a plane needs a complex social organisation to be able to get off the ground, so do radiologists as their reporting requires good organisation to be able to read the films efficiently. Radiographers, that is, the people who provide technical and production assistance to the radiologists, are greatly concerned about the technical production of the film and the organization of procedures. According to Goldman (1986), hospitals are increasingly reliant upon effective teamwork rather than isolated individuals pursuing their own ends. It is necessary that nurses and radiographers have sufficient knowledge of the x-ray investigative process to enable them to reassure anxious patients. The increase in volume and the extent of modern x-ray investigation, have meant that many of the tasks originally carried out entirely by medical doctors, and later radiologist as specialists, are now of necessity performed by less qualified staff. Radiologists monitor the quality of the films and ensure that procedure corresponds to the medical requirements.

A fundamental difference between the roles of radiologist and the radiographer is that "reporting" involves the radiologist's contact with persons outside the hospital organisation, such as other professionals etc. Officially and legally, the responsibility of reporting belongs to the radiologist, even if the experienced radiographer knows exactly what the situation is and could credibly "report" on many of the films. The radiologist takes responsibility for the diagnosis.

Though this responsibility is professionally personal, the ability to carry it out is collective in at least two ways. First, Yoxen (1989) writes that even after the first fifteen years of development in the technology of ultra-sound, there remained considerable skepticism about the comparative value of the ultra-sound image. He claims that there must be a general agreement among the professionals about its value and reliability for the new technology to receive general acceptance. Such general agreement must include a set of procedures for producing such images. This set of procedures comes to constitute much of the non-verbally expressed evolvement of the radiological code.

Secondly, the establishment of this code among neophytes and its exercise by qualified radiologists - though central to my own research enquiry as shown in chapter 10 and 11 - are accomplished by radiologists themselves in a practice called "Group Reporting". I was encouraged by my key informant to attend such sessions.

The process has a substantial teaching element and sessions are conducted on a fairly regular basis. There are a number of reasons why they are important. The first is that teaching is an extremely significant part of the practice of radiology, as indeed it is to any specialised discipline; but what is different about radiology is that the neophyte is taught to *see* and this involves a perceptual change in the individual. Such a change does not simply happen. In the physiological sense everyone's eyesight differs. Neophytes are also at different stages in their learning of the practice. All radiologists are qualified medical doctors, and although the motivation to become radiologists may be the same, inevitably there are differences in natural ability related to the physiological process of seeing. An ability to see relies upon an instrumental use of one's eyes.

What precipitated the importance of "group reporting" to this inquiry was "trouble". This has a particular relevance for ethnomethodologists. Garfinkel (1967) used "trouble" to shock people out of their taken-for-grantedness. This enabled him to examine more closely those invisible aspects that made a social order possible through the recognition of what background understandings social actors depended upon for the maintenance of their membership of a community. The "trouble" in question here was not so dramatic. It did not involve shock, but concerned the professional difficulties experienced by a neophyte radiologist having difficulty in reading films.

These sessions involved a team of five radiologists, including my key informant who conducted the sessions and selected the films for testing. The four registrars were all in various stages of their qualification as potential radiologists. The first session that I was invited to attend highlighted the different stages of individual perceptual ability. The most inexperienced had still not learned sufficient radiographic language to be able to translate from clinical descriptions. He was not confident about his starting point for his own personalised "search pattern" to know the usual pattern, or anatomical shape, in normal radiographic appearances. Initially he was quite confident with his use of metaphors to describe various skull patterns, e.g. moth-eaten

appearance, floor, skull vault; but later he couldn't settle on a starting point for discourse. In contrast, a more experienced reader was far more proficient and read the films with speed and accuracy. He rarely hesitated, but when he did, he was still "with it", that is, he hadn't "closed off", in that he could delay his choice. He seemed to be able to control his cognitive integration to a much greater extent than the inexperienced reader. It seemed to me at that time that his greater speed was due to his clearer and more definitive knowledge, which allowed him to make a much better use of deduction. This meant that he eliminated much more confidently those signs and patterns that were inappropriate. His search pattern was efficient, and he made a definite start by orientating himself to the radiograph confidently. This meant that he could much more easily control his sequential steps. When he paused he had the ability to "zoom in" and focus on a pattern that indicated a lesion.

The sociological significance of the "group reporting" sessions was their facility for members to legitimate and maintain the social order. Berger and Luckmann developing Max Weber's concept of "legitimacy", have incorporated it into the sociology of knowledge. In essence they argue that: "Legitimation justifies the institutional order by giving a normative dignity to its practical imperatives" (1967:111). In the practice of radiology this is an ongoing process and depends inextricably on the use of talk. As Berger and Luckmann (1967:111) argue, "The edifice of legitimations is built upon language and uses language as its principal instrumentality" (1967:111). However, radiologists also have to learn to see, thus adding another dimension to be explored in this research. This was also related to the process of "group reporting" which had a further significance in terms of establishing how a radiological code, and all its constituents, are constituted and maintained. The topic of a code is discussed in chapters 10 and 11.

Modern radiologists use three main visual modalities, x-ray, computerised tomography (CT), and ultra sound. According to Jaffe (1984), no one modality has become dominant or is used exclusively; although x-ray is still the most frequently used. Most radiologists are able to handle all three. Although all produce pictures, x-rays have been used for the longest time and therefore most medical practitioners are familiar with these. Furthermore, there is a great deal more historical literature available to demonstrate and illustrate the manner of its social and technical development. Both ultra-sound and CT technologies are still prominently in the process of development in terms of their technology and also medical practitioner experience. All three

technologies are constantly being improved on in some way or another, exemplifying the ongoing process of social/technical closure and stability. For example, even the quality of the film is still being improved and refined by manufacturers.

There is very little literature, if any, available on how a radiologist sets about interpreting a radiograph - making the transition from mind to radiographic pattern and back. As far as most people are concerned, the interpretive process is a 'blackbox'. Figure 7.2 is an example of the usual, rather simplistic models that are used to represent the perceptual and cognitive elements of the human interpretative process. It certainly outlines and names some of the constituent elements, but it fails to convey adequately the dynamism involved in interpretation and constitution of pattern recognition.

Writers on radiology, such as Jaffe (1984), Squire (1969), Abercrombie (1974) and Yerushalmy (1969), have all recognised the complications involved in the interpretative process. They question whether social interpretative practices are an 'art' or a "science". However, in contrast Pantoja et al (1990:323) state: "unlike other branches of medicine, radiology is more a science than art. Its principles are based on immutable physical laws and are so universal that they transcend clinical medicine and the human sphere". This claim seems to be based on an understanding that most forms of knowledge appropriate for scientists are essentially represented by numbers, and the printed word or literacy. It also suggests that the authors are working with very sophisticated technology. This implies that what is represented appears clear and unequivocal, and probably is also statistically efficient in diagnosis. The use of efficient visualising techniques in radiology - to see what cannot be seen with the naked eye or with surgery, such as microcalcifications (which indicate early signs of cancer) - demonstrates how the interpretation of such scientific activity becomes isolated from other social considerations.

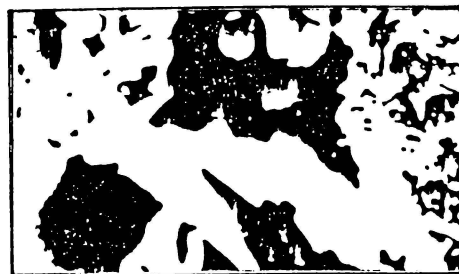


Fig 7.3 Cited by Hanson (1961:14).

Abercrombie's book on the teaching of radiology, A Process of Judgement (1974), is implicitly phenomenological; although she does not specifically use such language. Discussing one picture (Fig 7.3), she says that most people see a patchwork of black and white but no particular forms (Abercrombie 1974:27). She argues this is usually a condition of an observer in the first stage of the interpretative procedure. Later, in a second stage, a different interpretation can be made as a result of either having looked at the picture for some time or having been presented with a verbal description of the "hidden man", or alternatively, having "his face" traced out with a finger. The implication of Abercrombie's approach to the difficulties of interpretation is an emphasis on the importance of 'talk'. For example, she introduces discussion of what the word 'normal' means, thereby obliging students to think about linguistic context and the appropriateness of using the term "normal". Taking courses in radiological interpretation for several years she found that those students who were active in discussion made fewer false inferences, concluding that this was because of her emphasis on discussions which sensitized them critically towards the evidence before them.

Squire et al (1970) emphasise a similar approach to Abercrombie's, but their focus is on the logical aspect of the diagnostic process. This involves Exercises in Diagnostic Radiology, which is the title of a multi-volume series that concentrates on specific sections of the body such as the chest. These books contain photographs of various radiographs arranged in such a way that the student radiologist is obliged to work by a process of diagnostic logic; by methodically eliminating the irrelevant. See Fig.7.4 for an example of a basic exercise, and Fig. 7.5 for a more complex exercise involving a chest x-ray.

Jaffe identifies two of the most pressing problems of the 'art' of radiology to be:

"what role does the image play in the diagnosis of a particular disease? Can the signal be sufficiently simplified so that it can be recognised and diagnosed equally well by all observers?" (Jaffe 1984:4)

Addressing these two questions means taking into account the social context and organisation involved in the total process of interpretation.

The question, "Can the signal be sufficiently simplified so that it can be recognised and diagnosed equally well by all members?" points to individual differences in the "interpretive process" which I observed in the field work.

This can be regarded in two ways. First, although this inquiry is essentially sociological and concerned with shared understandings between members, it is vital that individual perceptual processes are examined. For example, one aspect of phenomenology that has particular relevance to the practice of radiology is the concept of "appresentation". This is defined by Wagner (1975:315) as, "An actual experience which refers to another experience not perceptually given. For example when perceiving an object, we immediately add to our mental image of it aspects which are not within the range of our perception, such as the colour and the shape of its back". This concept is a powerful conceptual tool for examining the need for bringing together the subjective/objective in all analyses.

Secondly, I refer to the enterprise associated with "reporting". This involves the collective experience of members of the radiological community. It includes the learning process between the neophyte and teacher, the recognition of the patient's needs, the reputations of medical people and their professional concerns, etc. Reporting epitomises a unifying element which constitutes the "radiological view", or particular '*Weltanschauung*'.

An individual's knowledge constitutes an utterly fluid process. Whether scientist or lay-person it is the personalised stock of knowledge that facilitates the assignment of meanings to things in the world, or the ability to see the world in a certain way. Consider the picture in Fig. 7.3. Sighted people can see a patchwork of black and white marks, but to understand by knowing, and to seeing what is symbolised on the radiograph, requires knowledge and experience in medicine and an understanding of the mode of graphic representation. Schutz and others have argued that if no two people experience and see the world in exactly the same way, how is it possible that an infinite number of individual perspectives can be combined into a common world view?. In a sense this was the fundamental thrust of the field work research into the practice of radiology, and is taken up in later chapters.

To summarise this chapter, I have argued that the most effective approach for examining radiologists at work is to adopt key phenomenological aspects of ethnomethodology. It would seem that radiologists at work offer an outstanding exemplar of Garfinkel's insight that when people make sense of

some phenomenon they have little option but to use a variety of "folk" methods, procedures and questions that enable them to make choices. In the case of radiology these methods and procedures are also intrinsically connected to the use of x-ray technology, and in particular the radiograph.

Garfinkel's original insight was based on his study of jurors. He realised that jurors during the course of their deliberations were vitally interested in such matters as the adequacy of their accounts, descriptions, evidence and so on. This meant that in order to get the work of deliberation done they had to be concerned with notions of evidence, truth, falsification, relevance, justice, fact, proof and many other factors that could all be labelled methodological issues. He considered that jurors were just as concerned with methodological matters as they were with guilt and innocence. There is a similarity between the deliberations of jurors who have to decide about guilt and innocence, and radiologists who are concerned about such things as whether a lesion exists or not.

What Garfinkel realised was that people constantly referred to "the adequate grounds of inference and action" held in common by the members of a society or community. The task he set himself as an ethnomethodologist was to make those procedures "visible" and investigatable. His stance was much more methodical than philosophical - "paying to the most common place activities of daily life the attention usually accorded extraordinary events" (Garfinkel 1967:1). Most importantly for this research it is the "tacit" aspect of interpreting a radiograph that is the most difficult to reveal, because it involves seeing and the iconic.

What seemed to be significant to the experience of interpreting a radiograph was a specific use of metaphor. Interpreting a radiograph involves a radiologist moving between his/her gamut, and a mark on the radiograph. Thus, the fundamental characteristic of metaphorical transference was present. It was with this in mind that the question of what is a radiograph image arose.

SPINAL OSTEOPENIA (LOSS OF DENSITY)**COMMON**

1. Anemia (esp. sickle cell anemia, thalassemia)
2. Carcinomatosis
3. Hyperparathyroidism (primary or secondary)
4. Multiple myeloma
5. Osteomalacia (see Gamut D-24)
6. Osteoporosis (esp. senile or postmenopausal) (see Gamut D-22)
7. Steroid therapy; Cushing's disease

UNCOMMON

1. Acromegaly
2. Amyloidosis
3. Fibrogenesis imperfecta ossium
4. Gaucher's disease; Niemann-Pick disease
5. Hyperthyroidism
6. Hypogonadism (eg, Fröhlich's)
7. Lymphoma, leukemia
8. Osteogenesis imperfecta

Reference:

Greenfield GB: *Radiology of Bone Diseases*. Philadelphia, JB Lippincott Co, 1969, p 11.

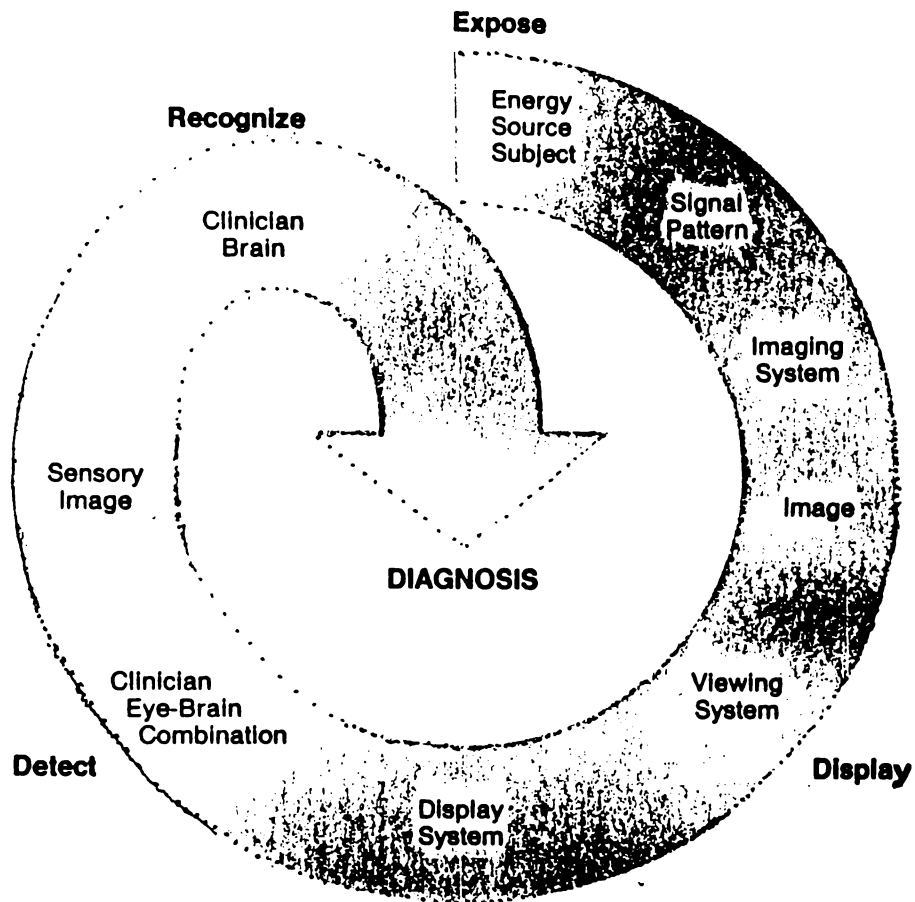
SOLITARY COLLAPSED VERTEBRA
(See also Gamut C-18)**COMMON**

1. Eosinophilic granuloma (histiocytosis X)
2. Fracture, traumatic or pathologic
3. Hemangioma
4. Hyperparathyroidism, brown tumor
5. Lymphoma
6. Metastasis
7. Myeloma, plasmacytoma
8. Osteomyelitis (eg, tuberculous, fungal, brucellar, typhoid)
9. Osteoporosis (eg, senile, postmenopausal) (see Gamut D-22)
10. Paget's disease
11. Steroid therapy; Cushing's disease

UNCOMMON

1. Amyloidosis
2. Benign tumor (eg, giant cell tumor, aneurysmal bone cyst)
3. Chordoma
4. Hydatid cyst
5. Sarcoidosis
6. Sarcoma (eg, Ewing's, osteosarcoma, chondrosarcoma)
7. Scheuermann's disease
8. Traumatic ischemic necrosis (eg, Kümmell's disease)

Fig 7.1 Cited by Reeder and Felson (1975:C-16-17).



Schematic diagram of individual steps in diagnostic imaging process. Note that several visual psychophysical steps beyond the image display are required for the final diagnostic output.

Fig 7.2 Cited Jaffe (1984:6).

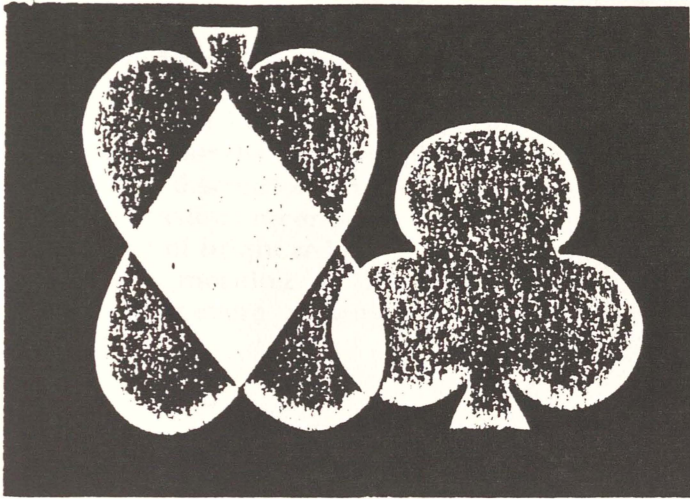


Figure 1

PROBLEMS

Figure 1. Is there a diamond in this hand?

Items to decide: Interpret the film as a summation shadowgram. What was the probable composition of the objects interposed between beam source and film? Shape? Thickness? Uniform or varied? Deduce the three-dimensional form and name/identity of the objects radiographed.



Figure 2

Figure 2. Account for the shape and form (and if possible identity) of every part of the objects radiographed. Why do the shadows of the objects have margins?

Short cut: Start by allowing intuition to suggest identity and then subject the guess you have made to logical analysis.

Tai Foon, 68, ping pong instructor, is brought to the hospital by his family who say that he has been losing weight for several months and complaining of abdominal discomfort and constipation. On two occasions recently he passed a small amount of bright red blood with his stool. On the morning of admission he developed severe generalized abdominal

pain and distention. Digital examination reveals an empty rectal ampulla. Except for a distended and tympanitic abdomen, the remainder of the physical examination is normal. Urine and stat blood studies are normal, and the patient is afebrile. You request a plain film of the abdomen (Fig. 1). What are your observations?



FIGURE 1. Tai Foon's abdomen

CHAPTER EIGHT

Chapter 8.

What is a Radiographic Image?

The question "What is a radiographic image"? is posed in the interest of clarity. The double iconic/ indexical nature of the radiograph makes it necessary to tease out actual meanings used in specific aspects of radiological practice. Addressing the issues raised by the question provides ways of comprehending the iconic dimension of radiological practice.

J.J.Gibson (1979) writes that although a science of language exists, the same cannot be said for a science of depiction. He says (1979:270) that "what artists, writers, and philosophers of art have to say about pictures has little in common with what photographers, opticians and geometers have to say about them". He argues that a "picture is a surface that always specifies something other than what it is". This is certainly the case of the radiographic image imprinted on a film.

According to Jaffe (1984:2), the medical "image" fulfils a role beyond the simple confirmation of the presence or absence of a disease. He says:

The image may represent energy that is either transmitted through, reflected by, or emitted from structures deep in the body. However, the results represents a physical construct *that correlates with, but is not identical to, the biological object*. The aphorism, "the map is not the territory assumes relevance here". (Jaffe 1984:2)

Furthermore,

It must also provide for: the precise mapping of the boundaries of known disease or the staging of tumours prior to surgical removal; monitoring the response of pathologic conditions to therapy; registering the course of degenerative diseases; and providing objective information about the range of "normal" as a basis for new definitions of disease. (loc. cit)

Jaffe's comments make it necessary to distinguish the notion of "image" from that of "artifact" when referencing a material object. In this regard, N.R. Hanson (1969:61) gives advice for avoiding confusion between two different ways of speaking when seeing is involved. He argues that those facets of observation which include the ordinary idiom of seeing, ordering and witnessing, are not usually distinguished in everyday speech from those contributions made to the act of observing by intuition, inference, imagination, memory, conjecture, habit and association. Hanson says that

although the word "observation" has many uses, a distinction must be made between two of them. For example, the word "observe" may sometimes indicate what a person is doing, or it may signify the success of what he or she is doing. Similarly, one can describe a person as "hunting for the coelacanth carefully or systematically, but not that he found the coelacanth carefully or systematically" (Hanson 1969:61).

In the same vein, Dretske (1969) notes the complexities involved in describing visual aspects of the world:

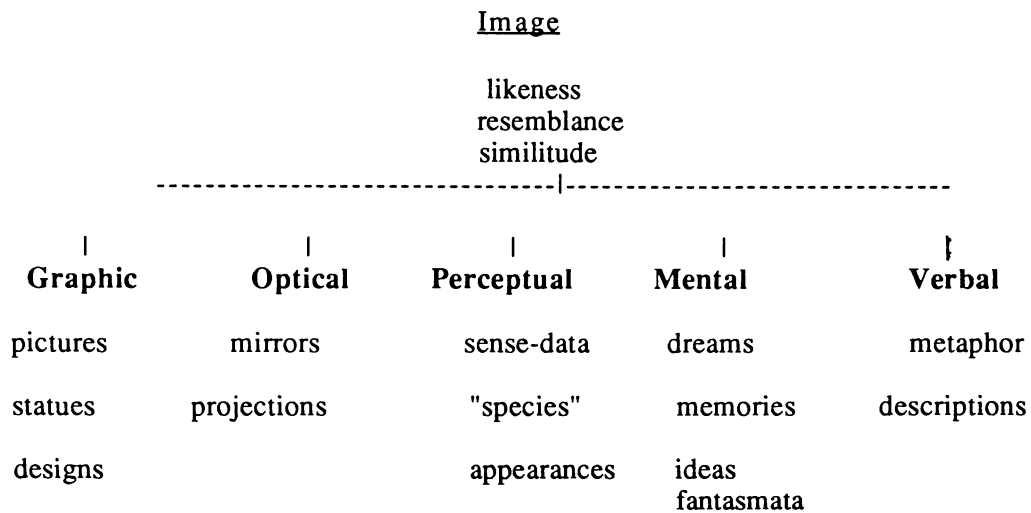
The variety of different verbs, and different constructions involving a single verb, which can be used to express what might be called a visual state of affairs is, indeed bewildering. We observe, study, perceive, watch, inspect, recognise, detect, identify, and discern the elements in our environment. We distinguish and discriminate between them; we glimpse, spot, notice, spy, and catch sight of them. Moreover, we see, or at least say we see, not only teapots and tigers, but what these things are, how they look, who they belong to, where they are located, what they are doing, that they have moved, whether they are nearby, when they arrived, and why they are late. We see under them, the difference between them, the condition they are in, if they are in trouble, what caused it and how to remedy it. (Dretske 1969:1)

In other words, in terms of the substantiation of a picture in a social order, it is imperative to distinguish between "picture" as in "artifact", and "picture as an image in the mind". An artifact cannot be substantiated in a social order but imagery evoked in the mind through social interaction is inextricably constitutive of an order.

Failure to make the distinction between artifact and mental image will inhibit any understanding of how individual consciousness is intersubjectively related. Furthermore, the problems related to intersubjectivity will be compounded if "image" and "picture" are used indiscriminately.

In this inquiry it became necessary to take care over the selection of names I used in making my analysis. The radiologists frequently mean the same thing when they talk about "image", "film", "radiograph", "radiogram". This is possible because of their familiarity with situational, customarily linguistic and cultural contexts. These contexts produce different shades of meaning that only occasionally have to be clarified with definitive precision. My field work showed that the most common term they used was "film".

Considering for a moment, the issue of "an image as an image", Mitchell(1987:9) comments that when someone attempts to formulate a general view of the phenomenon of imagery it soon becomes apparent that a wide variety of things go by this name. He says: "We speak of pictures, statues, optical illusions, maps, diagrams, dreams, hallucinations, spectacles, projections, poems, patterns, memories and even ideas as images". He makes the point that just because all these things go under one name it does not mean that they all have something in common. In one way or another each one is used in some institutionalised discourse that the following tree diagram depicts.



(Mitchell 1987:10)

It is likely that any apprehension of an image as an image will involve all five branches of this tree in their connection and relevance to the others. Such apprehension also illustrates the possibilities and options available to both radiologists and researcher in the choice of terms. Heeding Mitchell's advice for studying imagery; a starting point is required. This can be made by considering the radiograph as a model.

Max Black (1962:219) writes that scientists often speak of using models but seldom stop to consider the presuppositions and implications of their practice. He argues that a scale model can be thought of as an "icon" that literally embodies the features of interest in the original. It says, as it were; "This is how the original is". The aim behind the scale model is "to imitate" the original. Similarly, a prime purpose of the radiograph is to "reproduce in an accessible embodiment, selected features of the original".

To reiterate some points made previously, a radiograph can in some respects be compared to an optical instrument where the frame of the lens provides a focus on phenomena within it, and this tends to exclude phenomena that appear outside its boundary. The frame or surround of the radiograph provides an inbuilt matrix allowing the use of coordinates; left/right, up/down, a/x and so on. In actual radiological practice a wire is sometimes stretched across the radiograph to facilitate isolation and to pin-point something of interest.

Like the use of brackets in mathematics, the use of an optical lens permits a focus on selected aspects of the world it brackets. The frame assists the salience of visual aspects of the image by making objects more obvious to attention. The use of the frame is similar to a mathematical set where there is a relationship between the patterns within the set. This will be explained later when discussing metaphor and contiguous relationships in chapter 10. In essence:

A scale model is a representative of the real or imaginary thing for which it stands: its use is for "reading off" properties of the original from the directly presented properties of the model. (Black 1962:220)

Like most representations, interpreting or "reading" the model is governed by institutionalised conventions. Although radiologists talk about "reading the film" it is not like reading a book which, in Western cultures, is read from left to right in a discursive manner.

Discussing the picture, Langer (1963:79-80) develops Wittgenstein's idea of "projection". She suggests that when a child looks at a Mercator map of the world he or she cannot help believing that Greenland is larger than Australia. The child simply sees it as being larger. In this instance the "projection" employed is not simply that of *copying*. "It takes sophistication to "see" the relative size of Greenland and Australia on a Mercator map. Yet a mind educated to appreciate the projected image brings the eye's habit with it. After a while we genuinely "see" the thing as we apprehend it". Langer (1963: 68) argues that a picture "is essentially a symbol, not a duplicate of what it represents". She supports this claim by arguing that pictures of a rabbit or a cat (see Fig 8.1 on the next page).

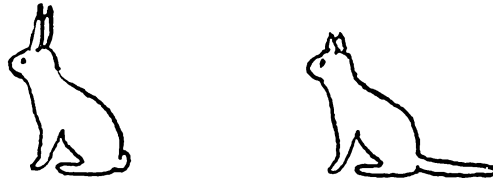


Fig 8.1 Rabbit and Cat

have certain salient features which in effect symbolise either animal. These features also enable an observer to distinguish between them. She (1963:69) argues that no one could really mistake these pictograms for a real cat, all that is shared with real animals is a *certain proportion of parts* -- the position and relative length of "ears", the dot where an "eye" . . etc belongs". She says that "all these traits of the pictured cat are irrelevant because the pictograms are symbols not pseudo animals."

The only characteristic that a picture must have in order to be a picture of a certain thing is an arrangement of elements *analogous* to the arrangement of salient visual elements in the object. A representation of a rabbit must have long ears; a man must feature arms and legs. (Langer 1963:71, my italics)

Regular patterns, like long ears, become known as reliable signs that something is the case, e.g. the "pugilist fracture" of the right hand in the practice of radiology. Emphasising the significance of caricature, research carried out by Gagne and J.J. Gibson (1947) on the ability of aviation trainees to recognise different types of aircraft shapes, suggested that in terms of pattern recognition "memory images" are based on distinctive features of a pattern rather than on some generalised concept of a plane.

This raises the question of analogy. The second type of model that Black proposes is the "analogue model":

An analogue model is some material object, system, or process designed to reproduce as faithfully as possible, in some new medium the "structure" or web of relationships in an original. (Black 1962:222)

Black argues that there is available an endless variety of media that can facilitate the embodiment of some kind of structural relationship. For example, in the practice of radiology there are three forms of visual modalities capable of conveying bodily structural features: x-ray, C.T. scan and ultrasound. Each one in its own way "symbolises" some anatomical part of the body, and it is not necessary to imitate the parts. Like a diagram (in Langer's words)

"The parts are merely indicated by conventional symbols, such as dots, circles, crosses, or what not. The only thing that is "pictured" is the relation of the parts to each other. *A diagram is a "picture" only of a form*". (Langer 1963:70. Her italics)

According to Black (1962:22), both "scale" and "analogue" models are "symbolic representations of some real or imaginary original", requiring "*appropriate rules of interpretation* for making accurate inferences from the relevant features of the original" (my italics). How does one interpret a photograph? A photograph has no visual syntax, but as Langer (1963:71) argues, "Consider a photograph, a painting, and a builders diagram, all showing the front view of one and the same house. With a little attention, you will recognise the house in each representation. Why? It is because each of the "images" express the same relation of parts which correlate with each person's conception of a house." For example, most houses have a pitched, angled or sloping roof to allow water or snow to drain off and are therefore shaped accordingly. The roof has to be held up by something, either by walls or poles for example. The wall's relationship to the roof is known by people from cultures where the vertical wall and sloping roof are common. In other words, seen together, wall and roof constitute a fundamental pattern which represents and embodies a concept. See Fig. 8.2 below.

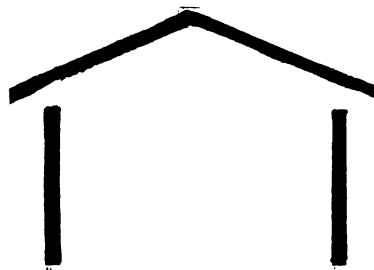


Fig 8.2

This remains so even though nearly everyone will have a different idea of what a house looks like. Langer (1963) argues that this means:

That which all adequate conceptions of an object must have in common, is the concept of the object. The same concept is embodied in a multitude of conceptions. . . . Probably no two people see anything just alike. Their sense organs differ, their attention and imagery and feelings differ so that they cannot be supposed to have identical impressions. But if their respective conceptions of a thing (or event or person, etc) embody the same *concept*, they will understand each other. (Langer 1963:71)

Significantly then, a diagram of a house symbolises a real house, and , "A concept is all that a symbol really conveys". Any arbitrary mark on a radiograph has the ability to connote a conception; a grey shadow of a certain shape becomes the symbol of tuberculosis. This is possible because, in Langer's words (1963:73), "the power of seeing configurations as symbols comes into play: [when] we make patterns of denotative symbols, and they promptly symbolize the very different, but *analogous*, configurations of denoted things".

Analogue models can be hydraulic models of economic systems, the use of physical qualities such as weight and length to represent numbers. Analogue instruments can be maps, rulers, thermometers, volume controls or sextants. And although analogies are pictorial, metaphorical, or model methods of thinking, they provide indications of what to look for. The important thing about the analogue in the practice of science is its use combined with an emphasis on experimentation and/or observation, in actually determining what is thought or believed to be the case.

The prime purpose of the scale model is the replication of the original, which implies that there is *less* need for interpretative deviations. In contrast, the use of the analogue model (to use Black's phrase), is influenced by the more "abstract aim of reproducing the "web of relationship in an original", such as the use of electrical circuits in computers, or specific anatomical relationships as seen through x-ray. The fundamental feature of Black's analogue model is that "the rules of interpretation determine the translation from one system of relationships to another". This process is known in mathematics as "isomorphism". As Paul Ricoeur (1986:241) puts it, "the model and the original resemble each other in their structures and not through sensible features". In Black's words:

An adequate analogue model will manifest a point-by-point correspondence between the relations "it" embodies and those embodied in the original. (Black 1962:222)

The aim of producing a radiograph is to create as accurately as possible a point to point relationship between actualities in a body, and those symbolised in the radiographic image, which differs from the ordinary picture. For example, a photograph of some scene taken without a specific purpose in mind (perhaps just to record the ambience), contains many visual items consisting of shapes, colours, lines or all manner of objects that may symbolise a multitude of

different things. In contrast, the radiograph is produced for a specific purpose. According to Tabar and Dean, who are specialists in the practice of mammography, it is absolutely essential that image quality is of the highest order - "Otherwise many lesions, in particular cancer in its early stages, will simply not be detectable on the films, regardless of the skill of the mammographer"(1985:146). They say that effective screen mammography involves a chain of events and that the end product, that is a quality image, will be no better than the weakest link in the chain. The links are:

- (1) A dedicated mammography unit.
- (2) The mammographic screen/film combination.
- (3) The dedicated single-emulsion film processor.
- (4) The specially trained x-ray technologist.
- (5) The radiologist with a special interest and training in mammography.

It is unnecessary to delve more deeply into the technologies and methods of mammography at this stage in my inquiry. Suffice to say that these procedures are a series of ongoing events requiring effective monitoring, processing and quality checks and balances at each stage to ensure that the radiograph (mammograph) *is* of the highest quality, i.e., is technically adequate.

Hanson (1961:28), expressing a concern about the differences between language and pictures, says that " Images, reflexions and maps, in fact copy originals with different degrees of strictness". He says there is a difference between maps and pictures, and the more like a reflection a map becomes the less useful it is as a map. The difference between maps and photographs is that the former is less like the original. The language of maps is that one either says: "This is Cambridge", or "this stands for Cambridge". And like the radiograph, "Maps with their partially conventional characters must be read (as pictures and photographs need not be); yet they must copy". (Hanson 1961:29).

In the practice of mammography, treating the "film" as a map is an explicit act. Tabar and Dean's (1985a) book on the subject is entitled The Teaching Atlas of Mammography. They say the purpose of the atlas is to teach radiologists to analyze mammograms and arrive at correct diagnosis through proper evaluation of the findings. With 419 partly coloured figures this book is unquestionably a picture book. There is an almost surprising lack of printed instruction. Most of the text is accompanied by a picture, which is in effect a "map". See Fig 8.3.

Like Abercrombie (1974), who argues that interpreting radiographic image is a two stage process, Tabar and Dean (1985a) argue there are two basic steps in the interpretation of mammograms: perception and analysis. In effect "perception" means being able to *see* something. It is necessary to look at the mammogram in a systematic way according to a sequence that has been found to be the most effective in practice.

Perception is influenced by several factors. One of the most important is the parenchymal pattern of the breast tissue, detection of pathological lesions being easier with fatty involution. The mammographer should use a method for the systematic viewing of the mammograms in order to ensure that all parts of each mammogram are carefully searched for the presence of lesions to help discover tumors which are partially obscured by overlying breast parenchyma. (Tabar and Dean 1985:147)

Searching the mammogram is a similar procedure as looking for a place on a map, (see Fig. 8.4). However, unlike the map, the place is not named. It may be shaped like the boot of Italy; but regarding a pattern as a symbol of some disease is fraught with difficulties. Variations in people's anatomy, shape, and size are only some of the complications involved in treating a pattern as a sign. In the practice of mammography, even though the map technique is used effectively, a lesion shown on the radiograph may not be in that precise location. Fatty tissue tends to distort the path of x-rays, and this can misrepresent the actual location of a lesion. Similarly, sometimes a round lesion may appear elliptical. Lucy Squire (1969) advises that when something is x-rayed the differences in x-ray density of different parts of the body means that there may be wide variations not only from person to person but even between x-rays of the same person at different times. She says,

The principle of tangentially viewed interfaces between masses or tissues of differing roentgen density may be illustrated very simply with a radiogram of any familiar object x-rayed in the air. A ball loses part of its circumferential interface when it is x-rayed in a socket exactly fitting it and of an identical material. The most direct anatomical parallel here is probably the disappearance of the heart shadow (a normally seen muscle-air interface) when the anterior lobe of either lung becomes consolidated. (Squires 1969:488; see Fig 8.5)

Squire (1969:488) indicates that it seems to her a retrograde step to present pattern information as a "sign" of any kind by any name. "Signs" in medicine, especially eponymic signs are memorised by rote more often than not, and this is both more tedious and less dependable than a habit of mind that employs a logic as its means of remembering. Nevertheless, despite this, warning patterns are construed as signs, particularly in mammography, where better and advanced visual technology has enabled the radiologist to see in much greater detail miniscule patterns that hint at the early beginnings of a cancer lesion. By zooming in (i.e framing, as discussed in chapter 4) on the dot or mark on the mammographic map, distinguishable patterns can be seen in the same way that patterns can be seen when looking through a microscope. In fact the same process takes place with each "look", taken in sequence, at the specific parts of the mammograph. Identification of a mark can only take place if it can be recognised as having a specific pattern. Tabar and Dean (1985) state:

The pathological lesions occurring in the breast can be grouped into four major categories according to their mammographic appearance: *circumscribed tumours*, *star-shaped lesions*, *calcifications* and pathological processes giving rise to the *thickened skin syndrome*. For each group there is a certain number of x-ray signs. When the type of lesion is recognised, the mammographer should actively search for those signs. (Tabar and Dean 1985:149, original italics) (See Fig 8.6 and 8.7)

In effect, through the use of perception, the mammographic image is gradually transformed in the observer's mind - beginning from the iconic sign of the female breast, then in a process of reduction, focussed to one or other of the above known signs, which, in turn symbolises some particular pathological state. In other words, as the intention of the observer changes so will the definition of what is being seen. Such reliance on the intention of the observer raises issues over the training of radiologists. These were introduced in chapter 7 and I will re-introduce them here.

Langer argues that philosophers and scientists of her day neglected any phenomena that could not be construed as language, because nothing that could not be projected into a discursive form could be accessible to the human mind. This attitude has resulted in a state of affairs where "The knowable is a clearly defined field, governed by the requirement of discursive projectability" (Langer 1963:86). Any other phenomena, from feelings to immediate experience, or what Wittgenstein called the "unspeakable", that cannot be converted into this form are equated to the mystical. Involvement in "intuition", "deeper meaning", "artistic truth", "insight", is a dangerous occupation for the rationally inclined. While Langer stresses the power of discursive symbolism, she argues for "an unexplored possibility of a genuine semantic beyond the limits of discursive language". At the time of her writing, in the early nineteen forties, she says that two fundamental tenets of current philosophical and scientific attitude have blocked efforts by a number of thinkers to develop new directions. These assumptions go hand in hand (1) That *language is the only means of articulating thought*, and (2) That *everything which is not speakable thought, is feeling* (Langer 1963:87).

As I discussed in chapter 7 since Langer's time ethnomethodologists now focus on the "tacit" and the "invisible" as significant aspects of social inquiry. For example, the radiograph has features of both the scale and the analogue model in the sense of being an artifact. This implies that the nature of the talk will differ as the function differs. Radiologists discuss certain features of radiographic images, either with reference to scale or analogue features, or with reference to an image produced for a specific purpose. Not only does the neophyte need to learn different types of speech, he or she has to learn to see. Knowledge of language alone is not enough to perceive a pattern, there needs to be a synthesis between what is seen and the appropriate medical term. This implies a "tacitness" usually expressed as feelings or intuitions, which constitute know-how.

Know-how is particularly exemplified in the third type or level of Black's models, which he calls the "theoretical model". The third also utilises identity of structure but differs from the other two, scale and analogue, which, as Black (1962:229) says, "must actually be put together". Or, as Ricoeur(1986:241) says, noting that the theoretical model is a mental construct, they cannot be pointed at, "nor are they to be constructed".

Black's prime example of a "theoretical model" is Maxwell's well known "representation of an electrical field in terms of the properties of an imaginary incompressible fluid"(1962:226). In Maxwell's case the *imaginary* mechanism is simply a mnemonic construct to aid in the understanding of mathematical relationships. Similarly, the experienced radiologist on occasions uses imaginary devices as mnemonic constructs to aid interpretation. A practice involving a specific use of metaphor which will be discussed in chapter 10 and 11.

Much of Black's (1962:228) discussion on models expresses concern about their inherent dangers, i.e. forgetfulness that they are only models and the ideas inferred from them may not be possible in actuality. He stresses that there is a vast difference between treating some abstract concept like "ether" as a "heuristic convenience", and regarding it, as Lord Kelvin does, as "real matter having definite -- though to be sure, paradoxical properties independent of our imagination". Black argues that "The difference is between thinking of the electrical field as if it were filled with a material medium, and thinking of it as being such a medium. One approach uses a detached comparison reminiscent of simile and argument from analogy; the other requires an identification *typical of metaphor*" (Black 1962:228, my italics).

The significance of Black's discussion on models is his recognition of their inherent dangers, and an awareness of the real and necessary value of model building for scientific endeavour. However, he is adamant that the value, or property, of the model is what is imputed to it by language convention. He writes that a "merely hypothetical" architect's model is nothing at all, and imaginary analogue models will never show us how things work in the large. But theoretical models (whether treated as real or fictitious) are not literally constructed: the heart of the method consists in *talking* in a certain way. (Black 1962:229). He argues that the "theoretical model need not be built, it is enough that it be described". Thereby he emphasises the importance of language in continuing the sense of the model that goes with both the scale and the analogue types of thinking.

Black argues that to make good use of a model "we usually need intuitive grasp ("Gestalt Knowledge") of its capacities, but so long as we can freely draw inferences from the model, its picturability is of no importance". However, a picture is an analog, and the intuitive grasp Black refers to cannot be dismissed in a rush in order to talk about what is being seen. In a sense, Black

almost implies that Gestalt knowledge is perhaps inferior to linguistic knowledge. Similarly, Hanson (1961:28) argues that "vision is essentially pictorial, knowledge fundamentally linguistic". This is a biased opinion which elevates linguistic understanding above other forms of "knowing", but he does concede that both "vision and knowledge are indispensable elements in seeing".

In contrast to Black and Hanson's stance, Langer (1963), argues that:

Language, our most faithful and indispensable picture of human experience, . . . contains a law of projection of which sometimes philosophers are sometimes unaware, so that their reading of the presented "facts" is obvious and *yet wrong* as a child's visual experience is obvious yet deceptive when his judgement is ensnared by the trick of the flattened map". (Langer 1963:80, my italics).

In Langer's words, "Language is by no means our only articulate product. Our merest sense-experience is a process of *formulation* " (1963:89). Stressing the acknowledgement of immediate experience, and a recognition of a phenomenological perspective, Langer argues no experience occurs more than once. This means that so called repeated experience can only be an *analogous* experience. It also means that not only is every visual experience a new one but it must be infinitely variable across a wide spectrum of human visual perception, except of course where the experience has been closed off by language. It is words, in the process of *formulation* which assist in the habit of hypostatizing impressions of what is seen.

The radiograph is one visual form that is capable of articulation as words.. Langer (1963:93) suggests that although "Visual forms-- lines, colors, proportions, etc. - are just as capable of *articulation*, i.e. of complex combination, as words. . . . the laws that govern this sort of articulation are altogether different to the laws of syntax that govern language. The most radical difference is that *visual forms are not discursive*. They do not represent their constituents successively, but simultaneously, so the relations determining a visual structure are grasped in one act of vision".

In effect, Langer (1963:93) argues that grasping the nature of a picture (or an icon) is an apperceptive act, and in many ways is too subtle for speech, but it is a form of symbolism, albeit of a non-discursive sort. It has a function in human perception of "conceptualising the flux of sensations, and giving us concrete things in place of kaleidoscopic colors or noises".

The radiograph is made deliberately for the constituent parts to be "read off" in order to eliminate the irrelevant. A pattern that is well known will be seen immediately rather than gradually. Unlike the photograph, which is merely taken, radiographic symbolism has to be recognised as separate units which are displayed like a map. Just as the crescent shape of the eclipsed moon indicates part of the full moon, various parts of the anatomy eclipse others but the shape that is seen or partially exposed is not necessarily the same every time and on every radiograph. Each shadow of an anatomical part has to be correlated with another in order to recognise it and spatially locate it. In a radiograph, even if the constituent elements are a thousand times more numerous than the element that language represents, they may well have to be accounted for in the same way that the space between two points in a map represents some territory. In the practice of radiology it matters a great deal how the radiologist orientates him/herself to the radiograph. Langer argues that there are no words of portraiture when looking at a photograph of someone, or for that matter when looking at a painting or a drawing; and, although there are obviously picturing techniques, she says that "the law governing this technique cannot properly be called a "syntax," since there are no items that might be called, metaphorically, the "words" of portraiture." For example, arguing that the example par excellence of the non-discursive symbol is the "picture", she writes:

Like language, it is composed of elements that represent various respective constituents in the object; but these elements are not units with independent meanings. The areas of light that constitute a portrait, a photograph for instance, have no significance in themselves. In isolation we would consider them simply blotches. Yet they are faithful representations of visual elements composing the visual object. However, they do not represent, item for item, those elements which have *names* ; there is not one blotch for the nose, one for the mouth, etc.; their shapes, in quite indescribable combinations, convey a total picture in which nameable features may be pointed out. The gradations of light and shade cannot be enumerated. They cannot be correlated one by one, with parts or characteristics by means of which we might *describe* the person who posed for the portrait. The "elements" that the camera represents are not the "elements" that language represents. They are a thousand times more numerous. For this reason the correspondence between a word-picture and a visible object can

never be as close as that between the object and its photograph. Given all at once to the intelligent eye, an incredible wealth and detail of information is conveyed by the portrait, where we do not have to stop to convey verbal meanings. That is why we use a photograph rather than a description on a passport or in the Rogues' Gallery. (Langer 1963:94-95)

Langer stresses that there can be no dictionary of meaning for lines, shadings or other pictorial techniques. It is possible to pick out a line or curve in a picture which may serve to represent some nameable item, but in another place it could have an entirely different meaning. This is an idea of Langer's that has been developed by Goodman (1985) who demonstrates that the status of a simple zig-zag line depends entirely on how it is construed, that is, its meaning is dependent on context. see the Fig. 8.8 below.

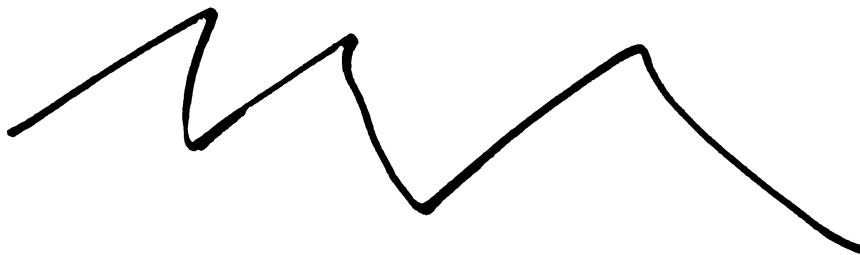


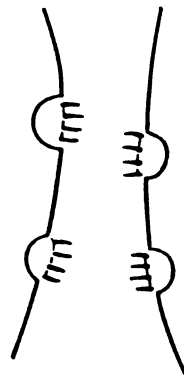
Fig 8.8 Zig-zag

Discussing Goodman's theory, Gardner (1982:55-56) states, about the above figure, " If the squiggle stands for something -- say a month-long record of the Dow Jones stock average --- then it is functioning as a symbol. If it is part of a painting -- say, the outline of a mountain range in a drawing by Hokusai - -- then it is functioning as an artistic symbol. The way in which one "reads" the squiggle depends upon the setting in which it is encountered, the graphic context which surrounds it, and the particular "mind set" of the viewer".

Furthermore, Langer (1963:95) argues that random lines and curves have no "complex of other elements that are equivalent to them at all times," as "2+2" is equivalent to "4". Non-discursive symbols cannot be defined in terms of others, as discursive symbols can". Again in the practice of radiology, this argument doesn't quite hold because of the nature of contiguity, a factor which involves metaphor. On a map, the shape of Italy resembles a boot and that shape can symbolise Italy or it can symbolise a boot. It is so well known that it doesn't need to be converted to words for metaphorical transference to occur. A star shaped lesion is an arbitrary mark which may never look exactly the same each time one is seen, in the same way that a printed letter

does, but the sharpness of its lines and points caricature its embodied meaning in the same way that long ears caricature a rabbit. In a radiograph designed and produced for a specific purpose, such symbols are not arbitrary but taken to mind sequentially.

A radiologist "reads off" the radiograph pattern, and any pattern that is seen as a sign indicates not just the possibilities of a lesion, but through the use of inference in language extends or completes what is seen. In the same way a picture of a thermometer signifies heat. Hanson (1961:24) makes this point while discussing whether "seeing" and "thinking" can be regarded as separate activities or as an amalgam of the two. He says there is more to seeing Fig. 8.9 below as a bear than optics, photochemistry or phenomenalism can explain.



This may look like meaningless marks. But given the notion that it is a bear behind a tree, it looks very different. (From Norwood Russell Hanson, *Patterns of Discovery*, Cambridge University Press, 1958.)

Fig 8.9 Hanson (1961:12).

Emphasising the significance of language Hanson says that logical features of "see that" and "seeing that" are always followed by *sentential* clauses. He explains:

One can see an ice-cube, or see a kite as a bird. One cannot see that an ice-cube, nor see that a bird. Nor is this due to limitations of vision. Rather, one may see that *ice-cubes can melt*; that *birds have "'hollow' bones*. Tycho and Simplicius see that the *universe is geocentric*; Kepler and Galileo see that *it is heliocentric*; The physicist sees that *anode-fluorescence will appear in an x-ray tube at high voltages*. The phrases in italics are completely sentential units. (Hanson 1961:25)

Radiologists are obliged to make an interpretation of some aspect of a radiograph which may or may not be available to the neophyte. In essence this involves a relativist approach in which the arbitrary nature of a sign comes into question, i.e. the essential, conventional nature of the association between a "word" and an "object". This entails a connection between a word

selected from the radiologist's medical repertoire (i.e. the gamut) and a mark on the radiograph.

The ability of the individual radiologist to transcribe from the model those features which are identical to those that may be found in a living body can be correlated with experience and ability. Initially the neophyte or the inexperienced radiologist needs to recognise a lesion in an iconic fashion. That is to say, there has to be some correspondence between the clinical appearance and the radiographic appearance. A broken bone on the radiograph should look like a broken bone in actuality, exemplifying the isomorphic relationship between them. Specifically, however, the radiographic appearance is analogous to the actual appearance.

The prime objective of this chapter has been to use Max Black's propositions on models to explain the nature of the radiographic image. However, rather ironically, Black (1962:32) downgrades the advantages of using the model as a picture. He argues that the wrong thing is emphasised when a picture replaces abstractions and mathematical formulas. He states categorically that the theoretical model depends on a particular way of talking because it cannot be seen or pointed at, but, both the scale and the analogue models also involve ways of talking. *Each way of talking depends upon their specific use or purpose.* These distinctive uses are necessary for the precision required in scientific practice. For example, if surgery is involved the radiograph can be used by the surgeon for determining as accurately as possible the position, extent and nature of the incision. This allows him or her to prepare in advance of the actual operation. This usage relates to the scale model, but it also exemplifies the analogue model. In the practice of mammography the exact location of lesions is difficult to determine because the x-ray process can be distorted by fatty tissue. This places the lesion, as seen on the radiograph, in a different position to where it is actually located in the breast. In this case the radiographic image is used symbolically or indexically and, where there is doubt, theorising occurs.

The answer to the question, "What is a radiographic image?", seems to me best explained with reference to Goodman's (1988:134) notion of a "fair sample" (see Fig. 8.10 on the next page).

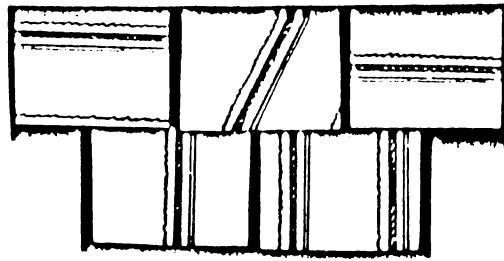


Fig 8.10 Fair Sample. Goodman (1988:134).

He offers a revealing analogy that serves to illustrate a way in which radiologists might agree on what is an acceptable pattern produced to signify some pathological condition. He explains:

A swatch cut from a bolt and used as a sample is not always a fair sample. It may be too small to show the pattern at all or else so cut as to show a component motif only partially or in a misleading orientation. The five sample sketched in Fig. 8.10 may all have come from the same bolt. Each contains the same amount of material as the rest, and of course none contains the whole pattern, which may consist of many long bands. Yet among the five, the one at the lower right may be the only fair sample. (Goodman 1988:134; figure numeral amended as appropriate)

The "fair sample" caricatures a particular condition. It is a pattern that is recognised by competent members of the radiological community as indicating a particular condition. Exemplifying the group processes involved in pattern recognition, a particular pattern will evoke some response in the minds of radiologists. It is never precise in the sense that it is exactly repeated on every occasion. It is the same phenomenon that a hunter experiences in a natural environment recognising the flight of a particular bird. The flying bird, radiographic pattern, are as Novitz (1977) argues, *illocutionary* acts which may evoke either a "meal" or a particular medical condition in the mind of the see-er.

An illocutionary act consists of both a proposition and an act of utterance. For example, Wardhaugh (1987:277) explains that it is quite possible to ask for a door to be closed by stating: "It's cold in here", "The door's open", or "Could someone see to the door" -- instead of, "close the door". An illocutionary act is unlike an utterance such as "damn" or some "mark" that has no meaning.

Novitz proposes that cartoonists and propagandists utilise the picture as an *illocutionary act*. Furthermore, if an illocutionary utterance compels a listener or see-er to do something, it has a specific effect upon feelings, thoughts or behaviour. This is termed a *perlocutionary ac.* The experience, background knowledge, and consensus achieved through negotiation in these situations constitute what Novitz calls the *perlocutionary dimension of pictorial representation*.

Novitz (1977:139) maintains that an understanding of the conditions necessary for a picture to evoke some emotion or response requires the expressive dimension to be distinguished from the perlocutionary effects. To achieve such a separation was another objective behind my discussion on Black's propositions and classifications on models. For example, use of each different image for various purposes signifies a peculiar form of speech. However, each must be apprehended as a whole, because, as Langer (1963:97n) states, unlike discursive language *the discriminatory parts are unreliable*.

In my opinion, treating the radiograph as a model offers an effective way of teasing out the tacitness that lies behind the interpretation of a radiograph. Separating particular uses embodied in readings assisted me in understanding the complexity involved when a radiologist integrates his or her background knowledge with what he or she is looking at. Discussing what he calls "visual metaphor", Novitz (1977) writes:

Most cartoonists and propagandists rely extensively on the fact that exposure to pictorial illocutionary acts -- where these involve the use of pictures which incorporate unusual combinations of schematic images -- often result in changes of beliefs, opinions and attitudes, and this, . . . is part and parcel of what I have called the perlocutionary dimension of pictorial representation. *Pictorial representation of this sort, one might say, provide us with models in terms of which to reassess our experience of the world: to carve the world anew, and so to reclassify the objects of our environment.* (Novitz 1977:135; my italics)

The practice of radiological knowledge is based to a large degree on iconic understanding. According to Bruner (1966:11), *iconic* representation refers to "principles of perceptual organisation and by economical transformations in perceptual organisation - techniques for filling in, completing, extrapolating". As mentioned previously skiagraphy or sciagraphy was the original name for radiography. It was a reference to the art of shading in drawing, or in the case of radiology it implied filling in what was missing from the radiograph - a technique that has been developed over the past

hundred years to a practice involving both individual and collective competence. However, Gross points out, like Polanyi's argument, "basic motor skills and perceptual-cognitive skills become increasingly less explicit and conscious as they become better known through practice". In a sense this is exemplified in Polanyi's (1966:4) claim that "we know more than we can tell". Gross agrees that this is the case, but, he says, "We know much that we *cannot* tell in other symbolic forms which express and communicate that knowledge"(1974:65; my italics). He stresses the importance of this when he says that the "tacit nature of skill is the crucial nontranslatability of knowledge of one symbolic mode into some assumed verbal *lingua franca* of individual consciousness and social communication".

This is of vital importance for the understanding of skill, and competence in a particular symbolic mode. For example, Bruner (1964) describes *enactive* representation as "based upon a learning of responses and forms of habituation". Driving a car is a good example of this, where the experienced driver doesn't have to think about the controls or changing gears. The change that drivers experience when driving on the opposite side of the road in another country exemplifies the habitual nature of driving and of course of *seeing*.

Gross (1974) argues that iconic symbols are an ideal way of organising and communicating meaningful information about spatial organisation, the topological nature of objects, and for expressing and evoking emotional response. This implies that not only does the perspective of the "see-er" need be included for effective radiological understanding, but that an investigation of the "tacitness" behind the act of seeing may reveal aspects of the invisible.

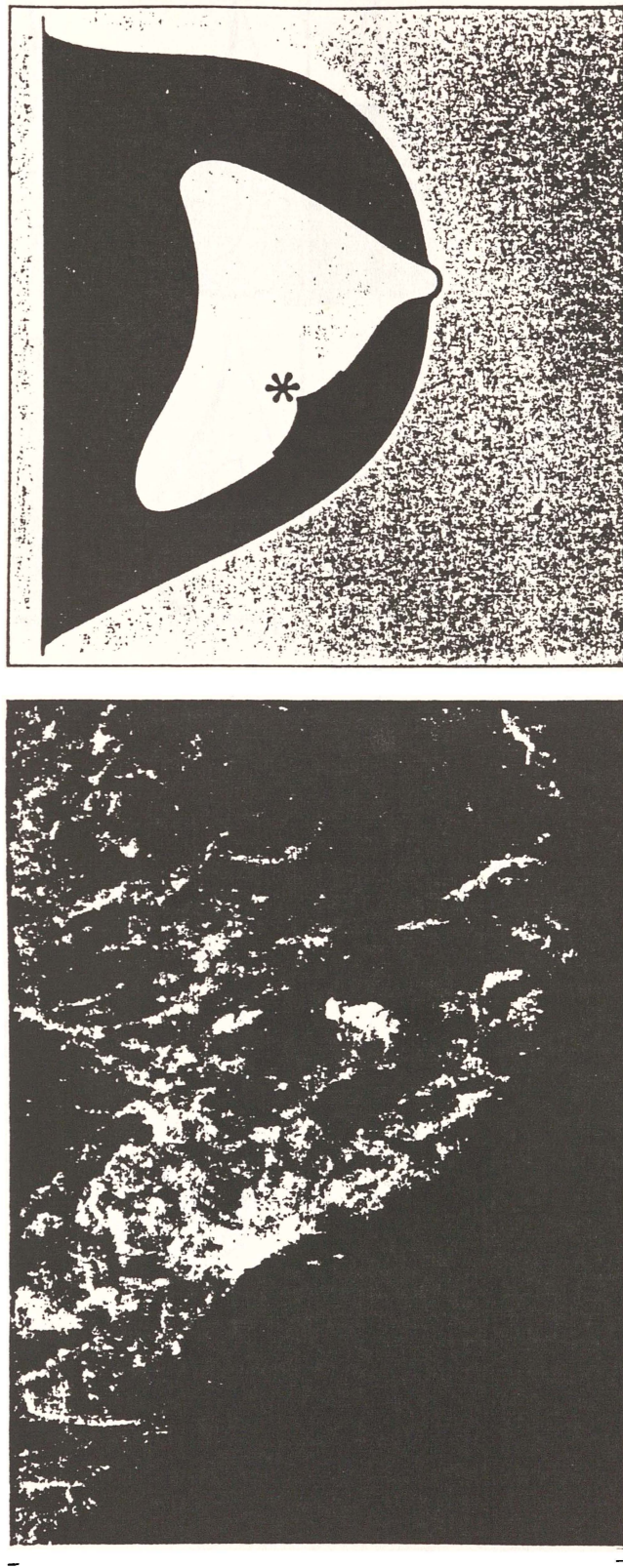


Fig 8.3 Atlas of Mammography. (Tabar 1985a).

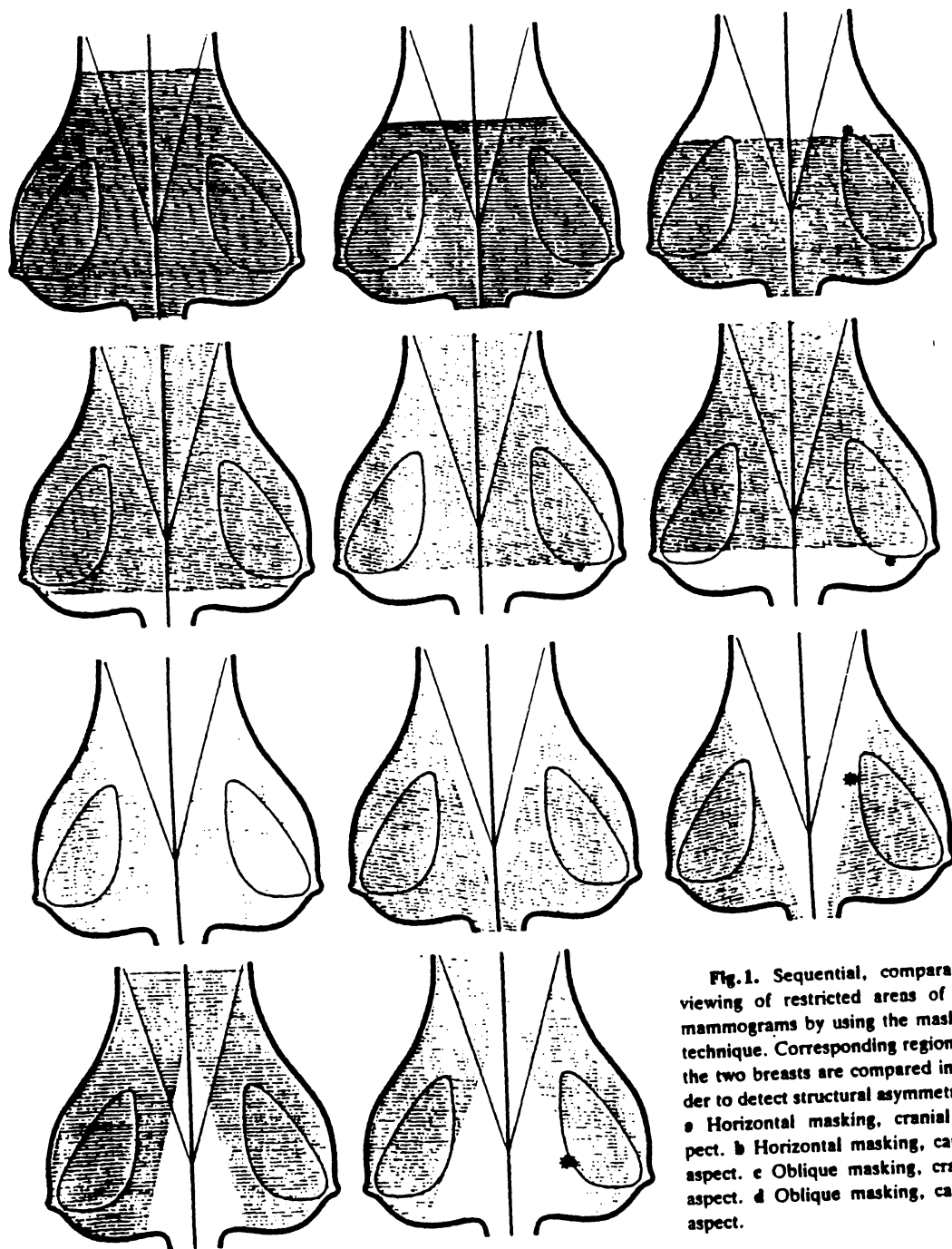


Fig 8.4

Tabar and Dean (1985:149).

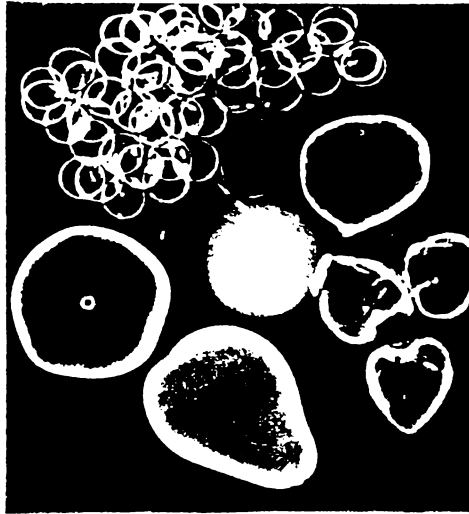
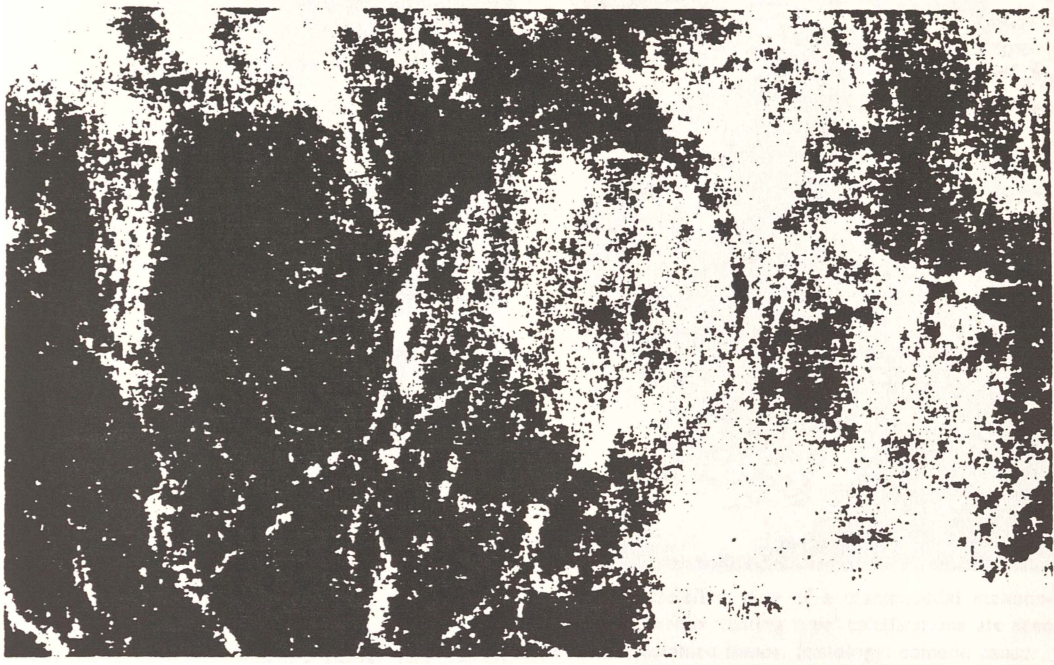


Fig 8.5 Squire. (1970:2-3) commenting on this picture says, "The margin of any radiographic shadow is produced by a sudden change in the number of rays traversing matter or, in other words, by the existence of a tangentially* seen interface of some sort between the masses of different roentgen density, here metal and air, or wood and air. Think in terms of summation shadows and of interfaces across which x-rays slide tangentially and you will be able to "account" for any shadow.

* peripheral.



. Circumscribed tumor with an extensive halo sign, which is a narrow radiolucent ring surrounding all or a part of a lesion, characterizing it as benign. The density of this tumor is equal to that of the parenchyma (low-density radiopaque), strengthening the mammographic diagnosis.



Fig. 7. Detail of the craniocaudal projection. There is a star-shaped lesion with central rounded radiolucencies and a benign type calcification. Long bunches of connective tissue strands alternating with linear translucencies give the radiating structure. Note the difference in the mammographic appearance of this benign stellate lesion compared with that in figure 6. Mammographically typical, histologically confirmed radial scar (sclerosing duct hyperplasia), no signs of malignancy.



Fig. 9. Detailed view of a craniocaudal mammogram. Numerous 'casting type' calcifications are seen with no associated tumor. Histology: comedo cancer.

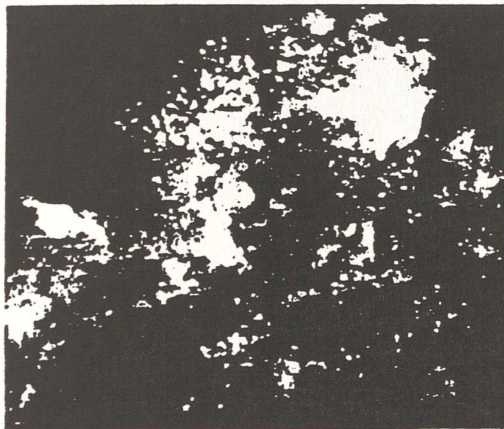


Fig. 8. Specimen radiograph. A large number of 'granular type' calcifications is seen, indicating a malignant lesion. Histology: ductal cancer.

CHAPTER NINE

Chapter 9.Radiologist: The See-er.

*The form of things unknown, the poet's pen
 Turns them to shapes, and gives to airy nothing
 A local habitation, and a name.
 Such tricks hath strong imagination,
 That if it would but apprehend some joy,
 It comprehends some bringer of that joy.
 Or in the night, imagining some fear,
 How easy is a bush supposed a bear!*

A Midsummer Night's Dream V.I

Looking at aspects of the world through a frame is fundamental to the practice of radiology. J. J. Gibson (1979: 149) would argue that the radiological experience is different from that of "direct perception" where one actually sees some phenomenon, like the Niagara falls, rather than seeing a picture of it. Radiographs are icons, representations translating spatial relationships into two dimensions; representing colour differences in black and white; abstracting live or moving bodies in static forms. Their advantage to the medical practitioner is that they represent discrete visual information that is unobtainable in any other way apart from surgery.

Fundamental to the practice of radiology is the ability of each specialist to provide the third dimension of depth. Seeing a radiographic pattern is a mediated kind of perception which, as Squire (1969:492) notes, requires the radiologist to imagine the dimension of depth. Kockelmans (1970:291), borrowing from Merleau-Ponty argues that more than *space*, it is *depth* which particularly compels us to relinquish our bias about the world in order to lay bare the primordial experience from which that world springs. One could call depth the most "existential" dimension because it belongs most clearly to *our* perspective and not to things.

Although there is controversy over J.J. Gibson's theories of depth perception, in part it is the approach to problems of understanding perception that does allow for the experience of the see-er to be taken into account. For example, his stress on the importance of perception when flying and landing a plane suggested to me that it is similar to the problem facing practising radiologists who have to learn to see and orientate themselves in a world that differs from what is normally available to the lay-

person. Gibson (1979) writes that during the Second World War, when millions of Americans were learning to fly, he realised how inadequate the official visual education was. Stressing the importance of experience, he argued that you couldn't tell a pilot how to fly a plane any more than you could allow him or her to learn by trial and error. One could be shown or flying could be simulated; but simulation was then an option that was too costly. Pilots were given tests for depth perception, but there was controversy as to whether depth perception was learned or innate. Psychologists were attempting to apply known theories of depth perception to the problems of practical aviation, especially the problems of how a pilot lands an aircraft. The tests based on cues for depth failed to predict the success or failure of the student pilots and, Gibson says, "none of the proposals for improving depth perception by training made it any easier to fly".

Gibson's (1979:3) concern over the problems associated with depth perception led him to offer an alternative approach. He argued that the "visual third dimension is a misapplication of Descarte's three axes for a coordinate system". He correctly identifies Cartesian coordinate geometry as a phenomenon that has mediated the experience of Western industrialised people's perception of space. In different ways both Poincare (1987) and Husserl (1970) recognised before him that knowledge of geometry and perspective was an attribute peculiar to specific Western cultures. Colin Turnbull (1961), living with pygmies, found out that when he took them out of the rain forest where they had lived all their lives their perception was different from his.

Henri pointed out the antelopes, which had moved closer and were staring at us as curiously as ever. Kenge clapped his hands together and said that they would give food for months and months. And then he saw the buffalo, still grazing lazily several miles away, far down below. He turned to me and said , "what insects are those ?"

At first I hardly understood, then I realised that in the forest vision is so limited there is no need to make automatic allowance for distance when judging size The same thing happened later on when I pointed out a boat, in the middle of the lake. It was a large fishing boat with a number of people in it. Kenge at first refused to believe it. He thought it was a floating piece of wood. (Turnbull 1961:229-230)

No doubt Turnbull might have experienced difficulties if he had been required to see in the depth of the rain forest things that the pygmies took seeing for granted. On one occasion, during my field work while observing

radiologists at work my key informant remarked, "God knows how many of these things I have seen". I had spent the morning observing him reading and reporting films. I was amazed at both the speed and the volume that he accomplished. I also noticed, or rather it was pointed out to me while a barium enema was being carried out, that the colour of the shadows on the x-ray monitor that is used to control the flow of barium meal were the reverse of those imprinted on film. The radiologists were able to mentally reverse them without too much difficulty.

Hebb and Favreau (1969) ask why the expert radiologist has a greater expertise than the neophyte.

What is this greater capacity of the expert? A parallel situation, more within the range of competence of the present authors, is found in the perception of fibre and cell masses in the sections of the brain seen under a microscope. Here it is evident that the superiority of the experienced viewer is not due to a superior visual acuity, *but to some fundamental modification of perception itself that develops slowly with repeated viewing taking months perhaps years for its full emergence.* The situation, presumably, is probably the same in radiologic diagnosis. The elements of the x-ray picture must be visible to the beginner as to the experienced practitioner, but they do not lead to the same perception. Part of learning here must be the elimination of irrelevances, but there is reason to think that more is going on -- that some new integration is being established in the brain at a supra sensory level, and a new perception is being achieved. (Hebb & Favreau 1969:399; my italics).

Hebb and Favreau may be right in suggesting that some fundamental adjustment to perception occurs with repeated viewing, but this does not seem particularly mysterious considering that humans have the ability to adapt to different environments in the sense that for all individuals perception is multidimensional experience. However, as discussed previously, reading and perspective are cultural acquisitions that can inhibit the ability of some people to understand that the world can be perceived in multidimensional ways. Merleau-Ponty (1969:13) has, to an extent greater than the other phenomenologists Husserl, Schutz and Heidegger, recognised from his understanding of aesthetics that there are multiple ways of seeing, which he called "multistabilities". He says that Cezanne discovered what some recent psychologists only just realised, that the lived perspective is not a geometric or photographic one. Cezanne had abandoned himself to the chaos, and kaleidoscopic world, of visual stimuli and as a result his work between 1870-1890 constantly suggests illusions.

Abandoning the perspectival concepts of the Renaissance painters, Cezanne painted the same scene up to one hundred and fifty times in his attempts to capture on canvas the flux of light, patterns and colours as they changed before his eyes. In the context of radiology it is worth emphasising that Merleau-Ponty (1964) said, "It is a remarkable fact that the uninstructed have no awareness of perspective and that it took a long time and much reflection for men to become aware of the perspectival deformation of objects". In the Visible and Invisible (1962a), he states that

I say that the Renaissance perspective is a cultural fact, that perception itself is polymorphic and that if it became Euclidian, this is because it allows itself to be orientated by the system. What I maintain is that: there is an informing of perception by culture which enables us to say that culture is perceived. (These paragraphs are also cited by Ihde (1986:52) for a different purpose).

Rejecting the conventional theories of depth perception, Gibson argues that there is no kind of perception called depth perception. He says:

If *depth* means the dimension of an object that goes with height and width, there is nothing special about it. Height becomes depth when the object is seen from the top, and width becomes depth when the object is seen from the side. If depth means distance from *here* then it involves self-perception and is continually changing as the observer moves about. (J.J. Gibson 1979:148)

According to Kockelmans (1970:291) "depth" can neither be extracted from nor put into individual perspective, a factor which prompted Merleau-Ponty to state that with the "rediscovery of depth which has not yet been objectified and which does not consist of mutually external points, we shall once more be able to transcend empiricism and intellectualism". I presume by the statement "not yet objectified" he means, for example, that depth perception in early childhood is uniquely individualistic in character, but eventually becomes collectively correlated through the social use of language, and enactive and iconic experience. Hence its "objectivity". This is similar to the case of the neophyte when he/she is learning the practice of reading a radiograph. In addition to learning to see (which J.J. Gibson (1979) regards as an act of attention) the neophyte requires the learning of an observational language based on radiographic appearances; and this suggests that more than just perception is involved in observation.

Hanson (1961) argues emphatically that seeing is theory laden, and rejects the view that scientific theories are produced from an objective observational base. His thesis is that theories, hypotheses or background knowledge strongly influence what is observed. What one sees is coloured

and interpreted via the conceptual framework that the seer holds; the notion of direct contact with the world is a myth.

Kuhn (1970) argued that if "the conceptual framework of two people differs dramatically, then, they will see different things. And if the world consists of what one sees (hears, feels, etc) they will inhabit different "worlds" as well". Hanson agrees with this view, suggesting that when there is a sense in which two observers do not see the same thing, they do not *begin* from the same phenomenon even although they have normal eyesight and are visually aware of the phenomenon. He explains.

Imagine these two observing a Protozoon - *Amoeba*. One sees a one-celled animal, the other a non-celled animal. The first sees *Amoeba* in all its analogies with different types of single cells: liver cells, nerve cells, epithelium cells. These have a wall, nucleus, cytoplasm, etc. Within this class *Amoeba* is distinguished only by its independence. The other, however, sees *Amoeba's* homology not with single cells, but with whole animals. Like all animals *Amoeba* ingests its food, digests and assimilates it. It excretes, reproduces and is mobile - more like a complete animal than an individual tissue cell. (Hanson 1961:4)

In the language of biology "unicellular" and "non-cellular" are terms peculiar to that discipline, and are used in an instrumental way to categorise what is seen, or as a way of seeing aspects of the world, so that which ever term is used first will act as a mind-set. "Our visual sensations may be "set" by language forms; how else could they be appreciated in terms of what we know?" (Hanson 1961:26). What an observer sees is determined by what there is to see and by the conceptual framework with which he or she perceives the world. Adopting this approach means that seeing is inevitably "theory-laden". Indeed as the field work discussed in previous chapters shows for accuracy in reading a radiograph it is essential that it is so.

Hanson argues that, "when it makes sense to say that two scientists looking at X do not see the same thing, there must always be a prior sense in which they do see the same thing"(1961:5). Identifying that prior sense must be a fundamental goal of anyone who is involved in observational sciences. In his paper on the Phenomenological Approach to Perception, McConville (1978) argues that, before studying some phenomenon, most perceptual psychologists have preconceived ideas which are usually based on the camera/photographic model. He says that this approach tends to lead to the assumption that the perceptual process can be understood as that which "facilitates good clear and distinct pictures of the world". However, as he says, a major problem with such

models of perception is that a great deal of our contact with the world is unclear. Meanings do not appear as well articulated pictures in consciousness. Meaning in actuality is often obscure, hidden and ambiguous, and sometimes people's perceptual experience goes beyond the limits of clear conscious awareness and cannot be comprehended in rational terms. Wittgenstein and many others have made references to such well known pictures as the bearded man (Fig 7.3) and the Dalmatian dog (9.1) to demonstrate the complexity involved in individuals' abilities to construct meaningful perceptual sensations. The struggle to see patterns as things was a perceptual/cognitive/linguistic process that fascinated Wittgenstein when he pondered how a seer manages to process the fragmented pattern as depicted in the bearded man. He was also curious what happened after initial learning. For example would any subsequent use of a word call up a picture in the mind and does the use of the word emanate from the image?. If after having recognised the bearded man by having someone trace the outline of his face or by describing the image, what sort of image is retained in the mind and what is it that will stimulate recall?

R.L Gregory (1986:13) suggests that perceptual understanding involves going beyond the immediacy of perceptual experience. He argues that the senses do not give the seer a picture of the world directly, "rather they provided evidence for the checking of hypotheses about what lies before us. Indeed we must say that the perception of an object is a hypothesis suggested and checked by the sensory data". This has particular relevance for the neophyte radiologist when it may be difficult to detect the clues that can indicate either a wrong or right hypothesis. To achieve an ability of being able to shift between alternative possibilities requires experience and practice. It can be a trying event for the neophyte faced with the task of assigning a label to some subtle pattern . During a training session that was taped for me but which I did not attend the staff radiologist put up a radiograph to test a registrar who was about to sit a final exam. This radiograph was such that alternative interpretations were possible, that is, it could be read more than one way. Listening to the tapes I sensed that the registrar seemed nervous. She seemed hesitant and stumbled, and groped at first as she attempted to read the radiograph; there were interjections from the others which seemed to make her even more unsure:

Staff Radiologist Don't listen to them, be brave!
 Can you tell us if its cardiac or not cardiac?
 Be brave, c'mon.

Registrar Non-cardiac.

Other Registrars O.K.

 Whats the gamut?

Registrar (ahem)

 What's the gamut?

 (ahem)

 (she describes it and then says it doesn't look like that).

Staff Radiologist (sternly) Why did you say that?

Registrar Doesn't it?

Staff Radiologist (insisting) But why did you say that ? --- it doesn't look like that --- do you believe your self? That's about number two on your list --- scratching as soon as you say it.

Registrar. O.K.

Staff Radiologist Musn't do that, O.K?

Registrar O.K.

Staff Radiologist Never do that, O.K?

Other Registrar Positive before negative, O.K!

The registrar was attempting to get from what she thought she saw in the film to the most likely heading that tops her gamut list. She was attempting to find the right visual classification or the most appropriate visual description for what she was seeing or thought she saw. In the visual, taken for grantedness of our everyday life, among other things, it is the sluggishness of our visual perception that allows us or deludes us into thinking that what we see is somehow fixed. In phenomenological terms she must somehow "bracket" her naive understanding of the world and enter a state of mind where she can call from her specialised experience and memory those descriptions that will seem

to match what she is seeing. Hanson (1969:20) suggests that, in terms of observation in physics, every physicist is "obliged to forget what he knows and to watch events like a child". Describing the type of seeing that is the goal of the scientist engaged in observation, he says:

The language of shapes, colour patches, oscillations and pointer readings is appropriate to the unsettled experimental situation. The observer may not know what he is seeing: he aims only to get his observations against a background of established knowledge. (Hanson 1969:20)

The more experienced radiologists demonstrate greater ability in controlling the process of "temporal integration" - a concept employed by Gombrich (1972:47) who argues that it is a phenomenon that cuts across faculty boundaries; implying a perception of the present, memory of the past, and an expectation of the future, exemplified by St Augustine's account of what went on in his mind as he recites a psalm:

Before I begin, my expectation alone extends itself over the whole, but as soon as I shall have once begun, how much so ever of it shall take off into the past over so much of my memory over reaches, thus the life of this action of mine is extended both ways: into my memory, so far as concerns the part I have repeated already, and into my expectation too, in respect of what I am about to repeat. (St Augustine Book XI, 28 in Gombrich 1972:47)

On different occasions the staff radiologist organised and conducted training sessions which involved four registrars in turn reading a number of radiographs. I was able to observe and record the individual performances. As expected, there was quite a difference between the experienced and the inexperienced in their ability to control the process of temporal integration. On one occasion a radiograph of the frontal chest of a baby a few months old was shown. One of the key clues to the right gamut list was the identification of a sign that indicated that the child was "blue". One of the experienced radiologists ran through various possibilities until she stated that the child was "somewhat oligoemic" (a condition where insufficient blood is flowing through the lungs) which indicated that the child was a "blue baby", an extremely important way of classifying the particular medical condition of the baby. The registrar then carried on working through her list; then realised that she was on the wrong track; she then was able to go back (figuratively speaking) and begin again from the sign of "oligoemic lungs", which was (metaphorically speaking) like a fork in the road. She had just returned from holiday and told me in a conversation later that she was

"having difficulty flicking into the right list by trying to think too fast". "Blue" indicates "cyanosis", a significant index of congenital heart disease, which must be known, as it indicates a point where knowledge of congenital heart disease is separated into two distinct classificatory branches. Prior knowledge of "blueness" in this context indicates Husserl's axiom that consciousness is always consciousness towards something, in other words, intentionality. This refers to an individual's power to confer and assign meaning. Roger Poole (1972:92) argues that intentionality, in purely subjective terms, is like a hypothesis - I "intend" what I see, hear, smell, want, fear, etc, in a certain manner. He argues that modern research seems to confirm Husserl's thesis about how the brain synthesises information through the eyes:

We do in fact more or less "process" what we see at the retinal level. What is finally sent along the brain as information has been heavily processed at the retina, and a sort of temporary hypothesis about what the eye is seeing is transmitted rather than any direct information what is "out there". The idea of a retinal hypothesis is in fact only a biological-physiological form of basis of Husserl's insight: that we confer meaning upon the world by the use of what he calls "intentionality" and thus in a sense create a world all the time, in a series of rapid achievements. (Poole 1972:93)

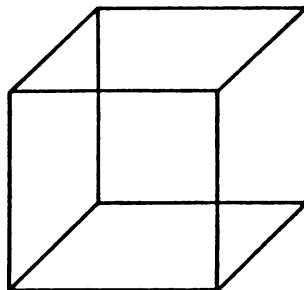
The registrar was able to return to the sign of "blue", and I stress "sign" because what indicted "blueness" to her was in fact a black or grey mark on the radiograph. Commenting on the significance of intentionality to the human condition, Schutz (1972) says that a life-world is only, "meaningful for me in virtue of those meaning-endowing intentional acts of which I become aware by a reflexive glance". As Bloor (1983) comments, the notion of a "reflexive glance" is the way in which a person can catch him or herself in the act of conferring meaning. This implies that this registrar was able to recognise her cognitive source of knowledge. As Schutz would argue catching oneself in the act of conferring meaning is something that can only take place within a "unique stream of consciousness" and, therefore, is "essentially inaccessible to every other individual". As he puts it,

I can look upon the world presenting itself to me as one that is completed, constituted, and to be taken for granted. When I do this, I leave out of my awareness the intentional operations of my consciousness within which their meanings have already been constituted. (Schutz 1972:35-36)

This exemplifies the naive state of a person in the natural attitude, a state of mind in which the world is taken for granted. However the radiologist must somehow bracket this state of mind, and change the condition of his/her awareness to that of a different attitude. For the neophyte it can be a state of estrangement, but, in contrast and exemplifying the experienced and practiced, Schutz says,

On the other hand, I can turn my glance toward the intentional operations of my consciousness which originally conferred the meaning. (ibid)

Knowledge of "blueness" also indicates Hanson's notion of a "prior sense", which introduces the inescapable issue of visual ambiguity for radiologists. In most medical literature on vision and observation there is some reference to visually ambiguous figures because as Hebb and Favreau (1969) note it raises the problem of separating "perception" from "sensation" and for behavioural psychologists that raise the problem of introspection. It is worth noting that almost every year or so in radiological literature there is an article on visual ambiguity, which frequently repeats known concepts and principles such as the Mach band, optical illusions and visual ambiguity. This emphasises and reminds radiologists that these basic principles must always be known and never forgotten.



The first visually ambiguous figure to be described and investigated – the Necker cube. It reverses spontaneously in depth, even when its image is optically stabilized on the retina. (From R. L. Gregory and E. H. Gombrich (eds.), *Illusion in Nature and Art*, Gerald Duckworth and Co. Ltd, 1973.)

Fig 9.2 Necker Cube

Ambiguous figures like the Necker cube (Fig. 9.2) according to Hebb and Favreau (1969:395) "involve no illusion (unless the perception of visual depth in a two dimensional representation, such as an ordinary photograph or a roentgenogram, is illusion), but instead illustrate the fact that *perception is not fully determined by sensory input*" (my emphasis). The spontaneous reversals of visual depth were first accounted for by the Swiss crystallographer, L.A. Necker, in 1832 when he was drawing rhomboid crystals as he saw them through his microscope. He was astonished that it was his perception and not the crystals or the drawing that had changed. The Necker cube (Fig 9.2) demonstrates that the same sensory input may give rise to two different perceptions. Orientation as to which way the cube can be seen may be controlled by showing a viewer an actual cube or block before seeing the drawing.



Fig 9.3 Staring Faces

The classical example of the variability of perception is given in Fig. 9.3, where the Gestalt switch occurs between the vase and the staring faces. It is this figure that for Hebb and Favreau (1969:395) illustrates "The fluidity or indetermination of perception with a given sensory input, and that this is a general feature of perception".

Referring to the different perspectives that are possible when seeing the Necker cube, Hanson states:

Do we, all see the same thing? If we do, how can these differences be accounted for? . . . Do I put different interpretations on figure when I see it now as a box from below, and now as a cube from above? I am aware of no such thing. I mean no such thing when I report that the box's perspective has snapped back into the page . . . Fig. 9.2 is simply seen now as a box from below, now as a cube from above; one does not first soak up an optical pattern and then clamp an interpretation on it. (Hanson 1961:9; figure numbers amended as appropriate)

Hebb and Favreau (1969:396) suggest that there is evidence that when a familiar object is perceived at a glance the perceptual process operates like a series of events. They say that this can be demonstrated by imagining a familiar object such as a car. The visual object does not become clear all at once. If the front bumper is seen clearly the rear window and the boot will not be clear at the same time but become clear one after another as attention shifts to each. The "image" is not really given simultaneously but "sequentially". They point out that as a clear image develops then this must inhibit any activity that would allow another image to interpose or overlap causing confusion. This can be demonstrated when looking at the Necker cube where only one orientation can be seen at one moment. According to R.L. Gregory (1986), the Necker cube also demonstrates the situation where alternative hypotheses are available because unless individuals have some previous orientation to one of the perspectives, there are no clues to indicate a right or wrong hypothesis.

The flip/flop nature of the Gestalt switch and the sequential nature of perceptual imagery emphasises the importance of *organisation* in the perceptual/conceptual process. Hanson argues that "seeing an antelope", and "seeing an object as an antelope" have much in common, but sorting out differences about data, evidence, and observation is much more complicated than simply gesturing at objects. Hanson (1961) suggests that what is portrayed in Fig 8.9 is a case where the observer seems to see something more than is presented:

Your retinas and visual cortices are affected as much as mine are; our sense-datum pictures would not differ. Surely we could all produce an accurate sketch of Fig. 8.9 Do we see the same thing? I see a bear climbing up the other side of a tree. Did the elements 'pull together'/cohere/organise, when you learned this?

Organisation is not itself seen as are the lines and colours of a drawing. It is not itself a line, shape, or colour. It is not an element in the visual field, but rather the way in which elements are appreciated. Again, the plot is not another detail in the story. Nor is the tune just one more note. Yet without plots and tunes details and notes would not hang together. Similarly the organisation of Fig. 8.9 is nothing that registers on the retina along with other details. Yet it gives the lines and shapes a pattern. Were this lacking we would be left with nothing but an unintelligible configuration of lines. (Hanson 1961:12-13) (figure numbers amended as appropriate)

The bear climbing up the tree is a different sort of figure from that of the ambiguous picture. The bear drawing demonstrates Husserl's axiom that consciousness is always intentional. The radiographic image is like the bear drawing in that it is incomplete, requiring further organisation between the mind and what is seen. In this regard, Jaffe (1984:14), warns that no matter how faithful medical images are to human anatomy, "they are not the body itself", but merely a representation of it. He asserts that it is not the detailed fidelity of a mental image which provides information, but rather it is its "symbolic content", and suggests that cartoons are premised on this fact. Jaffe's comments are revealing for they indicate to some extent the type of activity that constitutes radiological practice. The person who understands a cartoon is able to "see" in it the embodiment of some image that may be completely obscure to the uninitiated. In other words without sufficient background the lines and shapes of the cartoon may be meaningless. As radiologist Squire (1969:490) argues: "an object, structure, or mass of tissue may be name-identified only if its existence, shape, and nature are known to the viewer". Furthermore, "students must be told that it is difficult to identify any thing that he or she is not acquainted with, or reason out the presence of any pathological process affecting an x-rayed structure unless he/she knows that the process exists in morbid tissue".



The ability to construct meaningful perceptual descriptions is quite remarkable. Organization is imposed on visual sensations; we struggle to see patterns as things, a process that fascinated Ludwig Wittgenstein. How do we manage to handle such fragmentary information as in this photograph by Ronald James?

Fig 9.1 Blakemore (1977:66).

CHAPTER TEN

Chapter 10Radiology: The Code 1.

The introduction of x-ray technology into the practice of medical diagnostics was a radically innovative move. Prior to x-ray however doctors had a long tradition of detecting, recognising, and understanding the symptoms of disease. In many instances symptoms in the form of rashes, spots, and fevers are easily seen. In addition, the patient could indicate areas of discomfort and pain, all of which involved classificatory procedures that depended on a plethora of signs.

On two occasions during the field work research I told my informants that I was having difficulty in coming to terms with the complexities involved in the diagnostic process. It is very difficult to comprehend what a person reading a radiograph is actually doing. Logical thinking is of course invisible to someone else. My inclination, based largely on an engineering background, made me feel that the whole diagnostic exercise was somehow unnecessarily complicated. However, Foucault (1975:13) writing about the changes in medical knowledge in the late 18th century argues that medicine is quite different from mathematics. Measurement is used in medicine not to gain knowledge of mathematical form, but "to gauge the intensity of the pathological quality that constitutes the disease".

Pathological phenomena are substantially different from those symbolised in mechanical and inorganic forms. The physician requires a qualitative "gaze" in order to gauge the nature of disease.

in order to grasp the disease, one must look at those parts where there is dryness, ardour, excitation, and where there is humidity, discharge, debility. How can one distinguish, beneath the same fever, the same coughing, the same tiredness, pleurisy of the phthisis, if one does not recognise here a dry inflammation of the lungs, and there a serious discharge? How can one distinguish, if not by their quality, the convulsions of an epileptic suffering from cerebral inflammation, and those of a hypochondriac suffering from congestion of the viscera? A subtle perception of qualities, a perception of the differences between one case and another, a delicate perception of variants -- a whole hermeneutics of the pathological fact, based on modulated, coloured experience is required; should one measure variations, balances, excesses, and defects. (Foucault 1975:13-14)

In the absence of classificatory procedures to diagnose disease, the options available to the physician would be infinite. Variations in signs and symptoms require a perception of appearances capable of eliminating and retaining the obvious. According to radiologist Abercrombie (1972), implicit in the use of the word "normal" is the automatic division of the population into two classes, normal and abnormal. She argues that the unconscious and conscious manner in which criteria are selected depend upon the purpose at hand. Properties are selected according to convenience, things may be selected for their colour and size, in a process that ignores other qualities. A legacy of Newtonian natural science, which contemporary scientists have to contend with she argues, is the idea that truths exist in nature in the form of natural groupings - a dogma which ignores the fact that ways of grouping are devised by humans. Barnes (1981:315) lends support when he says that "clustering is something we do to the particulars, not something which is already done in 'reality'. 'Reality' does not mind how we cluster it; 'reality' is simply the massively complex array of unverbaised information which we cluster".

Abercrombie (1974:141) suggests that the most useful classification is one that groups similar phenomena in as many ways as possible. This means that other factors, which need to be known, can be inferred from the probability that they will be alike in other respects as well. The act of classification is akin to that of seeing, both involving the process of apperception. What is classified is constituted by experience of similar things in the past, "indeed when we classify a thing, we are deciding which of our schemata are appropriate to it". What is seen and classified is not assessed in isolation. Barnes (1981:318) argues that individuals "derive or legitimate expected future associations by reference to the strength of such associations in the past: the more strongly particulars are thought to have been associated in the past, the more they are expected to be associated in the future".

The use of logic in classification reduces possibilities to manageable proportions, and hence in radiology the use and application of the gamut. Radiological gamuts vary from culture to culture, because language and the patterns of disease differ. The development of classificatory systems throughout the history of medicine has occurred as a result of an accumulation of qualitative variations which indicate steps and changes in the progress of a disease. However visible symptoms are only some of the signs that constitute a particular disease. Inevitably with the development of more complex and sophisticated classificatory procedures becoming available from many

specialist branches of medical science, the possibility of variation in shades of meaning and perception is infinite.

According to Foucault (1975:15), the knowledge and perception of medical practice changed with the realisation that a crowded waiting room of patients displaying a variety of complaints, was not the way in which to understand medicine as a science, or to categorise illness. Like hospitals, this sort of medical practice "kills the capacity for observation and stifles the talents of the observer by the sheer number of things to observe". There was also the realisation that the patient could be considered as a "*portrait* of the disease" (my italics). He says that this meant that, " Medical perception must be directed neither to series nor to groups, it must be structured as a look through a 'magnifying glass', which, when applied to different parts of an object, makes one notice other parts that one would not otherwise perceive" (1975:15). In essence the complexity of the task that faced the diagnostic physician could be exemplified by his/her dependency on the sense of sight. As Foucault (1975:8) puts it, "One, must, as far as possible, make science ocular".

By the end of the 17th century medical science had become contingent on the "sovereignty of the gaze" as medical practitioners emulated scientists by analysing and classifying natural phenomena according to their "visible" character. Foucault (1975:89) argues that these were "structures" that consisted of "forms, spatial arrangements, the number and size of elements". The task of the naturalist scientist was to map and translate into discourse what was being seen. Medical practice was increasingly reliant upon botany, but built upon and extended the model of botany with more subtle and diverse shades of meaning. This was achieved by the addition of "colours, variations, tiny anomalies, always receptive to the deviant". By the time of Roentgen's discovery in 1895, there was a massive range of classified knowledge in existence. The introduction of the radiograph was an additional portrait of disease and anatomy that revealed symptoms and signs that had previously been invisible to both patient and doctor.

Foucault stresses that in the late 18th century the changes in medical procedures that emphasised the visual were not a return to the purity of the gaze of antiquity. He says:

It is not even a question of a displacement of the gaze, or of a finer application of its extent. New objects were to present themselves to the medical disease in the sense that, and at the same time as, the knowing subject reorganises himself, changes himself, and begins to function in a new way. (Foucault 1975:90)

The early use of x-ray photography did not mean that the older clinical and histological classifications were immediately replaced. As discussed previously, in chapter 6, diseases of the lungs, in particular silicosis, required many years of dedicated study before the technology of the x-ray could be used effectively in mapping and recording knowledge of the disease. As Foucault would argue, theory and visual experience were not yet bound together in codes of knowledge. The significance of this is that radiology as a specialised practice did not and could not develop overnight.

Nothing had changed since Galileo's time in terms of integrating theory and visual experience. In the practice of radiology, today's neophyte is a fully qualified medical registrar before being accepted to train as a radiologist. It takes some time for the neophyte to acquire "the knowing" of the experienced. I stress "knowing", and not understanding, because knowing in this sense means *being able to see*, in addition to understanding what is being looked at. As Foucault says, discussing the changes in medical visual practice:

At this level there was no distinction to be made between theory and experience, methods and results; one had to read the deep structures of visibility in which field and *gaze* are bound together by *codes of knowledge*. (Foucault 1975:90)

As stated in chapter 7 the field work for this inquiry was influenced serendipitously by "trouble", that is, the problems that neophyte radiologists experience as they learn their practice. Despite the trainee radiologist having some experience, and also knowing the technique of clinical medicine, in order to acquire the radiological code of knowledge he/she has to become proficient in an understanding and knowing of radiological appearances. Gradually, with training, this should result in a rational discourse that can be freely communicated to other radiologists. According to Barnes (1981), the acceptance of a classificatory system by both the experienced and the neophyte implies that it must be socially sustained. It is an institution that depends upon conventional and legitimated representation of specific phenomena. In the context of this inquiry these are radiographic appearances or images (icons), the language (symbols) used to describe them, and various marks acting as indexes.

Foucault (1975:1x) asks: "From what moment, from what semantic or syntactical change, can one recognise that language has turned into a rational discourse? What sharp line divides a description that depicts membranes as being like 'damp parchment' from that equally metaphorical description of them laid out over the tunic of the brain, like a film of egg whites?". In the early days of radiology, in a literal sense, the process of producing x-ray pictures, with black and white marks and grey shadows, could be compared to a printing process which produces letters, words, and numbers on paper. Except, of course, that no one knew what they meant - apart for those images that were obvious! It was the production of these unknown marks that was eventually to become the symbolic basis of a new language that extended the known boundaries of description. This was because, to use Foucault's phrase, "the greyness of things and their shapes" came to mean that the "structure" of the relationship between what could now be seen and what was previously known had changed. The patterns of medical language changed with the advent of x-ray technology because the constitution of a "shadow" and all its variations had to be learned and understood. What had existed before, below the threshold of visibility, was now symbolised on the radiograph.

The implication behind Foucault's metaphor, a "sharp line", is suggestive of Brown's (1977) contention that all knowledge is metaphorical, because even Foucault, when he is discussing metaphorical usage, cannot avoid using a metaphor. There are three options to describe phenomena that have never before been seen. One is to use a known or existing metaphor, the second is a specific use of metonymy, which I will discuss in chapter 11, and the third is to invent a neologism which in turn becomes a new metaphor. This illustrates the fluidity of language as it changes in historical and linguistic contexts, and also Foucault's point that although diseases do change it is more likely that the language of description changes more rapidly.

According to Foucault, throughout medical scientific history, before and after the use of devices like the microscope and x-ray, the fundamental goal of the medical practitioner was to weld new alliances between words and things, thereby enabling him/her "to see" and "say". The microscope, the telescope and x-ray all made it possible to see things that had no name. Observational languages, which facilitate the connection between what was being seen and what was known, rely inextricably on the use of metaphor. Foucault argues that after the change in the methods of science, the language of the older

discourse seems "naive". This may be so; but it seems to me that any inadequacy in metaphorical description relates to the different levels of perception, i.e seeing, that is possible through the use of some technology, or alternatively, through different cultural contexts.

Emphasising different aspects in the way people see, J.J. Gibson (1979) for example, argues that we see the shapes and forms of mountains and hills at the *level of kilometres* ; cliffs, boulders and trees at the *level of metres.*; pebbles, sand, leaves and blades of grass, at the *level of millimetres*. Gibson calls this "nesting". In a gradient effect, smaller units such as valleys are nested within mountains; trees are nested within canyons; leaves are nested within trees. The strength of Gibson's approach is that it is based on common sense. At close quarters a tiny grain of sand can be seen, and at a distance a large mountain can also be seen by the same person. Each level requires a different perception. Familiarity and repeatability tend to orientate the see-er to a particular way of seeing that depends upon context. Thus, as noted in chapter 9 the pygmy accustomed to the closed world of the jungle, thought that distant buffalo were insects; and, conversely, Navaho accustomed to wide open, clear spaces could see things in photographs that Europeans could not, emphasising the contribution to cultural and environmental orientation.

The neophyte radiologist needs to learn the language of radiographic appearances in addition to his/her knowledge of clinical language. This means getting to know the visual patterns and anatomical shapes that characterise normal radiographic appearances. In what follows I want to develop an argument (in the context of the field research with which I was involved, or perhaps more accurately, a participant comprehender), that demonstrates the use of metaphor in radiological practice.

According to Hawkes (1972:1), "The word *metaphor* comes from the Greek word *metaphora* derived from *meta* meaning 'over', and *pherein*, 'to carry'". In the case of radiology it refers to the process whereby symbolism of the gamut is "carried over" or transferred to the radiographic image. This means that the radiographic image is spoken of as if it were a term from the gamut. Hawkes argues that despite the vast range of possibilities in metaphorical speech, "the general procedure of 'transference' remains the same".

The radiologist's task is not just finding "words for things", but is actually to see the patterns that might go with words. Radiographic language has been systematically developed since Roentgen saw the first radiographically produced "shadow". Edge (1973) argues that a result of technological innovation is that new models and patterns of experience are generated. In time this has the effect of directly and surreptitiously affecting modes of thinking and understanding about the life-world. In a powerful example, taken from the history of technology, he says that the metaphor "letting off steam" was originally grounded in the language of the railways and the steam engine. This metaphor eventually became associated with a release of tension in human emotions. Despite steam engines having been replaced by diesel and electricity, the metaphor remains as a mode of explanation in another language domain from that in which it was originally conceived. This demonstrates an infinite range of possibilities for metaphorical transference and creation.

Barnes (1981:305) argues that knowledge of the utterances involved in concept application is fundamental to understanding how people learn to apply concepts -- that is, how they learn to classify. He claims that there are two basic features of concept learning. The first stresses the importance of experience, "people learn as they move around in an indefinitely complex physical environment of which they are aware. Secondly, learning always occurs within a social context; to learn to classify is to learn to employ the classifications of some community or culture, and this involves interaction with competent members of the culture".

As stated in chapter 7, an aspect of the field work was to observe separately four radiologists who were at different stages of perceptual ability - who were attempting to make the transfer from his/her gamut to a radiographic image. To distinguish each radiologist, I will refer on a continuum to the least experienced as R1, and to the most experienced R4, with the numeral standing for years of experience as a radiologist. Under the supervision of the staff radiologist, each radiologist had a turn at reading the same series of radiographs. For the purpose of this discussion I will ignore all other considerations and focus on the use of metaphor. For the sake of clarity, I concentrate on the few metaphors that were used when describing the first film, which was a C.T. scan of a brain with a mixed pattern.

R1 began confidently with his use of metaphors to describe various skull patterns, such as "moth-eaten appearance", "floor", and "skull vault". It appeared that as the series progressed he seemed to run out of metaphors, or things to say, indicating that he needed to increase his gamut considerably.

R2 also mentioned vault, but made no reference to the appearance of the pattern that appeared "moth eaten".

R3 read the film with speed and substituted for "moth-eaten", "woolly appearance".

R4 read the film with a use of language that omitted any reference to metaphors like "moth eaten" or "woolly", but demonstrated an economy of language that stated simply that the bone had "softened". This illustrates not only that she recognised the osteologic condition of bone softening, but demonstrated an observational ability that was reflected in her commonsense radiological speech. In her use of literal language she had in this instance dispensed with figurative speech in describing what she saw. Furthermore, the fact that her speech was economic indicated that on this occasion she was able also to dispense with the spatial metaphors employed by R1 and R2. Idiomatic usage of spatial metaphors is fundamental to radiological talk. The radiograph, after all, is like a map and part of the reading process is the ability to know where one is, as it were.

Before the use of radiology in medicine, there were no radiographic descriptions or patterns that could be treated as separate entities in the form of the radiographic image. The radiograph presents itself to the viewer as the bounded territory of the invisible, and it is important to realise that this "territory" is, in a sense, separate from the physical and social context in the immediate vicinity of the person reading a radiograph. The radiologist concentrates on what is perceived to be relevant to his/her consciousness, and is required to bracket extraneous factors out of the visual/interpretative process. In this situation understanding is a "diacritical" process. That is, it depends upon distinctive signs which are used to indicate different shades of meaning, between what is seen through the radiographic window (to use my metaphor) and clinical understanding symbolised in the gamut. Therefore, the radiological account establishes what is accountable in a specific setting. The setting is that which is bounded by the frame of the radiograph and the mind of the see-er. Therefore technically (or specifically in ethnomethodological

terms), the radiological situation is made up of radiological accounts of patterns, rather than the patterns themselves which are merely black and white marks. These marks have no medical significance until they are made to become accountable.

Differences in individuals' uses of metaphor indicate that it is not enough just to suggest that all one has to do to learn the language of radiology, is to select or find the most appropriate metaphor. For example, mammography is a specialised aspect of radiology where the high quality of the image in some instances is quite definitive. One of the advantages of recent mammography technology is that it is sufficiently evolved to allow things to be seen that cannot be observed with conventional x-ray equipment. Where the patterns are definitive and tend to be repeated, metaphorical description is relatively straightforward. For example, Tabar and Dean (1987:149) suggest that "pathological lesions occurring in the breast can be grouped into four major categories according to their mammographic appearance: *circumscribed tumours*, *star-shaped lesions*, *calcifications* and pathological process giving rise to the *thickened skin syndrome*". They also state that "benign breast tumours are sharply outlined in contour, characteristically having a halo sign or capsule. In contrast malignant tumours have an indistinct contour with short spicules". (see figures 10.1, 10.2, 10.3, 10.4). I had the opportunity to be present during a formal session when current mammographs were available for inspection. If the pattern of the tumour was definitive it was relatively easy to detect, in contrast to the complexity of other patterns that were obscure to me.

The metaphors "moth-eaten" and "woolly" are different from the metaphor "softened bone". This difference can be explained by distinguishing between "metaphor" and "metonymy". The latter, according to Hawkes (1972:4), comes from the Greek word metonymia, derived from *meta* 'change' and *onoma* "name". The use of metonymy implies that the part stands for the whole, thus The White House stands for the Presidency of the United States. The radiographic image that is described metaphorically as "moth-eaten", "woolly" and "softened bone", exemplifies the use of metonymy in practical radiology. The image or pattern on the radiograph stands for a bone. Demonstrating how finely drawn such distinctions can be made in situ, both "woolly" and "moth-eaten" differ from "softened bone" because, although all three indicate the context of the message being communicated via the radiologist's account, only "softened bone" relates directly or more accurately to the code of

clinical/radiological understanding and explanation. According to Wilden (1972:47), there are always two possible interpretants to a sign, one which refers to the code and the other to the context of the message. The interpretant (Peirce's term) referring to the code is linked to it by similarity (metaphor), thus the radiographic image stands for a softened bone in the mind of R4, the experienced radiologist. In contrast, "woolly" and "moth-eaten" are linked by metonymy to the explanation of R1 and R2, who, with less experience, are not fully conversant with the code. Exploiting this difference between metaphor and metonymy even further, Leach (1981) asserts that "signs" are always contiguous to other signs which are members of the same set". For example, he argues that any particular letter of the alphabet is meaningless by itself, but, combined with twenty five other letter signs, hundreds of thousands of words can be represented in hundreds of different languages. His point is that (1) signs do not occur in isolation. (2) a sign only conveys information when it is combined with other signs in the same context. Thus the radiographic pattern that was described as "woolly" and "moth-eaten" made indexical sense in the specific context of naming that particular pattern, but were not suitable descriptions as they were outside the appropriate symbolic context or set.

According to Barnes (1981) there are two fundamental aspects of learning in context. The first is *ostention* where a person who is involved in concept application, by pointing and saying, attempts to make a direct association between a term and an object or pattern, . Thus R1 could point and say that the mixed pattern on the radiograph looked moth-eaten. Although "poking the film" is considered bad manners by radiological examiners, it is understandable why people display a propensity to point. The second aspect that is crucial to learning in context is *generalisation*. For example, birds can fly, birds can lay eggs. As Barnes says, generalisations suggest expectations about objects based on the experience of people interpreting events as the knowledge of a culture, rather than by simple taxonomy. Older radiologists used metaphors, such as the "cottage loafheart", which are no longer considered suitable by modern radiologists. This would support Barnes's claim that proper usage is "agreed" usage. "Moth-eaten" and "woolly" were not generalisations that were part of accepted radiological expectations in this instance. As Barnes (1981:315) suggests, from a sociological viewpoint, "proper usage is what is *agreed* to be proper usage; it is made evident by the practice of the relevant community".

In the case of radiology this corresponds to individual knowledge of the gamut which lists all the known terms that signify the cause of a particular disease or pathological condition. This is not as straightforward as it appears as Barnes explains citing a hypothetical example discussed previously by T.S.Kuhn:

A boy, familiar with the terms 'duck' and 'goose', calls a large white bird a goose, only to be corrected by his father, who offers the proper designation 'swan'. As the boy's experience of swans increases, so his use of the term 'goose' becomes more competent. Moreover, it is difficult to see how this increase in competence could have been brought about either purely verbally, or through further ostensive indications of accepted instances of 'goose'. Evidently, knowing what a goose is involves knowing what a swan is. Proper application of the term 'goose' involves familiarity with accepted instances of 'swan'. By generalising this point, we arrive at the interesting conclusion that competent usage of a term ideally requires command of all the terms in the associated net (1981:312).

Barnes contends that concepts are learned from authoritative sources from within particular environments, which means in the case of radiology that effective knowledge of the gamut requires a command of all the terms that the gamut represents. However, although this implies that a particular pattern be identified with a term from the gamut list on an isomorphic basis, in practice this is not the case. The best that can be achieved is that a pattern resembles a certain condition, exemplified by Goodman's illustration of a *fair sample*, discussed previously in chapter 8, because no two radiographic images are exactly alike and no image can be reproduced in exactly the same way on every occasion. Furthermore, the competent radiologist probably uses the gamut as a mnemonic device rather than having a cognitively ready-made label that readily identifies the pattern. In other words there are no absolute criteria available. As Barnes puts it:

Concepts do not come with labels attached, carrying instructions which tell us how they are to be used. We ourselves determine usage, taking previous usage as precedent. Moreover, such precedent is corrigible, since it is itself the product of judgements. It can always be said that previous usage was wrong, that it weighed similarity and difference incorrectly, and that it must be revised. Kinds of thing can be re-classified so that even previously paradigmatic examples of the proper usage of one term come to fall under another. (Barnes 1981: 30)

In 1946 a group of radiologists in the United States pioneered an attempt at statistical analysis of reading radiographs. Yerushalmy (1969), who was a member of the research board, says that in the 1940's "photofluorography" (the technology of mass x-rays) had developed in a short period from crude experiment to an instrument that was suitable for screening large groups. This had post war implications for two main federal agencies, The United States Public Health Service and the Veterans Administration. The administrators of the Health service realised that mass x-ray could have a potential use in its tuberculosis programs, and the administrators of the Veterans Administration were interested in the advantages in keeping a record of discharge x-ray films on millions of war veterans. The need was to evaluate the efficiency of the technology, particularly in terms of the ability of radiologists to detect pulmonary lesions. Four sets of films were taken within a few minutes of each other on 1256 individuals. Each of the four in the set of films was interpreted independently, twice by each of the five members of the board. The results demonstrated a great variation in radiologic interpretation.

Although this discovery worried some members of the board, it stimulated others to develop more reliable methods for describing and classifying pulmonary shadows. However, as Yerushalmy says, although his group tested nearly all the methods in use to describe and classify lesions, and invented new ones, all the methods of classification were found to be unreliable. It became apparent that the classification of radiographs into "positive" and "negative" depended not only whether a specific shadow was present, but whether the shadow could actually be seen by the reader. In essence, classification into positive or negative relies upon individual interpretation of a radiograph. The implications of this are that if a lesion is represented on the film, but cannot be detected under normal interpretive practice, it must be regarded as non-existent.

Dual and multiple readings overcome some of the problems when individuals miss something. Furthermore, the practice of labelling some radiographs as suspicious allows recall for further interpretation. This was the basis of another experiment involving Yerushalmy in 1954 at the University of California at Berkeley when all 14,000 students were examined. Each film was interpreted independently ten times by eight competent radiologists and phthisisologists practicing in the San Francisco Bay area; six of the eight provided a single reading, and two read the films independently twice. . . In total, some 50 physicians participated in this investigation" (Yersushalmy

1969:384). Yerushalmy says there were two fundamental advantages of this study: the first was the use of multiple readings, and the second, and more importantly, students were available for follow up investigations which assisted in assessing the significance of any lesion located.

The statistical approach was designed to investigate observer error, and the results showed that 25 per cent of significant lesions were missed by competent radiologists. This seemed relatively high to the supervisory board members. There was a realisation that a single film is not necessarily a good guide to prognostication (active, probably, inactive). It was also found that nearly all the classificatory terms were inadequate. A shadow that was regarded as "hard" by one reader could be regarded as "soft" by another, and this could happen by the same reader on the second occasion. The percentage agreement for different terms for describing lesions was relatively low, with the exception of the rarely used term "nummular". (See fig. 10.5) The research group did agree that most lesions are composed of three mutually exclusive characteristics: *smooth matrix* (a homogeneous matrix), *spotted* (white spots with a dark reticulum), and *honey-combed* (black spots with a white reticulum). Two factors became obvious as a result of the research program. The first was that no single term could adequately describe a lesion, and secondly, different interpreters may see the same lesion differently.

After two years the researchers had to concede that they had failed in their attempts to find a reliable classification of the radiographic appearance, or the quality of the pulmonary lesion. However, another group of researchers, undeterred by the failure of the research, were convinced that they could achieve better results by trying to find the reasons for missing a lesion. Their approach was to identify films that were easy and difficult to evaluate, and then to determine the reasons why. The reasons that were investigated were "location, size, density, faintness, artifact, etc". They also examined the factors that related to the description of a lesion, such as shape, orientation, sharpness of border, and uniformity. In addition, the attitudes of the interpreters were considered; for example, what effect would pessimistic and optimistic attitudes have on the efficiency of a reading? They were no more successful than the first group. The research committee concluded that it was one of the most difficult and major problems facing radiologists.

Yerushalmy's article, just outlined, was republished in 1969 and the research is regarded as having historical significance in that it represents a classical model for the application of statistical techniques to the study of radiographic shadow perception. Furthermore, as Tuddenham (1969) points out, the research outlined by Yerushalmy raised questions that are often ignored in the enthusiasm for technological progress. Yerushalmy's work suggests that, although the research in effect failed, metaphor as a powerful descriptive device deserves further examination. This is something that positivistically inclined researchers fail to appreciate.

It is a surprise to many people that fundamentally, a scientific inquiry or investigation requires the use of metaphorical language for its understanding. Max Black's discussion on different type of models culminates in what he calls "the mysterious uses" of theoretical models. To the uninitiated, scientific areas of investigation such as interpreting a radiographic pattern can seem inchoate and confusing, particularly if he/she lacks prior concepts. The most likely response is to ask: what is it like? or what are we looking for?, which emphasises an inexorable use of metaphor and simile.

As part of my field work I attended a group session where the intention was to arrive at decisions on mammographic patterns in order to identify lesions, or become satisfied that there were no lesions present. What was salient in the group discussion was the metaphors that were used to describe patterns, such as "broken needles", "smashed rock", "cigar shaped", "nothing jagged about it", "cloud like", "shell like", "non-craggy", "comet shaped"; but the one that stood out was used to describe a carcinomic lesion, "egg with whiskers". The staff radiologist stated categorically that this was ominous because it indicated cancer.

The following transcription of a taped session is an attempt to represent the grammatical organisation of the spontaneous utterances used when reading a mammograph. R stands for the staff radiologists. R1, R2, R3, R4, stand for trainee radiologists, the numeral indicating years of experience. Dots signal pauses and hesitations. Brackets contain my comments. I considered that punctuation appropriate to sentence construction was inappropriate. Each mammograph is numbered.

(1)

R: Describe the lump . . . on the mammogram
describe the lump on the mammogram

R2: Its at least ahem six centimetre. . . lesion which is behind the nipple and to the right laterally . . . right

R: mm Margins ? (unclear) its well demarcated (unclear)

R2: it's size . . .

R: O.K. you wanna know . . size

R2: site

R: edge

R2: the margins

R: o.k. site density, alright? the margins this is probably one of the most important things the - edge

R3: such as calcification

R: calcification

R3: parenchymal distortion

R: aw yeah o.k. surrounding..surrounding breast..ok so you've got to think that way all the time. . because those, thats, you've got to classify your hard evidence o.k. what's the edge like?

R2: I think the edge's

R: not bad?

R2: yes it's well demarcated

R: may be a bit worrying there but in another shot it look's good . . ahem pretty dense . . what are the like l'hood of a big round dense lesion ? it might be one of those funny cysts carcinoma which o k are rare right it might be - what a giant fibroadenoma. It might [yes] what's against that?

R2 and R3: no calcification

R: It might be a [[cyst]] so what are we gonna . . we ultrasound and it was a simple cyst so that's the end of it. No worries . . is that the end of it?

R1: well if your are certain no worries

R: If its a big lump stick a needle in it and it might go away yeah stick some air in it . . because the other thing is that be careful when they're that big because because they might hide something small around the corner

R1: thats what I was thinking

R3: I mean . . .Is it I mean how often do you actually get cysts that that size?

R: Awh thats the biggest I've seen, I think, but then, you know, but we haven't being going that long

R1: the trouble is when they're referred to that's why when someone comes in I liked to stick a needle in it put some air in it re-mamm. but you're not allowed to. (by the clinician - unsaid)

R: well it's not your patient, that's the problem

R2: mmm

R: they've been referred and you have to . . suggest it

(2)

R2: o k there is a [?] abnormality in the left breast where there is a spiculated . . quite dense mass lesion associated with extensive micro-calcifications and these have a malignant appearance . . they're linear . . they're thin they're sharp . . there's parenchyma distortion around it with spicules . . . heading into the lesion but not through it . . and these are the appearances of carcinoma. . I think it needs to be removed

R: Full house of signs. See those straight lines?

R3: mmm

R: ahem and this is microcalcification in there is down there away from it so it's a spiculated lesion with . . with . . intraduct component beyond it

(3) ok

R1: well you've got cloud-like calcifications

R: cloud-like

R1: you can call it or . . shell-like calcifications surrounding . . fairly poorly defined. . fairly poorly defined mass . . there's also smaller smooth micro calcifications associated with this but it's definitely associated with a mass

R: Do you think there's mass

R1: yep I think there is, and relatively dense breasts and the way the calcification is I'm considering something like a fibroadenoma with degeneration just the way the calcification is here

R2: peripheral conglomerate

R1: mmm [?] the poet

R: is that benign or malignant calcification?

R1: dunno . . might be wrong. . I'm definite to day

R1: I think it's benign as well

R: yeah I think it's benign as well but what do you think about this . . if that's where her lump is . . What does it say here? [looking at request form]

R1: you could ah I mean that it looks like that

R3: calcification

R: "two cysts removed"

R1: it could be fat necrosis then

R: ahem "previous biopsy" ah-h "breast lumpiness" yes ahe scars "a scar" there where's that's right "no lump" . . .

R1: I mean I . . I have just seen ones where you have fibroadenoma

R: she's got lumpy breasts they say . . [?] lump there we are what does he say . . . "routine" so what are we gonna do

R1: well I think it's benign and if I think if there's any concern you do another mamm in three or six month's time otherwise you do her in a year

R2: depending a little bit on her age too I think

R: If there's any concern you don't do her in six months. . what do you do? if there's a

R1: you take it out. . but it's very interesting when you sort of hear of people saying . . .

R: I think we advocated taking it out . . . it's not far away from the nipple

R1: it's very interesting when you hear people like Kallegian and they'll turn round and say follow up - it's amazing!

R: the only reason I would say take it out . . I'm not quite sure

R2: dense you can't see - margin

R: your either gone to do something or your going to return the patient for screening, alright?

R2: mm

R: that's what you have to decide

R1: except that sometimes you do call back in three or six month's

R: I know that we all bugger about. We shouldn't though, we shouldn't I say we shouldn't

R1: ninety nine percent it's benign

R: For all your doing is scaring the woman to death for . . you know for three months. . . she goes round thinking she might or she might not it doesn't do anyone do any one much good

R1: I think that's benign

R2: same here

R3: if it's an extra I think the calcification is benign I am just a bit concerned about the density . . alright ok I

(4)

R3: well there's a um stellate lesion in the

R: stellate . . star-shaped

R: its absolutely beautiful for a star shaped lesion . . . stellate lesion

R2: Alpha Centuri

R:3 um the right outer behind the nipple it has to come out its malignant

R: mm notice how dense it is for its size its only about a centimetre and a half but its real dense eh . . .and do you think it will be a scirrous. It might be eh but its very straight see those straight

R:1 R2: R:3 mmm saw that

R1: well there is an obvious (what) two or three dense centimetre lesion arising from the posterior inferior, and lateral aspect of the right breast centering on the pectoral muscles and it doesn't but it doesn't appear to have got behind it theres spiculations that are coming. . . out of it . . . no overlying parenchymal distortion that I can see and there's no skin retraction . certainly its most likely a malignant lesion given the density and its spiculation

R: where is it in the AP?

R2: I just wonder if there's any better imaging to. . . .

R: There are a lot of other pictures but those are the only picture that showed it

R2: mm well certainly, its very posterior its inferior and its slightly lateral em I was just wondering whether a clearer picture?

R: we tried them all . . . round the corners and all sorts . . . again highly suspicious - well

R: so there you have a lesion in one view and its impalpable they can't feel it

R2: I think its malignant lesion

R: oh good so do we

R: and they went in there and they found it was a deep carcinoma stuck to the pectoralis major muscle

R2: be a mastectomy

R: You see you can't go away and forget about something thats just on the edge of the film

R1: its in that wrong area isn't it

R: and just because you can't get it on the other film? . . . they have made their point that's one place to remember to look right up the back . . . but yes you can't have a density that big in what is predominantly a fatty breast anywhere including at the back - Right!

(5)

R1: there's a relatively large (well) three centimetre dense lesion with some spiculations rising from its superior aspect can see them in the oblique lateral and this lesion needs to come out because it's suspicious of malignancy

R: yeah this is the egg with the whiskers on it . . . your not allowed whiskers on it your not allowed whiskers on any thing not even on a . . . your not allowed whiskers on a ping pong ball your not even allowed whiskers on a fingernail because one whisker

R1: is enough . . . how long do they have to be? is that even if it was a short

R: it can just be a wee short () if it comes off as a wee comet tail like a little yeah . . . an don't ask me the histology

(6)

R3: theres scattered calcification through both breasts which are of mixed density and are really quite dense

R: you're feeling better already because you see it scattered

R3: mm theres no . . . it is bi-lateral um theres no sort of obvious mass lesions

R: shape of the calciums?

R3: I think they're

R: little commas?

R3: mm . . some of them are like. . a dunno sort of saucer

R: not very craggy though?

R3: no no not craggy

R: non-craggy or non-pointy

R: any benign lesions you are worried about anything . . . any little dense things?

R3: well its just . . just this one here lets see this one here

R: that that ((pointing)) well we ultra sound that breast and there was a lot of little

((others interjecting)) are these cysts

R: they seem to be just cysts one centimetre cysts these little fellows right just did it for fun really its a very benign looking . . . mild fibroadenosis and I think that all benign calcium don't you . . . all agree

R3: when you say comma shaped what do you ?

R: well that little round blobs isn't it . . look are they a different shape in there . . not really. . they're scattered round and non-craggy aren't they totally non-craggy . . it looks like totally non-craggy therefore benign

R3: when you say comet shaped what are you . . . ?

R: aw well um a comet really is just a variation of of rounded on rounded on the edges see those are like that too aren't they . . . most of those are round they're not like that . . . not craggy or sharp like broken rocks or broken needle tips. . . now we haven't got a good example anywhere there (you'll notice) of what they call casting calcification . . . which means that you can actually see the calcium in the branching duct . . . which is intra duct, classic intra duct per se, but doesn't matter, that other stuff. It doesn't h have to be that way. . . that other one that showed the extension I still think that's intra-duct component even although its not the branching pattern . . . alright.

An important feature of this session was that the technology and the techniques for mammography were relatively new, and therefore the use of metaphors was also new to the context. This was an occasion when the high quality of the films astounded me, I felt as if I could walk right into the picture. The mood of the meeting was serious; each radiograph was considered studiously and deliberately by all the members of the group and they all offered an opinion making use of some of the above metaphors. This variety of metaphor may mean that there hasn't been sufficient time to establish, with a reasonable amount of certainty, what might be appropriate metaphorical language, that is, the language that will become recognised as "proper" by the members of the radiological community. The basis of this language is what Pepper (cited by Brown 1977) calls a "root metaphor", and what Max Black (1962:241) called a "conceptual archetype", which is a "systematic repertoire of ideas, by means of which a given thinker describes by *analogical extension* some domain to which these ideas do not immediately and literally apply".

There are two points to consider in this proposition of Black's. First, the idea of extension is concerned with symbolic understanding, and not sensory extension of the visual. Secondly, and much more importantly, is the idea that a repertoire of ideas or terms is suggestive of Kuhn's notion of a paradigm. This is also exemplified by Black (1962:241) when he says that, "a detailed account of a particular archetype would require a list of key words and expressions, with statements of their interconnections and their paradigmatic meanings in the field from which they were originally drawn" for example, the radiological gamut. R.H.Brown (1977:125) lists numerous writers, including Kuhn, who have produced similar theories to those of "root metaphor" or "paradigm". He argues that they differ from models or illustrative metaphors; they are generally below the level of conscious

awareness and in that sense, he argues, they are, and can only be, *iconic*:. "For their users they *are* the world and contain everything in it". (His italics). He argues that what is meant by "root metaphor" or "paradigm" is "its use as a perspective from which to view something else. The metaphor lies not in the thing seen,. . . but in the stance of the see-er, his standing within one picture, so to speak, in order to attain a certain vision of another" (Brown 1977:128). Metaphors can be elaborated into models, exemplified by the metaphor of the map. Hence the title of Tabar,s the Swedish radiologist's book, The Atlas of Mammography, and the contextual use of metaphors from the fields of geography and geology for describing lesions.

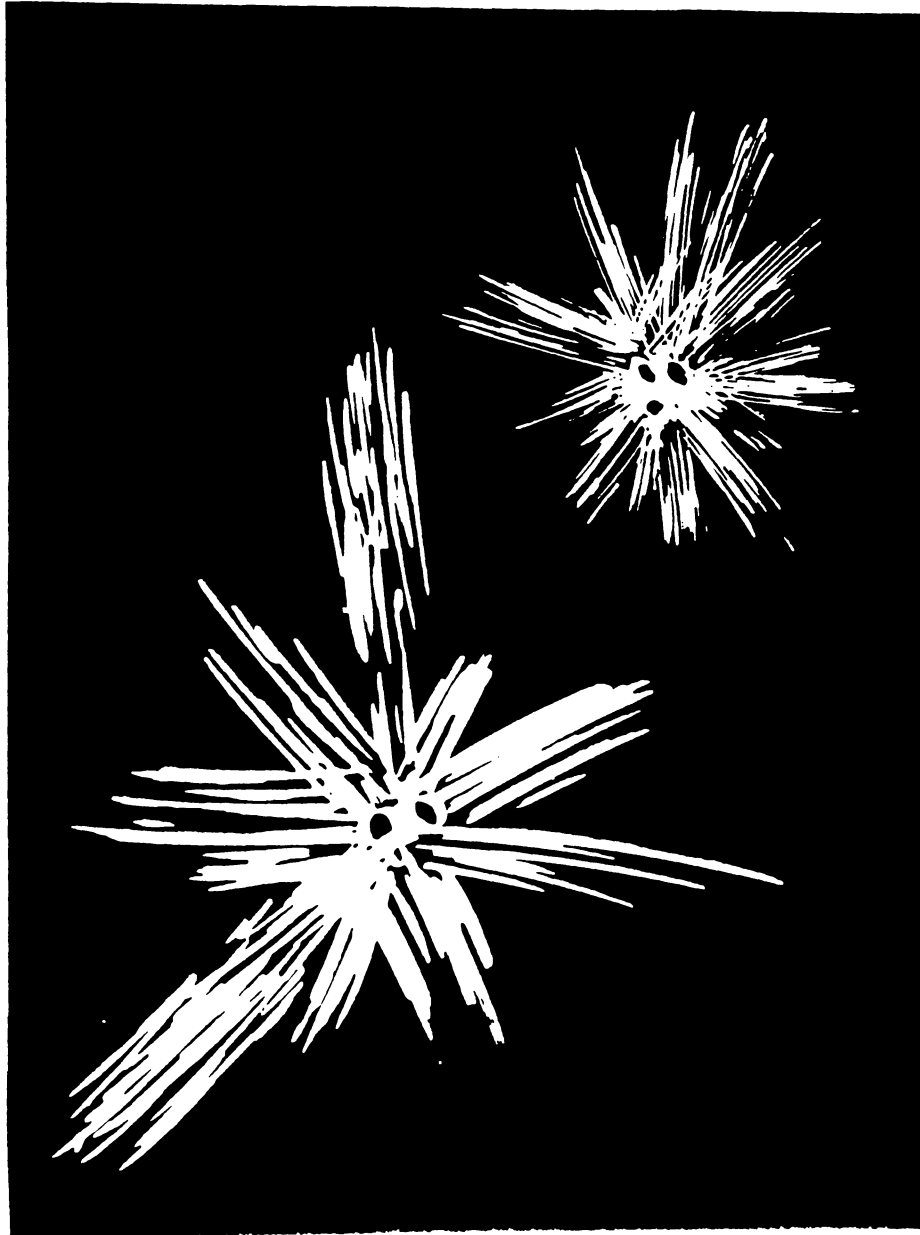
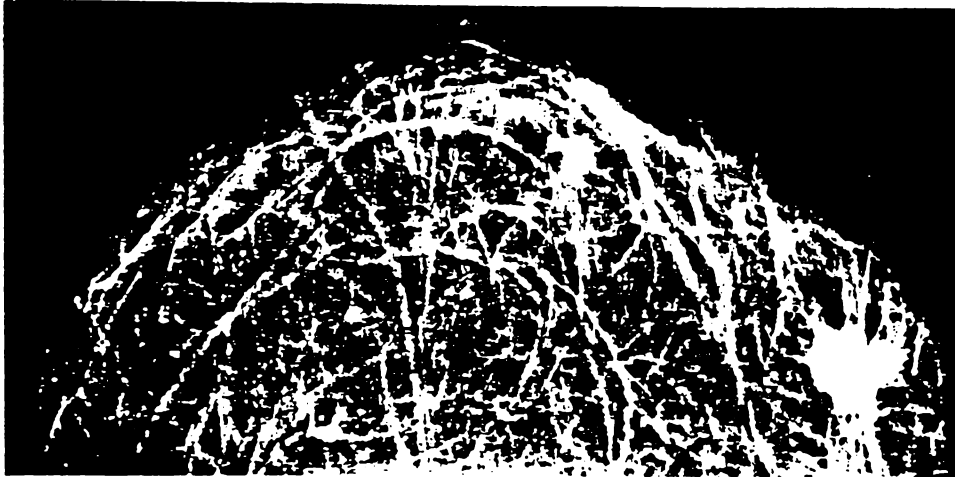


Illustration of the mammographic appearance of sclerosing duct hyperplasia.

Fig 10.1 Malignant Tumours

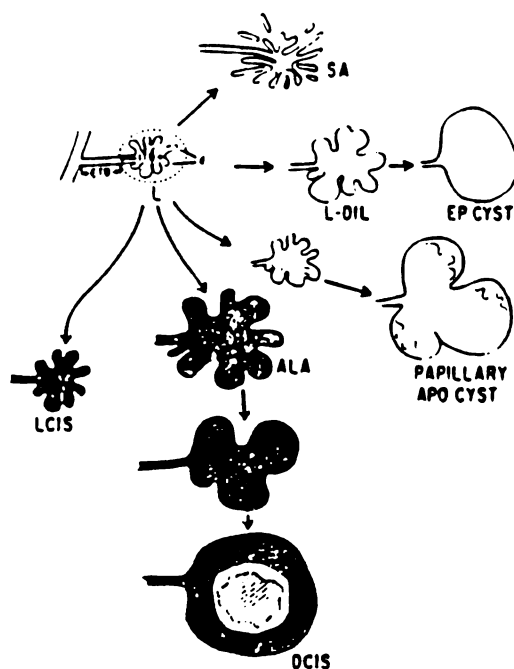
Line1 in Tabar and Deane (1985:108) states that this benign, rarely palpable lesion may be mistakenly diagnosed as carcinoma.



Craniocaudal projection. There is a stellate tumor in the lateral half of the breast 8 cm from the nipple with a distinct central tumor mass surrounded by spicules. Typical mammographic picture of infiltrating duct carcinoma.



Fig. 2a, b. Comparative analysis of the parenchymal contours reveals a contour retraction and short spicules (arrow) indicating the presence of an underlying tumor covered by the dense parenchyma (1-cm infiltrating ductal cancer).



Proposed histogenesis of sclerosing adenosis (SA), simple epithelial cysts (E) cyst), apocrine cysts (APO cyst), ductal carcinoma *in situ* (DCIS), and lobular carcinoma *in situ* (LCIS) from terminal ductal lobular unit (TDLU). EDT, extralobular terminal duct; ITD, intralobular terminal duct; d, ductule.

J. Yerushalmy

*Consistency in the Use of Certain Symbols in X-Ray Interpretation**

SET	SYMBOL	PER CENT OF LESIONS ON WHICH SYMBOL WAS USED	PER CENT AGREEMENT BETWEEN TWO READERS		RATIO OF OBSERVED TO EXPECTED
			OBSERVED	EXPECTED	
A	Active†	42.1	51.4	26.8	1.92
	Inactive	57.9	62.2	40.9	1.54
B	Fibrotic	54.5	43.8	36.7	1.19
	Soft	60.6	71.6	40.6	1.76
	Hard	54.5	46.6	35.3	1.32
	Cavity	14.4	51.9	7.0	7.41
	Nummular	8.3	100.0	3.1	32.3
C	Checkered	62.0	59.3	42.4	1.40
	Spotted	32.9	29.5	18.9	1.56
	Honeycombed	23.7	25.0	12.4	2.02
	Smooth matrix	23.2	44.9	12.5	3.59
	Unclassified	38.2	39.2	24.6	1.59

*Observed per cent agreement between two readers in employing specific symbols and per cent agreement expected by chance in independent interpretations of three sets of x-ray films by three radiologists.

†The analysis of activity was limited to lesions that were classified as reinfection tuberculosis by both readers and excludes also such films that were classified as being of "questionable activity" by any reader.

Fig 10.5 Use of Certain X-Ray Symbols. Cited by Yerushalmy (1969:388).

CHAPTER ELEVEN

Chapter 11.Radiology: The Code 2

According to Mann (1983), contemporary semiological theorists have tended to concentrate on the analysis of discourse and linguistic passages longer than a sentence in length, but not much work has been done on the study of signification in the social actions of everyday life. This is particularly relevant to the practice of radiology where the symbolic element is not as definitive as that which forms the basis of many linguistic orders. Medical terms in themselves are definitive in the sense that they constitute and denote specific medical conditions, represented by conventional symbols in written texts and spoken language. However, the radiographic pattern is an arbitrary mark, which cannot be sensibly or safely regarded as a fixed shape in practice.

Central to the notion of a radiological code is a second order system of signification grounded on radiographic patterns. This system is also constituted by other factors such as the symbolic (e.g. gamut), the enactive (e.g. pointing) and the iconic e.g. (a radiograph of a hand in which there is specific pattern indicating a lesion). A radiological system consists of a mixture of various constituents which when combined and coordinated in the context of interpreting a radiograph, form grounds of sensibility for the reader. In this context the notion of system could be instrumental, that is, it can be regarded as a technology. This is not as clear-cut as structuralists, like Barthes and Levi Strauss, have made out. For these writers, a second order system involves the notion of *myth*, which, for Barthes, is a type of speech consisting of both the linguistic and the non-linguistic use of signs. However, there is danger in construing everything as a sign and incorporating it into a system, and in particular, grounding understanding of it in terms of binary opposition. According to Wilden (1972: 458-460), this is what happened to French semiology, where writers such as Barthes (1964) and Levi-Strauss's early work, deified binary forms. Wilden cites Leach (1970:105) among the many thinkers who recognised the can of worms associated with "the entire problematic of language, communication, system and structure".

My disagreement here is basic. Levi-Strauss has said somewhere that social anthropology is a "branch of semiology", which would imply that its central concern is with the internal logical structure of the meanings of sets of symbols. But for me the real subject matter of social anthropology always remains the actual social behaviour of human beings . . . (Leach in Wilden 1980:460)

Following Leach (1972:10), it can be assumed that all the various non-verbal dimensions of a radiological culture or community, such as the technical equipment, the radiograph, physical gestures, office lay-out, ergonomics, non-linguistic conventions, postural attitudes, radiographic signs and so on, could be organised into patterned sets, which may be incorporated into a code in much the same way as the sounds and words and sentences of a natural language. The justification for this thesis is "that the messages which we receive in different modes (through our various senses of touch, sight, hearing, smell, taste etc) are easily transformed into other modes". Human beings can visualise what is heard in words, they can convert written texts into speech, and as Leach points out "a musician can transform the patterns of a musical score into movements of the arms, mouth and fingers". This suggests that, at a deep abstract level, the different senses are coordinated and coded in the same way. Leach argues that it must be recognised that there are significant differences between the way in which communication takes place through the use of ordinary speech, the written word, and the manner of communication by coded conventions of non-verbal behaviour such as non-verbal signs and signals.

Leach writes that it is important to recognise that the "grammatical rules which govern speech utterances are such that anyone with a fluent command of a language can generate spontaneously entirely new sentences with the confident expectation that he will be understood by his audience". He emphasises that this is not the case with most forms of non-verbal communication because *conventions can only be understood if they are familiar*. This highlights the importance of the ability of members of a community to share both linguistic and non-linguistic meanings, and it also points to the problems associated with a private language.

Demonstrating that the syntax of non-verbal "language" must be considerably simpler than that of spoken or written language, Leach (1972:11) argues that "A private symbol generated in a dream or in a poem, or a newly invented 'symbolic statement' of a non-verbal kind, will fail to convey information to

others until it has been explained by other means". He further argues (1972:11) that there is "only an *analogic* similarity between the generation of new sentences by an individual engaged in spontaneous discourse and the generation of new customs by a cultural community over a period of time" (my italics). He also points out that little is understood about either.

With respect to radiology, as far as I am aware there have been no attempts so far to organise linguistic and non-linguistic constituents into a code or system. I now identify some factors that may be central to rules and conventions that govern the selective interpretive process used by radiologists. This exercise is directed at a way of explaining human behaviour and would reveal the inherent difficulties associated with the structural systems approach. I question those analyses that attempt to incorporate all non-linguistic and linguistic factors into a single code. This is a point that Wilden (1972) makes when discussing the continuing tendency in the modern world to digitise everything. Despite any code considered in its totality, being an analog or metaphor of something, a digital code is an abstraction and its use is therefore instrumental in mediating the relationship between a sender and receiver. In contrast he says "an analog code is the relationship" or the totality of the experience.

Further difficulties associated with the structuralist/system approach are outlined by Pitkin's (1973:82) point that people do not say all that could be said. "We do not talk all the time, do not utter everything that happens to be true, or everything we know, or everything we think. As a consequence, when we do speak, that action itself has significance; the context in which we do speak and our act of speaking have implications for the meaning and the sense of what is said." Furthermore, to support this, she cites Toulmin's argument that medieval logic dealt with context-dependent utterances rather than "timeless propositions", and, that language does not consist of "timeless propositions", but of utterances which are dependent in all sorts of ways on the context or occasion on which they are uttered. "Statements are made in particular situations, and the interpretation to be assigned to them is inextricably bound to their relation to these situations. In this respect they are like fireworks, signals or Very Lights" (Pitkin 1973:82).

The notion of "context-dependent utterances" emphasises Voloshinov's (1973) (cited by Hodge and Kress 1988) criticism of Saussurean based linguistics. Voloshinov argued that Saussure had discarded the social implications of the speech act. In contrast, Voloshinov asserts that the utterance is a social phenomenon. Placing the utterance, i.e. a unitary semiotic act, as the focus of "social semiotics" he argues that

The form of signs is conditioned above all by the social organization of the participants and also by the immediate conditions of their interaction. (Voloshinov in Hodge and Kress 1988:37)

As Hodge and Kress (1988) point out, Voloshinov's perspective was a distinct break from those who followed the path of structural semiotics - a discipline which has its place, but can in practice lead to forgetfulness of contextual and social considerations. Hence their stress on "semiosis" and process, rather than semiotics, which implies structure with all the connotations of closed systems.

Unlike many other forms of scientific knowledge that depend to a large degree on written discursive language, radiologic reporting tends to be cryptic. This is because it is supported by radiographic evidence. The significance of this is that radiological language is dynamic and fluid, unlike what Wheelwright (1963) calls "blocked language"; that is, language that is characterised by meanings that have become static or frozen. Arguing that the specificity of scientific and technical closure depends on the stipulated manner in which it is closed, he explains;

When language is closed by stipulation as is done in scientific and logical usage, the aim is to get rid of ambiguity as far as possible and to establish scientific precision combined with shareability by all "normal observers" or in the case of technical matters "all qualified observers". (Wheelwright 1963:3)

Static meaning occurs through the use and advocacy of prescription, which is common in paradigmatic speech that contains jargon or technical terms. It contrasts with what Wheelwright (1963) calls the "freshly borne" metaphor which is a reference to those perspectives that are "in the making", and which involve the "unveiling of some perspective that has not been already ordered into the public map". An example of this was the lesion described as "an egg with whiskers" in chapter 10. Creating new metaphors seems to be an ongoing activity in the practice of radiology where technologies, methods, and, significantly, people are liable to change.

Nevertheless, radiologists are required to use objective, scientific terms such as "micro calcification" where the meaning does remain more or less static - unless there has been some revolutionary discovery that precipitates a change. Many of the terms in the gamut are therefore relatively static terms - although there is variation and change in the lists of causes of particular diseases. Gamut terms may also be closed by habit or experience. In this sense these terms are established social facts, and thereby may provide a perceptual framework through which to perceive aspects of medicine and their practices.

To appreciate the radiographic situation, and to understand significant factors that constitute the experience of it, I will outline briefly some non-linguistic and linguistic conventions, and technical and perceptual considerations, that constitute the practice of reading a radiograph.

Although seemingly trivial, non-linguistic conventions can be important. For example, on several occasions the most experienced radiologist R4 removed the radiograph from the lighted board in order to improve the optical angle. This is quite a common practice, and may be evidence of Livingstone's (1988) thesis concerning the specific visual pathway connected with the perception of form being stimulated by movement; thereby enhancing vision.

Before placing a radiograph on the lighted board it must be checked to ensure that it is not back to front. Being transparent, the radiograph can be viewed either way: the back shows the pattern in reverse. The radiograph is read from left to right. E.L. Thomas (1969:403) notes that searching a film is not a random walk, but the shifting of selective attention. This attribute has cultural implications exemplified by Western magazine readers who shift attention readily to the upper left-hand quadrant of the page and this is reflected in higher space rates for advertising in that particular space.

Before committing themselves to an interpretation radiographic readers need to be orientated to the task in hand. This involves preparations that facilitate the appropriate attitude and a change from a naive acceptance of the immediate world to that of adopting the scientific attitude. There is nothing unusual in this; drivers, pilots, machine operators, performers, and sportspeople all carry out procedures that orientate themselves to the task in hand. These procedures precipitate the right frame of mind.

If two radiographs, of the same subject taken at different times, are placed on the board together, the older one is placed to the left. Previously, I mentioned that poking the radiograph is considered bad manners; however, pointing is unavoidable and a small pointer is sometimes made available to avoid touching the radiograph. During one session the staff radiologist remarked that sometimes he has to make sure that the inexperienced radiologist is positioned in such a way as to take advantage of the optical angle, indicating ergonomics may be important. However, I suspect that the immediate reason underpinning many of the non-linguistic conventions relate to preventing behaviour that may disrupt concentration.

According to Jaffe (1984:6), there has been a change in the belief that "the diagnostic properties of medical images were synonymous with spatial resolution; the higher the spatial resolution, the better quality of the diagnostic image". Today the problems associated with reducing an image to only one parameter have been recognised. Diagnostic information is normally too complex to summarise succinctly, and at best can be only partially summarised. This means that clear distinct lines and patterns are not necessarily the best way of communicating information via the radiograph. Sometimes fuzzy pictures provide much more meaningful diagnostic information. Jaffe argues that any new diagnostic imaging system should include the following;

- (1) Properties of the radiation interaction with tissue.
- (2) Theoretical and practical limits of resolution.
- (3) A dynamic range of data.
- (4) Sources of noise (structured and unstructured).
- (5) Artifacts.
- (6) Image acquisition time.
- (7) Number of images necessary for a complete examination.
- (8) Archival requirements.

These factors are probably too dynamic and variable to treat strictly as rules or axioms. For example, artifacts may not be a problem if sorted out during the early stages of the technical development. The same applies to image acquisition, time and noise. However, like optical illusions and Mach band effects, they have to be known by the radiologist just in case they occur. Radiologists have to be taught that there is a vast difference between the

information that is gathered directly from the body organs and what is represented by the indirect means of the body image.

The neophyte radiologist must remember three things which *do* constitute rules for seeing:

- (1) Radiographic white-grey-black values are the result of variations in the number of rays that have passed through the object radiographed to darken the film. There are always summation shadowgrams of all masses in the full thickness of the object which has been interposed between the beam source and film.
- (2) The margin of *any* shadow on the film represents a tangentially seen interface between two masses of different radiographic density. Average atomic number determines radiographic density. If one of two masses changes so that they are alike in density, there will be little differential interface and the shadow margin will disappear.
- (3) Awareness of the range of atomic numbers (radiographic densities) of objects or tissues, plus the information deduced about their thickness, shape and form, may make it possible for the reader to identify an object by name from its radiograph.

All radiologists must have the background knowledge just described, but it takes time for it to be integrated and assimilated. To understand what is involved in this process, it is useful (although perhaps simplistic) to categorise interpreters into left or right brain "see-ers", that is, those who would seem to be identified as someone whose visual orientation is either cognitively left brain or cognitively right brain. Initial pattern organisation in radiology does require an efficient response to spatial organisation as indicated by search pattern analysis. (see Fig. 11.1). This would seem to indicate right brain orientation on the first sighting of a pattern. People who are right brain orientated are supposed to be more spatially biased or lateral thinkers. Left brain orientation tends to be characterised by more logically sequential thought, which is fundamental to efficient interpretation due to the nature of radiological diagnosis. Left/right brain perception has been popularised recently by the work of Edwards (1986) with regards to teaching people to draw what they see, rather than drawing what they know.

McConville (1972), following others, categorises perception into "physiognomic" and "objectifying" states. This dichotomy is based upon Heinz Werner's distinction between "physiognomic" and "geometric-technical perception", and also on the work of Goldstein who worked with brain injured patients. Goldstein's distinction was between the "concrete" and the "categorical". McConville explains:

Concrete performances are those which flow in direct response to the immediate surrounds, and where the surrounds are experienced according to their meaning for the individual's ongoing, situated bodily behaviour. In the concrete attitude, the individual embeds himself in the world according to his ongoing motor projects. In the categorical attitude, on the other hand, the individual steps back from his direct engagement of the immediate surrounds, and instead organises his behaviour according to abstract and symbolic systems of meaning. He becomes capable, therefore, of relating to the verbal and imaginary dimensions of a situation, and of organising his experience according to abstract categories. (McConville 1972:104).

An ability to be cognitively flexible is desirable in the practice of radiology. This requires both right brain and left brain ability, that is, the ability to "see" and "read" alternatively. As Jaffe (1984) warns, treating the image as an object is fraught with dangers. Like the use of dichotomies, reification can produce confusion. It shows up during attempts to reconcile contradictory evidence from disparate or independent sources. The importance of radiological discussion as a factor in the social accomplishment of appropriate interpretations of subtle patterns, is highlighted in Jaffe's assertion that it is not the medical image's *detached fidelity* that is the significant factor in the diagnostic process; rather, it is the symbolic content that is stimulated and engendered by a radiographic image that is of fundamental importance. It is in this sense that the radiographic pattern can be compared to the cartoon, which caricatures a disease or its symptoms. This is a means of understanding that depends inextricably on the use of metaphor.

The process of radiological interpretation is fundamentally dependent on the the use of metaphor as the means of integration. The use of a metaphor such as "cottage loaf heart" by older radiologists, to describe a pattern similar to the profile of the loaf, integrates common sense knowledge of bread and the perceived pattern on the radiograph. It is in this way that the use of metaphorical language acts as a measure of actuality not in the exact sense of mathematics but by analogy. Common sense knowledge of the profile of the loaf of bread is shared by all those familiar with it, and it is in this sense that Goodman's notion of a "fair sample" operates. Fairness is a moral judgement

exercised by members of a radiological community which requires a consensus. This is achieved by collective social and ongoing negotiation which results in social closure. By ongoing, I mean daily communication, talking and discussing cases with each other, and also in specific formal venues such as conferences where ideas and knowledge are exchanged. These occasions are both formal and informal venues where metaphor can be used as a didactic device. The fundamental objective is to teach not only the neophyte but each other, regardless of experience.

Although a radiological pattern may have universal characteristics due to similarities in the patterns of disease, or the use of the same technology and methodological procedures, common sense understanding will vary from community to community. It will depend also, to a large degree, on the nature of the culture and the environment that people live in. The wider culture, to which all radiologists belong, provides not only the grounds of their common sense knowledge but is also a rich source of metaphors. Today, "cottage loaf heart" bread is no longer available from the bakers, therefore a replacement metaphor has to be found and learned by all the members of the community. The neophyte is required to learn new metaphors that have been sanctioned and legitimated by the members of the community to which he/she intends to belong. Thus "woolly", "moth-eaten" may eventually be substituted with a term that describes more accurately the osteologic appearance of "softened bone"; but however appropriate the terms are in so called scientific descriptions they are still metaphors. Considered in didactic terms, perhaps the main feature of the use of metaphors is to gain the advantage of existing knowledge and insight by way of analogy. Picture language, which has long been used to accompany everyday speech, remains appropriate for pedagogic purposes.

Underpinning much of the argument in this chapter is the question of whether radiology is a science or an art. I bring up this issue here because I have noted in radiological literature that this question seems to concern radiologists. For example, Jaffe (1984) argues that radiology is more of an art than a science, in contrast to Pantoja et al (1990) who insist that it is a science. Such differences may influence the intentions of radiologists. For example, those who opt for a structural scientific approach tend to construct quantitative models. This differs from one that relies upon a practice open to

the use of language. This raises the question of classificatory systems, which Barnes (1981:316) argues have the character of institutions. He explains:

All systems of verbal culture are equally rationally held: . . . alternative classifications are *conventions* between which neither 'reality' nor 'pure reason' can discriminate. Accepted systems of classification are *institutions* which are socially sustained" (Barnes 1981:316).

Barnes says that the notion that classificatory systems have the character of institutions is not widely understood by academics, and some even find the idea unintelligible. The institutional character of classificatory systems is also recognised by contemporary sociologists of technology, such as M.Callon (1989) who questions distinctions between technical, scientific, social and economic considerations in any sociological analysis of technological communities. He argues that from the very beginning such factors are bound inextricably into an organic whole. Like Barnes his stance avoids the use of dichotomies, which Barnes argues are false contrasts between the "rational" and the "social", or between "nature" and "culture". The significance of dichotomies in the practice of radiology is that habitual use may inhibit understanding.

Recent indications of a shift in perspective by medical practitioners is outlined in an article by Donnelly (1988), who argues that it is astounding that in many large hospitals extensive records on patients have little or no information on what the patients feel or understand about their own condition, and in some cases their impending deaths. He argues that what patients know and feel should belong to many parts of the medical record, and in particular the history of the present illness. In the past, he says that doctors have often ignored medical histories compiled from oral accounts from the patient's past and present illness by family friends, and including the oral and written statement of colleagues. The thrust of Donnelly's argument is that medical histories are created, not found. Any data compiled and recorded as history is not "reality" in any global sense, but only a version that has been selected for construction. Donnelly suggests that in the past thoughts and feelings have not been regarded as part of the medical tradition because they are not objective enough. He writes:

Nowadays, a clinician who suspects systemic lupus erythematosus or peptic ulcer disease is more likely to look to the laboratory than to a more detailed history for definitive diagnosis. The limitations of a depersonalised history (or chronicle) may not become apparent until it is time to convey the diagnosis and its implications to the patient and family, to propose therapy, and to actually treat the patient. (Donnelly 1988:824)

McConville (1972), Lakoff and Johnson (1980) all argue that most people clarify and organise their thinking through the use of ontological metaphors such as those associated with spatial factors. For example, when people conceptualise and verbalise their emotional experience they speak of "depth" of grief and depression, getting "high" on love, joy or enthusiasm, and "narrow" minded. McConville (1972:106) argues that there are literally *no* spatial dimensions to these phenomena, and yet the spatial metaphor influences how people think about them. The strength of the spatial metaphor's expressive qualities is gained by the ongoing primordial contact that people have in their immediate experience in the world. But, more importantly, the use of spatial metaphors exemplifies the distinction that Merleau-Ponty made between the objective physiological body of physical science from the phenomenal body of experience and behaviour. These arguments have profound significance when applied to more disciplined modes of thinking, such as scientific theorising. McConville explains that scientists typically formulate and convey their insights through spatial imagery such as continua and hierarchies; he argues that "the structures of space provide a very natural and convenient language for the "higher order" mental processes".

Donnelly (1988) makes the point that when a patient perceives and states that cancer is "eating him up" or that she has "failed chemotherapy", that these thoughts cannot be seen or touched. Such mental activities are invisible and intangible to others. The only way in which meaning can be conveyed is through, as it were, some instinctual or compulsive use of metaphor. According to R.H. Brown (1977:85), Nietzsche said that the human mind's first or immediate use of metaphor is the act of cognition itself -- the translation of sensual perception into an image. Nietzsche also argued that only through another metaphor can this image be translated into language. A prime use of metaphor is to make visible the subjective feelings of the individual. Donnelly (1988:825) writes that, "metaphor is no stranger to medicine" as an indispensable means of describing pain. "We speak of pain as burning, stabbing, knifelike, viselike crushing and the like, using words from the

familiar world of outer experience to describe distress. We speak of "burn out" polycythemia vera and "smouldering" acute leukemia".

Donnelly supports asking patients about their particular understanding of illness and its impact on their lives, by way of asking them for an image or picture of "what it is like for them". The chance evocation of metaphor cannot be depended upon. He argues that fundamental questions, "how are you?" and "what is it like?", can only be answered analogically, allusively, in terms of "as if" and likeness, by images, similitudes, models, metaphors". Implicit in Donnelly's argument is the possibility that the patient may be wiser than the doctor. This illustrates that patients, doctors and neophyte radiologists share a common world at various times during their social contact. Finally, he argues for a new language that is different from the existing technical language in use.

The radiologist is a specialist who relies inextricably on an intrinsic use of metaphor; he/she is also a trained physician who must always keep in mind that radiographic factors are *only a part* of the total diagnostic process. The importance of this may seem obvious and common sense, but common sense based on the use of synecdoche can obfuscate meaning. The situation resembles Cicourel's (1972) point, who argued that statisticians numbers (symbols) are often considered to represent the whole, because, when presented jointly with other relevant data, numbers are very persuasive in that they seem more objective and fully representative of the subject under study. This is the nature of an overly scientific approach where there is a tendency to rely solely upon the use of objective language or jargon.

Cicourel's argument also emphasises Leach's point that signs do not occur in isolation, and that a sign only conveys information when it is combined with other signs in the same context. The sign that is recognised in the radiographic context is combined with other signs that may suggest further meanings, either by analogy or contiguity. But, ideally, radiographic information should always be combined or considered as part of a wider diagnostic context including the patient's own body perspective.

The radiologist is obliged to treat each pattern or sign in a physiognomic fashion unless it is so well known or obvious that it can be recognised as the sign of a particular disease. This was exemplified on one occasion during the field work when the group of radiologists were shown a radiograph of a hand

in which the radiographic appearance of gout was quite evident to the experienced. The most experienced radiologist (R4), said immediately, when she saw the pattern, "gout", whereas the others had to satisfy themselves by reading the image and using deduction before they came to the same conclusion.

The pattern that signifies "gout", *unlike* the letters in the alphabet, is always liable to some uncertainty. However, when marks on a radiograph or a page become so well known they are recognised as immediately as known pictures. Indeed, McLuhan (1969:5) makes this point when he says that *Headlines are icons, not literature*.

The importance of the Saussurean system of linguistics is that words do not refer to things isomorphically, but point to meanings within the language system. According to Wollen (1970:117), "Saussure stressed, as his first principle the arbitrariness of the sign. The signifier (the sound-image o-k-s or b-o-f, for example) has no natural connection with the signified (the concept 'ox')".

Similarly, Peirce's three-term relationship, that he called 'the second trichotomy of signs', is their division into icons, indices and symbols. For example, when a radiographic pattern (the sign) stands for something else (the object) in context (interpretant), it will not be a fixed or permanent relationship. Categories of choice can vary between the denotative and the connotative, and even these are never clearly defined. For example, the signifier may point directly as an index - as in the case of lesion/cancer. It may resemble it as an icon e.g. a radiograph of a hand; or it may be a purely conventional symbol such as a word, for example, "gout".

Peirce divided the icon into two sub-classes: images and diagrams, and recognised that many diagrams have symboloid features due to the relationship between the parts. In the case of the radiograph the parts could include the words that provide details of the patient such as race and age. Metaphorical transference between parts of the radiograph, whether they are words or marks is a vital part of the interpretive process. This is why the notion of caricature and the selected use of metaphor are so fundamental to the practice of pattern recognition in radiology.

In essence, construing the icon as a social fact suggests two things. First, a radiographic pattern that signifies "gout" can be recognised by all competent practitioners in the same way that a written word can. Secondly, to be an accomplished practitioner means that a perceptual change does take place in order to recognise a complex pattern. This perceptual ability must be maintained through consistent and repeated practice. A great deal of this practice consists of talking and being involved in the "experience" of reading a radiograph. Individual perceptual closure is achieved through group consensus, (and negotiation between radiologists working together), in a process that relies inextricably on the use of logic. By working logically together, in what is essentially a reading process, radiologists assist one another in the construction of an image (the syntagmatic).

Radiologists work through a series of logical steps such as checking the label on the radiograph to see whether it is a man or woman, for example. Less complex and familiar patterns are known almost immediately. All radiographs are accompanied by some text. However, in the case of complex and subtle patterns, this does not necessarily ensure that they can be interpreted with ease. Nor is an algorithmic procedure a firm guarantee of 100 per cent success. The most talented trainee radiologist that I had contact with in the field work had a tendency to move too quickly through his list. I believe that this was because his style relied upon the expression of exact objective terms linked with set statements. For example, consider the following sequence by R2 during the examination of a chest x-ray:

R2: Chest x-ray of a mature adult . . . P.A. projection . . . the striking abnormality is that . . . there is an increase in . . . there is a uniform increase in density in both upper lobes circular in nature . . . the . . . the . . circular lesion in the left upper zone is outlined but in fact is irregular in density. . . does not appear to have calcium within the lesion and there appears to be generalised decrease . . . in the left lung.

Mathematical type procedures that indicate each step in a gamut list are clearly necessary, but they can also inhibit seeing an image because they may disrupt a critical and sensitive "sense" so necessary for a fluid reading. It is this critical sense that is intrinsic to the selected use of metaphor. The second point of the hypothesis, social fact construed as an icon, is the use of metonymy in the syntagmatic process. The use of metonymy is a process similar to the use of logic in mechanical or mathematical symbols, but there

are differences. (1) Each stage evokes in the reader's mind an image that constitutes part of the whole. (2) Metonymic symbolism differs from the fixed symbols used in mathematics or in written discourse. Wilden (1972:49) gives an outstanding example of the use of metonymy cited by Jakobson. This exemplifies how an image is constructed in a process that relies upon caricature, but in this case it is also a process in which the parts totally obscure the whole.

From under an ancient straw cap with a black spot on its shield, there peeked two braids resembling the tusks of a wild boar; a chin grown fat and pendulous definitely spread over the greasy collars of the calico dicky and in thick layer on the coarse collar of the canvas coat firmly buttoned at the neck. From below this coat to the eyes of the observer there protruded massive hands with a ring, which had eaten into the fat finger, a cane with a copper top, a significant bulge of the stomach and the presence of very broad pants, almost of muslin quality, in the broad ends of which hid the toes of the boots. (Uspenskij 1840-1902, cited by Jakobson in Wilden 1972:49)

In this example the medium is the written word, and as Wilden points out, it illustrates that the metonymic process is one of progressive displacement, with the order of top to bottom not just a principle of literary style. In the case of radiology, there is a build up of the image in the manner of a cartoon drawing, where each line examined by the reader changes the meaning that can be imputed to the drawing as a whole, especially if there is a meaningful contiguous relationship between parts of the radiograph. At the same time in the reader's mind, as each constituent part of the image is presented in sequence, an image will be evoked in his/her mind eventually constituting a whole or gestalt. Interestingly, like Jakobson's example where the parts obscure the whole, the eventual image that is construed from reading a radiograph is rarely seen in actuality because radiology is a practice that is based on second order experience, or in Barthes' terms, "myth".

One of the post significant factors to emerge from the field work was confirmation of McConville's (1972:111-112) point that the term "reading" is probably the most accurate description of what happens in the interpretative process. It is more appropriate than terms such as vision, sensation or even perception. All sorts of visual experiences are read, from peoples' faces to rugby matches, where reading or unfolding the play is an intentional visual act. The intentional character of the gaze is a very difficult phenomenon to capture for reflection. McConville (1972:112) says it "remains for the most part a way of experiencing rather than its self focally experienced".

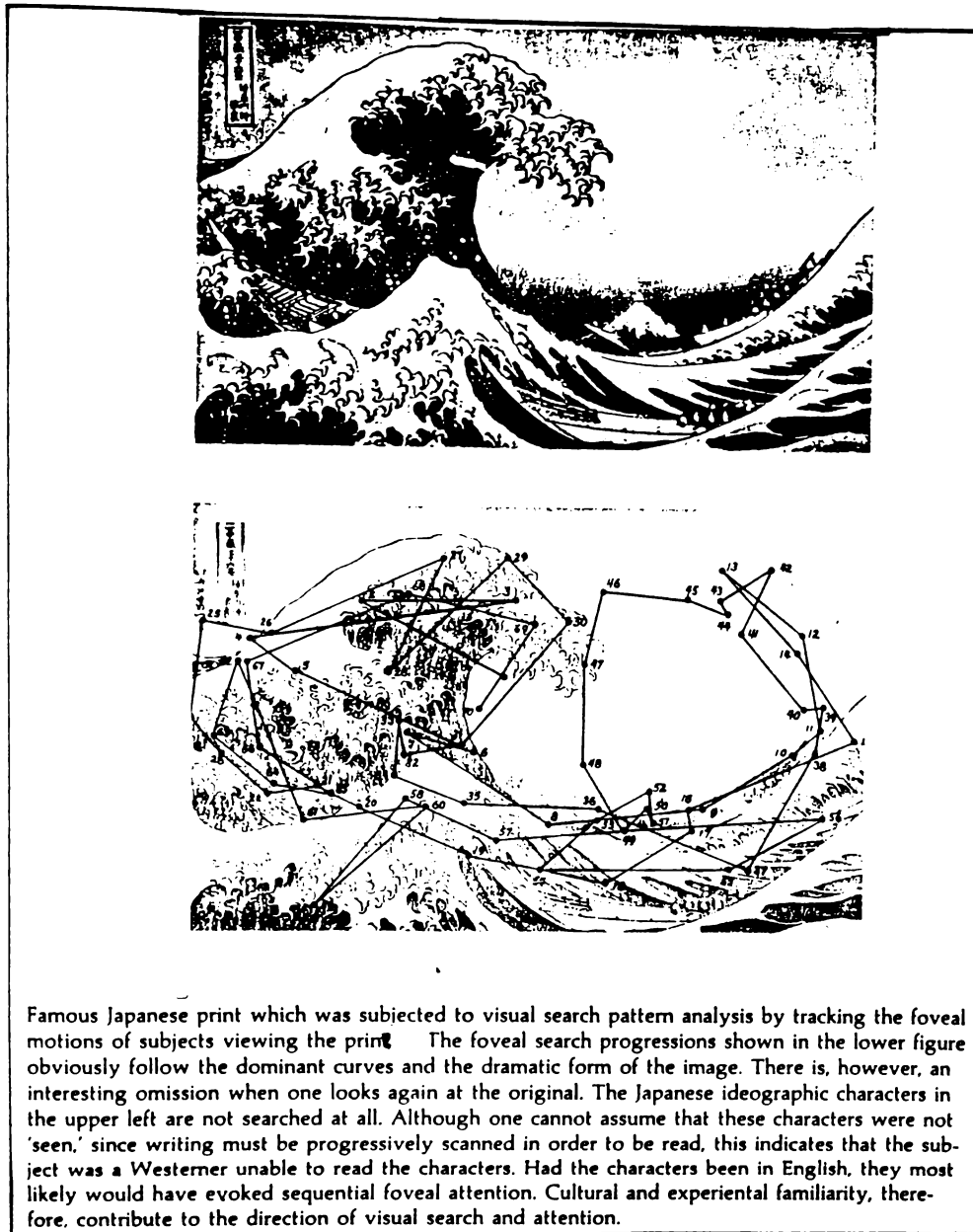


Fig 11.1 Search Pattern. Cited by Jaffe (1984:38).

CHAPTER TWELVE

Chapter 12Conclusion: Reading Pictures.

When Narcissus died, the flowers of the field were desolate and asked the river for some drops of water to weep for him. "Oh!" answered the river, "if all my drops of water were tears. I should not have enough to weep for Narcissus myself. I love him." "Oh!" replied the flowers of the field, "how could you not have loved Narcissus? He was Beautiful." "Was he beautiful?" said the river. And who should know better than you? Each day, leaning over your bank, he beheld his beauty in his waters. "If I loved him," replied the river, "it was because, when he leaned over my waters, I saw the reflection of my waters in his eyes." Oscar Wilde.

I do not look at chaos, but at things. Merleau-Ponty

My understanding of radiological practice follows Heidegger's (1977:13) advocacy of the sense of *techne* proposed by Plato and Aristotle. Their understanding of technology linked *techne* with *episteme*, both of which are broad terms for knowing. They imply the understanding of the expert who is comfortable with his or her knowing to the extent that such knowing engenders a revealing; that is, *techne* in the sense of creative art revealing what has not previously been brought forth. This is the sense of the experienced radiologist who is both technician, and artist at home with his or her expertise.

In this inquiry, in order to comprehend radiological expertise, different senses of *techne* have been considered and explored. First, the sense of technology as an artifact was discussed in chapter 8 'What is a Radiographic Image?'. Second, the sense of technological know-how, i.e., radiologists's ability when reading radiographs was demonstrated by their use of metaphor discussed in chapter 10 'Radiology: The Code 1' and 'Chapter 11 Radiology: The Code 2.' In these two chapters the third sense of *techne*, i.e. the technological system was revealed in two different ways. First, there is the syntagmatic process discussed in chapter 10 which depends upon the use of metonymy to construct and reveal what an image represents. The other sense of the system is the explicit use and involvement with technology and methods of people other than

radiologists. This is similar to the process which constitutes any film production and would include the work by radiographers, quality checks and the like. In effect this involves radiologists at work.

The situational aspects of work have become a significant domain of ethnomethodologists who have devised ways to reveal methods individuals use to make sense of their situations and this is discussed in chapter 7 in detail. In his early, rather diabolical experiments, Garfinkel (1967) revealed the fragility of the mundane when individual taken for grantedness is disturbed by shock or trouble. However, I have argued that though effective, such techniques are inadequate to reveal or grasp the way in which a technology becomes historically embodied in a life world. For example, because literate individuals knowing is so intertwined and coordinated with the world of print and grammar, awareness of the technology of print will not necessarily change understanding of the literate life-world. Much more is required.

Comprehension of the significance of embodied technology requires an understanding of perceptual change. Such change is dependent upon the length of time it takes to effect individual and collective perceptions, and on the nature of history formulated about social organisation. In order to grasp the implicit nature and manner in which the three senses of technology are intertwined in the substantiation of a social order, I prepared the way through a discussion of the history of glass in chapter 2 'Galileo: Common Sense and Practical Science'. Similarly in chapter 6 'Radiology: Some Historical Considerations'. I have outlined relevant historical points.

Unlike the telescope and microscope, glass and perspective are technologies which are not so obviously considered as technologies. Yet each of them in their own way precipitated the replacement of old signs, and subsequent development of new observational languages. In Galileo's case the creation of a new observational language was complicated by ideological considerations. The manner in which he overcame these and sought to change common sense demonstrates an instrumental use of language and techne.

The field work has suggested that the search for scientific understanding through interpretive processes that synthesise word and appearance may not have changed since Galileo's early attempts. For example, in chapter 10 page 197 a radiologist using a term from astronomy referred to the pattern on a radiograph as "Alpha Centuri".

Central to radiographic or caricature interpretation is a "pointing" to the see-er's background knowledge and/or experience. A linguistically inclined person will recognise the sentential aspect of what they see. (Hanson chapter 8). While a non-literate person will more likely remember, or recapture the image of a particular experience.

Effective radiographic reading is influenced by the radiologists ability to abstract from the radiograph, their expertise relying upon the knowledge of a particular code. This code relates to the specialist practice of perceiving the icon as an index or a symbol. In the practice of radiology, knowledge of one's gamut provides the basis of the see-er's background knowledge. Gamuts however vary and this suggests a fluidity differing markedly from mathematized and grammatically based codes.

The field work did suggest that there are elements of radiological practice that can be construed as a code, but if reading the radiograph is learned like a code this can interfere with the reader's perception, i.e. his/her ability to see. This occurs because each reading is only analogous to the next. However, there are always those patterns that remain much the same and which every radiologist knows. The fact that an image is different each time, and never placed in quite the same place, emphasises the ability required of radiologists to cope with this fluidity. In turn, this implies that visual common sense in this context is neither precise nor exact.

Radiology is fundamentally about interpretation not translation. In the process of learning the neophyte needs to understand as much as he/she can until such time as their perception alters and when it does alter, they can share with their more experienced colleagues a cultural process of collective understanding, which involves continuous acts of seeing, reading, and above all, talking. The fluidity of this interaction is exemplified in a situation where the shapes are never quite the same each time, but are sufficiently salient, through the process of caricature, to evoke specific images in the mind.

The unintended consequences of using codified information is an almost inevitable feature of specialisation and was the thrust of Husserl's argument about Galileo's use of geometry which led to the mathematization of nature. Geometers' use, application and classification of "pure limit shapes", to use Husserl's term, resulted in a situation as outlined by Sapir:

Human beings do not live in the objective world alone, nor alone in the world of social activity as ordinarily understood, but are very much at the mercy of the particular language which has become the medium of expression for their society. It is quite an illusion to imagine that one adjusts to reality essentially without the use of language and that language is merely an incidental means of solving specific problems of communication or reflection. The fact of the matter is that the "real world" is to a large extent built up on the language habits of the group We see and hear and otherwise experience very largely as we do because the language habits of our community predispose certain choices of interpretation. (Sapir 1929:207)

Sapir's thesis has a broader significance when it is extended to include the alphabet, writing, print and the exactly repeated picture, for example. The technology accounts for the major difference between oral representation and those forms which can ensure that concepts being represented are preserved in various ways outside the memories of speakers.

The artifactual nature of a form may remain frozen, as in the printed word, but people change constantly as their history changes. Fixed marks are actually arbitrary symbols which may be meaningless to people from other cultures or to those living at a later time or distant in space. Nevertheless, as Husserl argued, in a culture in which knowledge is based upon a mathematical conception of reasoning, there is a tendency to assume that the use of *exact* symbolic forms (as in geometry) is a superior way of thinking about the world. Grounded in the use of observational languages, this way of thinking is also a way of seeing.

Following Husserl, Langer's argument outlined in chapter 3 'Edmund Husserl and Galilean Science' extended Husserl's point by arguing that those sciences that have become reliant upon mathematical language inevitably become "relegated to mathematical technique". The inevitability is derived from the practices of those who organise, coordinate, and manage knowledge.

Specialisation is an inherent characteristic of the modern world with specialists belonging to each particular discipline speaking and communicating with each other in separate codes and this means, as R.H. Brown (1977:141) argues, abstract or ideal concepts, such as "information" are translated into discrete units of data. "The subject and the object are both collapsed into the operations of measurement. The recipe, in effect, defines the cake, regardless of who made it and how it might taste. . . Thus Binet defines intelligence as what is measured by intelligence tests".

Isomorphic understanding, i.e. on a word for word basis, so crucial for scientific activity, is a quite different enterprise from wanting to understand what another person is saying in a face to face situation. For example, basic to oral discourse is explanation through interpretation, not translation. Discussing oral discourse Illich and Sanders (1989) explain:

For the idealistic language inmate of a language prison this type of discourse has become either inconceivable or irritating. He finds it hard to accept that the phenomenon to which he refers the term "language" has a history --- that it was once *socially* created and may also pass away. Just as the word assumed its present form through writing, so did "language" assume its present form through the translation of texts. (Illich and Sanders 1989:54; my italics)

Nevertheless, despite the dominance of what Rorty (1980) has called "privileged representations" and the complexities involved in communication between people from disparate specialist activities, individuals do communicate with one another, albeit in mundane and common sense ways. In the taken-for-grantedness of radiological everyday life, intersubjective agreement is achieved through the sharing of many aspects of the life-world which are not classified as science or technology. For example, although radiologists employ a rather queer form of writing, radiological communication is successfully achieved to a very large extent through iconic means and talk. Communication is difficult with others outside their own specialist practice.

The notion of language as a technological process that, given the right circumstances can evaporate into thin air is incomprehensible to many people. My experience (i.e. radiological participant comprehension) assisted greatly in understanding this possibility, by providing insight into the natural fluidity of the spoken word. This phenomenon can be difficult to understand in a culture where knowledge is grounded in discursive language, and is reliant upon the technology of print.

Extensive use of an alphabet based on the technology of print has created and established a view that language is monolingual. Illich and Sanders (1989:52-54) argue that "[f]rom Saussure to Chomsky "homo monolinguis" is posited as the man who uses language - the man who speaks". This idea had no place in early Greece and the Middle Ages". Some people in Java are comfortable in several kinds of discourse. From a modern Western perspective this is an ability that could imply competence in several distinct languages. However, this is not the case. The Javanese say, "I cannot understand you", rather than, "I do not know your language". By emphasising a contextual sense of the iconic and enactive, their concern is with grasping what people have to say by explanation, gesture and summary. This contrasts with the modern notion of translation, which relies on a perception of language as something complete, as in a system or fixed as an artifact. The notion of language as a system had no place in cultures where the boundaries of speech are fluid, and where the iconic and enactive constituents form a substantial part of explanatory and interpretive processes.

Except where there have been recent attempts to use computers as interpreters, radiology is a practice still very much dependent upon an instrumental use of human perception. Reliance on an individual's visual perceptions and subsequent interpretations would seem to be an exception to a linguistic situation that exemplifies scientific exactness, i.e. operates like a code through the use of permanent and fixed shapes.

The use of pictures, such as the radiograph is a supplement to the radiologists's code as illustrated in their use of the gamut. Where the radiograph complements or completes a particular perspective in a combined mode of representation it can be described as a sort of "empirical illusion", that is, the substitution of first hand *iconic* experience with the technologised picture, implies that typifications are represented by icons.

It also emphasises that in radiological practice representations are social facts. A perspective that takes into account the technological means for producing representations. This was also noted by Max Weber (cited in Rabinow 1986) who says that 17th century capitalists were not only economic men who traded and built ships, they also looked at Rembrandt's paintings, and drew maps of the world.

In context, radiological practice can be compared to Barthes' (1987) notion of myth, where he argues that a system of communication based on pictures differs from written language in the way that the signifier and the signified are related. For example, the word r-o-s-e represents something additional i.e. the signified. In a process based on pictures, Barthes maintains that what is grasped is not one term after another but a correlation between the signified and the signifier and a third image the "sign". To demonstrate this: in nearly all Western countries red roses signify passionate love, so that associated with a bunch of red roses is the meaning of love (the sign). When a picture of a red rose is used to signify love, the signifier and the sign appear to be the same, but they are not. There is nothing intrinsic in roses that limits their meaning to passion alone. Just as the mark on a radiograph is collectively understood to mean something, the meaning that is assigned to a rose is culturally and contextually determined.

It was Barthes's contention that a reductive process occurs when the materials of mythical speech are "caught by myth". It is a bit like Pavlov's dog salivating to the ringing of a bell when there is no food, or the experienced radiologist exclaiming "gout" at the first or immediate glance when presented with a radiograph (see chapter 11). Reduction to "myth" through the use of photography as Monaco (1981:128) demonstrates, contrasts with a literate person's use of English, where a word like rose can simply be the flower, rose, or it "can be modified and confused with other similar words: rose, rosy, rosier, rosiest . . . and so forth".

In effect, Barthes's metaphor "caught by myth" is the same phenomenon that Husserl describes as "a garb of ideas" which can lead to the situation whereby users of specialised codes forget their life-world. Husserl considered that the life-world is the foundation of all knowledge. In chapter 4 ('The Frame') I have argued that the technology of the frame -being so crucial for acquiring scientific accuracy - has permeated almost every

aspect of modern life. The frame is fundamental to a variety of language codes, and these require specific knowledge of a technological perspective.

Motion pictures, photography and writing are cultural techniques that have, as Olson (1974) observes, specific limitations; but writing, according to Williams (1986), from the very beginning gained a radical technical status from its specialisation. Literacy has become the hallmark of the knowledgeable person. Freire's (1985) work exemplifies a situation where people are denied knowledge, in particular written knowledge, for reasons of power and privilege. Specialised written codes have obfuscated the role that iconic and enactive experience has in the constitution of everyday knowledge and common sense. Illiterate people see and read things, although not necessarily texts, but they do have an understanding of pictures and the iconic and enactive dimension of their everyday lives.

The need for exactness in scientific practice is demonstrated by Ivins's (1953) thesis on the significance of repeatable fixed shapes on the manner in which modern knowledge is constituted. He argued that those educated in the technology of the framed print or drawing take for granted its form. The central focus is on the symbolic content, not on the technological process as are those involved in calligraphy and radiology. Reductionism is an almost inevitable, unintended consequence associated with the use of the frame and its internal contents. This is connected to the practice of isolating phenomena from the natural world and representing them in repeatable and predictable patterns.

The reductionist tendency associated with the technology of print can be demonstrated by William Caxton's (1442-1491) decision to reproduce the English of London and the South-East of England. This was absolutely fundamental to the way English was to be spelt in the future. McCrum et al (1989) argue that Caxton's decision was no easy matter. He needed to choose a version of English that would find favour with all readers. Caxton's attempts to translate a book into English, that had already been translated from Latin to French, made him realise after two pages of strange terms that his translation could not be understood by common people. He also recognised the variations that were spoken between shires.

When Caxton settled for the idiosyncracies of the English he heard in the streets of London - "right" for instance reflects the fifteenth-century pronunciation "richt" (*ch* pronounced as in *loch*) - he (and printers like him) helped to fix the language on the page before its writers and teachers had reached a consensus. (McCrum et al 1989:86)

Unquestionably, the exactly repeatable word was a great asset to the spread of learning and knowledge because unlike oral discourse it was laid out and readily available within the framework of the printed page as though under a microscope. This technical facility inevitably focussed attention on superfluous phrases, or what were sometimes called "half-chewed Latin" words. This was in the interest of increasing knowledge by adding to common idiom during the European Renaissance. McCrum et al state that:

This sort of writing provoked Bishop Reginald Pecock to make what is, perhaps, the first proposal (in a long tradition of such proposals) to "purify" the English language. Latinate borrowings, he argued, should be purged. Instead of *impenetrable*, he proposed *ungothrough-some*; instead of *inconceivable*, he suggested *not-to-be-thought-upon-able*. Pecock was not taken seriously; by the eighteenth century, however, such suggestions were given more weight. (McCrum et al, 1989:87)

Probing the conventions associated with text and picture, Foucault (1982) reveals alternatives to the ossified forms of letters. He achieves this by focussing on the notion of the calligram. This is a poem whose words are arranged in such a fashion as to form a picture of its topic. Indeed, this could apply to the radiograph which is always accompanied by a text, providing name, age, medical history etc.

Traditionally, Foucault states, the calligram had a triple function. It was used to augment the alphabet, to repeat something without the aid of rhetoric and to trap things in a double cipher. All this was achieved by merging text and shape as closely together as possible. This creates a powerful illocutionary force that compels the reader to synthesize text and drawing.

The importance of the calligram is that the stamp of an authority is still retained in the qualitative aspect of its form; unlike the universality of the alphabet where authorship has been forgotten. There is a sense in which the radiographic image can be compared to a calligram, because the radiologist is intrinsically connected to its production through supervision and the monitoring of image quality. The subtle and complex patterns of

the radiograph present a greater challenge to the reader than any fixed form would do. Radiological interpretation requires a fluidity of interpretation, which implies an openness to language - not simple translation from image to word.

The radiographic image is always incomplete, requiring further organisation between the mind and what is seen. This emphasises that consciousness is always intentional, as the detailed fidelity of a mental image is nothing without its symbolic content. The radiologist who understands a radiograph is able to see in it the embodiment of some image or symbol that may be completely obscured to the uninitiated. This supports Squires (1969:490) point, that this can occur only if the nature of a structure, mass of tissue or lesion is known to the viewer.

This knowing, in the context of the frame as developed in chapter 4, has narcissistic consequences. First developed in relation to the photograph, Lasch (1979) has developed a wider feature in respect of the modern manager who resembles

the narcissist, who sees the world as a mirror of himself and has no interest in external events except as they reflect back on his own image. The dense interpersonal environment of modern bureaucracy, in which work assumes an abstract quality almost wholly divorced from performance, by its very nature elicits and often rewards a narcissistic response. . . . Another such influence is the mechanical reproduction of culture, the proliferation of visual and audial images in the "society of the spectacle". (Lasch 1979:47)

The narcissism theme has also been taken up by Merleau-Ponty who considers it one of the most compelling influences associated with the use of pictures, particularly photographs. Merleau-Ponty (1987:138-139) writes: "We have to ask ourselves what exactly we have found with this strange adhesion of the seer and the visible?". To answer this he suggests that the process can be compared to "two mirrors facing one another where two indefinite senses of images in one another arise which belong really to neither of the two surfaces", and, "which therefore form a couple, a couple more real than either of them". He continues,

Thus the seer is caught in what he sees, it is still himself he sees: there is a fundamental narcissism of all vision. (Merleau-Ponty 1987:139)

The see-er is drawn into what he/she knows. It is this tacit knowing or "seeing" that Polanyi (1966:4) refers to when he says, that "we can know more than we can tell". I would argue that it is the tacitness of verisimilitude that is the outstanding characteristic of the photograph. In radiology well known patterns draw the see-er into what he or she knows. This was demonstrated by the difference between the neophytes and more experienced radiologists who could instantly recognise the condition "gout" for example.

Tacit knowing through sight is the principle behind John Berger's (1972:10) claim that, "Every image embodies a way of seeing. Even a photograph. For photographs are not, as is often assumed, a mechanical record. Every time we look at a photograph, we are aware, however slightly, of the photographer selecting that sight from an infinity of other possible sights". He also argues that "although every image embodies a way of seeing our perception or appreciation of an image depends also on our own way of seeing". Inevitably, individuals, like radiologists living in the same technical culture, share their ways of seeing through social interaction in the taken-for-grantedness of daily living. The sighted person, living in a predominantly visual life-world, can be compared to a fish in water.

Unlike touch, it is difficult to control what is being seen because a great deal of the visual dimension of our lives cannot be avoided. Seeing is so pervasive and instantaneous that as an act it succeeds without recourse to an argument. To a significant degree this so among the radiologists who share a language that allows interpretation to take place. In the process of reading the radiograph that language is not usually subject to scrutiny.

Radiologists rely upon the taken for grantedness of their iconic dimension as seen through the radiographic window. Their understanding depends upon culturally derived tacit knowing, or background assumptions that they need in order to understand their specifically framed worlds. Without this knowledge the marks on the radiograph would be as meaningless as cartoons from Mars. The more general phenomenon was referred to by Novitz (1977:126-128) in terms of both affective and cognitive effects being present in pictorial representations, by incorporating beliefs and

knowledge generated by pictorial illocutionary acts. In addition, this includes the perlocutionary effects of these acts, such as moods, emotions and attitudes produced by them.

Technically speaking, the possibilities are endless for the creation of ideational shapes and picture codes. These can be used effectively to represent the typifications of everyday life, reflecting the process of metaphorical transference of almost anything one cares to imagine. This process involves the technical means of coordinating disparate constituents of metaphor, i.e. a bringing together of images (iconic) and words (symbolic) in the constitution of new ways of seeing. For those involved in their production, and for anyone who chooses or is compelled to watch, an understanding of the code can become a way of seeing. But, as Silverman (1974:44 citing Poggi) remarks, "All perspectives offer insights in exchange for limitations in approach: 'A way of seeing is also a way of not seeing'." This raises the difficulties addressed in chapter 5, 'Problems of a Visual Life-World'.

These difficulties are associated with the use of the icon as a sign, which is the very basis of picture language. At first it seemed that semiotics offered the most sensible approach to a study of pictures. Though useful in many instances the complications are well expressed by Langer:

Charles Peirce, who was probably the first person to concern himself seriously with semantics, began by making an inventory of all "symbol-situations," in the hope that when all possible meanings of "meaning" were herded together, they would show empirical differentia whereby one could divide the sheep from the goats. But the obstreperous flock, instead of falling into a few classes, each according to its kind, divided and subdivided into the most terrifying order of icons, qualisigns, legisigns, semes, phemes, and delomes, and there is but cold comfort in his assurance that his original 59,049 types can really be boiled down to a mere sixty-six. (Langer 1963:54)

I do not deny that today with powerful computers, this type of structural system could be extremely useful; but there is always the inherent danger of creating the very situation that Husserl implied with his metaphor "the garb of ideas" that inhibits seeing. Husserl was referring to science and the mathematization of nature, but it can also be applied to traditional social analysis based on written representation, particularly if there is a change from the lexical to the iconic, in the mode of symbolising in every-day life. From this it could also be argued that in some cases traditional social

analysis is deficient because, as Tyler (1986:124) argues, the model of language that has been adopted has become a "self-perfecting form of closed communication". Indeed, this is the problem when a language is transformed into a code - a concern of writers such as Roszak (1988) and Illich and Sanders (1988).

Roszak points to the historical importance of a paper by Claude Shannon, A Mathematical Theory of Communication, which established the discipline of information theory. Significantly, Shannon's paper was responsible for how the word "information" was changed from its former use of a sensible statement implying something factual, to a special technical usage abstracted from common-sense usage. "Information is no longer connected with the semantic content of statements. Rather, information comes to be a purely quantitative measure of communicative exchanges, especially as these take place through some mechanical channel which requires the message to be encoded and then decoded, say, into electronic signals" (Roszak 1988:24). For Shannon's purposes the following are deemed information.

$E = mc^2$

Jesus saves

Thou shalt not kill

I think, therefore I am

Phillies 8, Dodgers 5

'Twas brillig and the slithy toves did gyre and gimble in the wabe.

(Roszak 1988:26)

Roszak (1988:27-28) argues that the way in which information is used can be described as "messages without meanings", and this has resulted in a blurring of intellectual distinctions.

Just as it is irrelevant to a physicist (from the viewpoint of the purely physical phenomenon) whether we are measuring the fall of a stone or the fall of a human body, so, for the information theorist, it does not matter whether we are transmitting a fact, a judgement, a shallow teaching, a sublime truth, or a nasty obscenity. All are "information". The word comes to have vast generality but at a price: the meaning of things communicated comes to be levelled, and so too the value" (Roszak 1988:27)

The second point Roszak makes about messages without meanings is that "information theory" has worked. One has to acknowledge the staggering advances made through the use of this powerful instrument, exemplified by the "micro-chip" revolution. His concern, nevertheless, is that the focus has inevitably shifted. The success has contributed to replacing people as sources or receivers of information, with apparatus and system which is the interest of those using information theory.

In a similar vein to Roszak, Illich and Sanders (1988) have resurrected George Orwell's concept of "newspeak", which he developed through his experience in the 1930's with the promotion of standard English. Newspeak was conceived as a linguistic parody that mirrored basic English as a way of standardising speech according to the formal written word. Its essence was a form of language consisting of utterances used by people who were compelled to communicate. Orwell's "newspeak" has insidious overtones when related to "messages without meanings", but my concern is the unintended consequences of using codified information.

In the early days of radiology outlined in chapter 6 ('Radiology: Some Historical considerations'), radiographic signs had yet to be assembled into a coherent system. The elusive nature of chest x-ray patterns exemplified a fluid interpretive situation that the early radiologists struggled to standardise. Without such standardisation effective application was limited. There had to be collective agreement on what constituted the normal and the abnormal. It was many years before the identification and classification of lesions occurred and before the technology could be considered to be an effective instrument - albeit one that was inextricably dependent on human vision and interpretive capabilities. In those early days radiology was not a specialist discipline, as was exemplified in 1901 by Williams who stressed that X-rays were a valuable method of controlling one method by another. To repeat his words, "We may, by their use, not only control one method by another, but with the eye supporting the ear we also control one sense with another". (Williams, cited in Pendergrass 1945:596)

Despite the development of a secondary language based on different types of shadows, radiologists cannot afford to allow their code to inhibit the interpretive process, hence the necessity for fluidity and sensitivity in their reading. It is not like translation which can be learned by rote. It is more like music where one can learn the technique, but acquiring the art

is much more difficult. My concern in chapter 7 'Radiology: Considerations of Method', was to develop a way to discern and understand the acquisition of the tacit skills needed by an effective radiologist. Radiological practice is a life-world grounded in the use of pictures. I was challenged by coming to grips with understanding what was involved, and in particular with how to re-present the observed phenomena was the challenge.

Aspects of ethnomethodology offered an effective approach to understanding radiologists at work. Ethnomethodologists focus on the methods individuals use to make sense of their situations. This involves the concept of documentary interpretation that needs to be considered in two ways. First, there is the "folk" ways that radiologists use to make their interpretive choices. Secondly, there is the "folk" ways that the researcher employs when investigating how radiologists make their choices.

The difficulty arises when producing a report that integrates these and provides the most effective representation. Proceeding by way of an audio video tape would be very effective, but cumbersome in that it would contain much more than is actually required to demonstrate the thesis. It may not bring out the salient points as effectively as a written report, but that in turn may leave out essential aspects of the practice. Sound alone is insufficient for accurate representation.

Until recently, such dilemmas as these would not have occurred for the researcher. Today, with the advent of a wide variety of media options, the researcher is unavoidably obliged to consider the choice made and its implications for the enquiry.

Writing in the Los Angeles Times April 23, 1989, Asch, who is Director of UCS'S Centre for Visual Anthropology, suggests that it will not be too long before new anthropological research will include videodiscs placed inside the book cover. However, in the same article, Jay Ruby argues that "CD ROMs and 8-mm video and high-resolution television are not going to help us think". He complains about seeing the same ideas represented on the screen. He says: "I work with some students who are technological wizards but don't have a single thing to say". Ruby's comments also illustrate the technological trap that the specific use of one medium may hold for the unwary. However, regardless of the kind of inquiry and of the technology used, what does matter is the sense of commitment, rigour and discipline

that lies behind honest attempts at explicating and articulating aspects of what has been observed. Ruby's argument, that students should be taught how to analyse and interpret data rather than producing endless pictures is fundamental to the social constructivist approach. Interpretive flexibility is crucial; and it is a human achievement. The interpreter attempts to encompass an array interlocking phenomena - the radiographic image, the social order of those involved in institutional settings and its organisation, technical considerations and so on.

What became evident only as the field work got well under way was the specific use of metaphor in radiology. Metaphor was found to be a justifiable extension of literary concepts. In particular, this centred on the notion of "visual metaphor", that is, when an actual mark or pattern forms part of the process of metaphorical transference. Novitz (1977) also argues that there are genuine pictorial illocutionary acts; but what is involved in metaphorical extension when using radiographs, is that unless they are socialised they are meaningless marks or patterns. The Hidden Man exemplifies this, as does Bourdieu's (1990) point that the introduction and use of perspective technology for three centuries, prepared the ground for the acceptance and perception of photography as another form of symbolic system.

Regarding a radiographic pattern as a metaphor includes the subjective and illustrative, frequently omitted from scientific accounts. Theories that are created through the use of metaphors and models are not scaffolding that can be dispensed with once understanding has been reached. The radiologists' choice of metaphors exemplify this. These metaphors come from common and known aspects of their life-world. Hesse (1970:165) argues that evidence for the phenomenon comes from the fact that other people may elaborate the model to a greater extent than the original theorist had intended. Conversely, others may regard the model for some reason as unsuitable. But, she says: ". . . none of this would be possible unless the model functioned cognitively as part of the commonly understood theoretical language of that scientific community". This is also the sense of Goodman's notion of a "fair sample" - a concept that requires moral judgement and agreement by members of the radiological community for a radiographic pattern to be an acceptable icon.

A radiological community, despite its technical equipment remains dependent upon each of its individual members having the ability to provide the imagery of the radiograph with the third, or "depth" dimension. This was the topic of chapter 9 ('Radiologist: The See-er'). How this individual capacity is achieved is fundamental to appreciating the social world of a radiological community.

The ability to assign depth is central to the creation of radiological objectivity. A neophyte learns the observational language by talking and "seeing" through the radiological window. He or she becomes assimilated into a community of practitioners already skilled in "seeing". Agreement and disagreement on what is seen are collective, yet personal behavioural acts. The appropriate is treated positively and the inappropriate is rejected by other radiologists, thereby providing the shared grounds of their social order.

Both chapters 10 ('Radiology: The Code 10'), and chapter 11 (Radiology: The Code 2') discuss aspects of the radiological code, but focus on particular issues. The first of these chapters was used to identify the process of metaphorical transfer. By examining the early days of experimental radiology, it became possible to discern in the practices of the present what had once existed beneath the threshold of the currently visual. Marks and patterns (visual metaphors) had over time to be incorporated into evolving codes of medical knowledge. The creation of a new observational language, to use Foucault's words, was for the purpose of enabling radiologists to "see" and "say" in the same way as occurred with the microscope and telescope. This they achieved by forming "new alliances" between the things they saw and the words they knew.

This forming of "new alliances" is a structural process. The "rules for seeing" developed for analysis in chapter 11 outline specific aspects of structure. The syntagmatic process of producing a radiograph is the objective statement of "the rules of seeing". The technical perspective and quality of production are integral to this process. However, structural factors such as the "rules for seeing" are fluid and flexible in that they are human constructs. This notion of structure is not abstract, but is context dependent and intrinsic to the radiological life-world.

Structural considerations are particularly relevant to a practice that depends upon second hand experience and upon the signs of physical facts. Collective discourse, associated with technical aspects of x-ray production, provides means for bringing together images and words necessary to evoke the appropriate image in the see-er's mind. Spatial metaphors, and metaphors pertaining to depth, are the means whereby abstract and physical phenomena are socially objectified. Structure is achieved by reification through collective participation in radiological practice.

The social process of objectifying a physical sign may be considered more theoretically. Implicit in ways of "seeing" are different senses of reification, of shades of objectifying. There is a sense of objectivity that places physical objects of the world as outside or separate from the see-er's immediate experience of them. That is, physical objects in the world are regarded as having an independent existence from the see-er. In other words, they are regarded as factual. As Langer argues, "Sheer observation is hard to contradict, for sense-data have an inalienable semblance of 'fact' . . . Facts are something we can all observe, identify, and hold in common; in the last resort seeing is believing". (Langer 1963:14-15).

A further sense of objectifying relates to the reification of symbols. Unlike the objects and artifacts of the physical world, symbols are artificial in the sense that they have been technologically created for a purpose e.g. writing. These differ from a natural object such as a volcano. Physical objects that are active in themselves may readily be ascribed symbolic properties e.g. for religious purposes, but any sense of objectifying must involve the attribute of the typical. That is, in Schutz's words, "The factual world of our experience . . . is experienced from the outset as a typical one. . . . If we see a dog, that is, if we recognise an object as being an animal and more *precisely as a dog*, we anticipate a certain behaviour on the part of this dog, a typical (not individual) way of eating, of running, of playing, of jumping, and so on" (1975:116; my italics). In other words, in our respective life-worlds we read the typifications available to us.

Reading a radiograph is a creative act. That is to say a person or see-er does not apprehend some phenomenon as a completed form. In Lavine's words, (cited by Outhwaite 1983:69), in the "activity of providing interpretation or conferring meaning or imposing structure, mind in some measure constitutes or 'creates' the object known". Outhwaite (1983) stresses the

dynamics and fluidity of this process, and in particular suggests that variations of objectivity are possible. He proposes that what makes up "constitution" can be considered on a continuum from a solipsistic perspective, where the "objective world is my own invention", to that of positivism or empirical realism, where, as I have argued, there has been a significant emphasis on observational codes (See chapter 3).

All typifications are characterised by their repeatability. Natanson (1970:5) argues that in a typified world there is always "an horizon of typicality", but, when seeing and acting, we are compelled to seize variables that are unavoidably generalizable, and fundamentally repeatable. "Repeatability is the constitutive moment in the act. A type of act has been performed but a type which is taken as something I can do again and again". Although, if each experience is typical, it is only analogous or similar to the previous and the next. Gablik (1988:139) stresses this difference when he argues that: "Resemblance . . . unlike reflections must be self-reflexive". To support this proposition he cites George Kubler, who argued in his book The Shape of Time that the universe keeps its form by being perpetuated in self-resembling shapes. If it did not our perceptions would be reduced to chaos. However, emphasising the dialectical nature of human existence, Kubler writes:

No two things or acts can be accepted as identical. Every act is an invention. Yet the entire organization of thought and language denies this simple affirmation of non-identity. We can grasp the universe only by simplifying it with ideas of identity by classes, types and categories, and by rearranging the infinite continuation of non-identical events into a finite system of similitudes. It is in the nature of being that no event ever repeats, but it is the nature of thought that we understand events only by the identities we imagine among them. (Kubler cited by Gablik 1988:139)

In contrast to typifications based on direct experience, representative typifications such as symbols and icons become what they are (i.e. objects), through practices involving repetition and resemblance in order to achieve identity. In human terms, regardless of how exactly this process is achieved technically, it is only a part of the process reflecting one side of the coin. This has been demonstrated in the radiological field work where symbolic identity relies upon the same meaning being assigned to particular patterns by different users.

The other side of the coin relates to caricature where there is an inextricable reliance on the mental construct of the interpreter or seer. I argue that due to the pervasive nature of reification, if the verisimilitude embodied in a radiograph resembles some aspect of a symbolic order, perceptual resistance may be difficult. Seeing is fundamentally tacit, but given the right circumstances peoples' perceptions can be altered. Although this alteration may not be enduring. For to maintain a world view requires above all else, human discourse on a face to face basis, a factor that is missing from most one way media communication.

A significant conclusion that has emerged from this inquiry is the intrinsic importance of reading as a perceptual act. In the sense that reading can be equated with perception, everyone reads. McLuhan (1967) is correct when he writes that the literate person has learned to step back from the frame, picture, page, or mirror; but any inference that people living in oral cultures do not "read" is misleading. For Maori people, their land was a script, albeit a script like a picture. This changed with the advent of the European and the introduction of a culture based upon writing. Such a culture embodied the ideology of exactness. Wedde (1990:11) argues that:

It was language, and particularly the language of naming, of writing upon the landscape as upon a map, of representing the land in language, of *translating* the land into English, that resulted in that land's alienation to a system of signs the indigenous people could neither see nor hear. The land they once understood in their own language became a palimpsest overwritten by *an other* language, by a system of signs that represented the land in names, in maps, in landscape paintings, in photographs, in surveyors' codes; (Wedde 1990:11 his italics)

The concept of exactness may be based on a variety of requirements from the recall of myth to ritual acts. Its presence in the ordinary world of daily life depends upon an ideological perspective promoting the status of physical science. There is no denying the necessity and accuracy demanded by the activity of science, but scientific daily life, like any other human endeavour is fundamentally dependent upon the imprecise, inconsistent and iconic typifications of living itself, which suggests that all sciences are unavoidably social.

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