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The Truth of the Trace:
Constructing the Power of the Medical Image

by

Anne Beaulieu

Graduate Program in Communications
McGill University, Montreal

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Abstract

This thesis traces the developments of imaging technologies used for medical diagnosis. Giddens' sociological theory of modernity serves as a basis for the consideration of the bureaucratisation of medicine and the use of the patient file as source of information about health. The importance of 'inscriptions', in relation to scientific knowledge and power, is analysed through Bruno Latour's theory. Donna Haraway's call to rethink objectivity, not as a quality of universal knowledge, but as a given point of view, also influence the approach of this discussion of diagnostic practices.

The author demonstrates the need for abstract concepts of patient and disease to achieve modern medicine. The links between theoretical notions (anatomical pathology, in particular) and diagnostic practices, as well as the concept of objectivity underlying the use of technology to gather information about health are examined. The effects of the biostatistical method used to evaluate health are also discussed. Finally, the importance of context in the experience of illness is noted.

Résumé

Cette thèse tente de tracer le développement des technologies de visualisation qui servent au diagnostique médical. En partant d'une analyse sociologique de l'institution selon la théorie de la modernité de Giddens, la bureaucratisation de la médecine et l'utilisation du dossier comme source d'information sur la santé sont explorées. L'importance de l'inscription de données, par rapport au savoir et au pouvoir scientifique, est analysée selon la méthode développée par Bruno Latour. Les notions avancées par Donna Haraway quand à la nécéssité de repenser l'objectivité, non comme une qualité du savoir universel, mais plutôt comme point de vue donné sont aussi examinées.

Après avoir établi la nécéssité de conceptions abstraites de la maladie et des personnes malades pour parvenir à créer une institution médicale moderne, l'auteur se penche sur les notions théoriques (notamment le domaine de l'anatomie pathologique) et les rapports de celles-ci avec les pratiques diagnostiques, ainsi que sur le concept d'objectivité qui soutend l'utilisation de moyens méchaniques pour obtenir des données sur l'état de santé. Les répercussions sur le bien-être de la population de l'utilisation de la méthode biostatistique pour fins d'évaluation de la santé sont aussi examinées. Finalement, l'importance du contexte dans l'expression et l'expérience de la maladie est notée.

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with me and shared enough of herself that I now find I have picked up many of her (work) habits. Her unfailing support in my many endeavours over the past three years make her a model of the mentor, and her dedication to building a responsible science is an inspiration. Thanks also to Ron Burnett, who acted as co-supervisor, and who generously offered to undertake the role after his friend and colleague, Roger Keesing, passed away. I appreciated his support in this endeavour and his insightful comments.

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In memory of Roger M. Kessing.

Chapter One

Discursive Construction of Patient and Disease

Vous me parlez de mon art minutieux du détail, de l'imperceptible, etc. Ce que je fais, je l'ignore, mais je sais ce que je veux faire; or j'omets... tout détail, tout fait, je ne m'attache qu'à ce qui me semble... déceler quelque loi générale.

Marcel Proust
Le Temps Retrouvé

At the heart of this research is the attempt to understand the power of the medical image to determine the truth about health. Notions of the self, definitions of health and illness, institutional and societal priorities, cultural assumptions about technology and science, and the nature of objectivity, all are elements of a complex web that has given a dominant role to the many forms of images in Western biomedical institutions. The present examination of the use of images will centre on diagnostic and screening practices, not only in an attempt to limit the scope of this work, but also, and most importantly, because diagnosis is the site of direct and more visible links

between the institution, medical knowledge and the individual. Since "the medical system forms... a whole in which healing acts are closely linked with ideas about disease causation and models for classifying disease" (Kleinman, 1973, 208), I will examine how theories of disease are entwined with diagnostic practices, and how each influences the other.

This approach is in contrast to many studies of medical knowledge and medical technology which have attempted to show how truth overcame obstacles, or how a few brilliant individuals battled disbelief and rejection from their peers to allow truth to triumph, and advance the knowledge of the Western world. Bernike Pasveer, in her study of the development of x-ray technology, reviews these approaches to the history of radiology and calls these 'reality-push' (the truth is implicit in the images) or 'technology-push' (the x-ray machine is a logical step in ever-progressing technology) (Pasveer, 1989, 362). Recounting history in this manner results in teleological narratives of progress, which are unable to account neither for the partiality of knowledge acquired by these technologies, nor for the potential consequences of this knowledge, nor indeed for the ways in which new media (images produced) have to be incorporated into existing institutional and cultural structures. Alternately, Pasveer seeks to better understand the development of radiology by asking the following questions: How did x-ray images come

to be accepted as adequate and reliable representations of parts of the human body? How did the cognitive, social and technological organisations of the medical world change in part around the images? The answers to these questions can elucidate the sociological aspects of the growth in the use of x-rays. The same questions can be usefully put to the development of other diagnostic technologies; this is the intention of the current discussion.

Further studies which will serve as models for my research include Donna Haraway's study of sociobiology (Haraway, 1991) and Barbara Stafford's study of metaphors of medicine and art (Stafford, 1991). Both are enlightened examinations of the power of metaphor to pervade science. Furthermore, the two historians' work convincingly describes the existence of the untenability of a boundary between culture and science. Susan Leigh Star's account of brain localisation studies (Star, 1981) also examines the discipline of neurobiology in its institutional and cultural setting, and the factors involved in the clinical acceptance of research findings. The questions advanced by these authors are instrumental in shaping my own attempts to understand how contemporary medical science has come to be largely organised around the production, circulation and interpretation of images. The power of the image will thus be discussed in relation to scientific objectivity, to set the stage for a discussion of the particularities of visual forms of knowledge about health, and lead finally to an

examination of the knowledge consequences of diagnostic imaging.

In order to capture the main features of the image's predominance, I propose to examine medicine as an institution, and consider how it has grown closer to the hard sciences. These two main perspectives intersect at the point after which medicine becomes unable to deal with the phenomena of disease without selecting certain aspects of it for consideration. Therefore, I will examine how written documents become essential in making disease (1) an object that is manageable within a large institution and (2) an object that can become part of scientific work.

Latour and Scientific Change

How and why do images become relevant to the evaluation of health within the medical institution, and how is this process subsequently forgotten, once the visual proof is accepted as adequate? I have mentioned the 'power' of the image. This is a power largely derived from its institutional setting. But how did the institution come by such power? The sociologist Bruno Latour has attempted to understand the power of modern science by considering the role of "inscriptions" in the formation of modern institutions. By using a framework that is both "materialist" and "mentalist", he shows how the question of the advancement of modern science is best understood through a consideration of both visualisation and

cognition. In order to make a statement hold true, there must be a mustering of support (Latour, 1990, 23). For Latour, science advances only once the mobilisation of written proofs is actively pursued, because these support statements. Once inscriptions are mobilised (gathered and used) to show the result of a displacement (experiment, test, travel), they can be useful to science. Thus, modern science becomes the result, not of greater powers of mind, of cognition (a mentalist explanation), but rather of the conditions that permit the creation, gathering and use of traces (inscriptions). The "binocular" framework maintains a balance between cognitive efforts and the material supports for them. Modern science is not just about going to look and see, but also about being able to come back and show.

One of the principal motivators in the creation of inscriptions is the development of perspective drawing (Latour, 1990, 28). The optical consistency afforded by perspective allows objects to be handled from a common point of reference, no matter what their original setting might have been. This advantage is especially important in relation to images generated by instrumental observation; this is often the case in medical diagnosis, since it becomes possible to represent images without showing the enhancement effect of the technologies used. The technology becomes transparent, and conveys an impression of direct

access, as though the inscription were that of an everyday sight.

Immutability is another important feature of inscriptions. It consists in the quality of similarity between inscriptions, the fact of their having been reproduced exactly. The printing press certainly played an important role in the production of these immutable inscriptions.[1] Latour argues that once immutable mobile inscriptions become widely available, comparison, compilation and correction are greatly facilitated. This in turn spurs forward the development of scientific knowledge (Latour, 1990, 33). He suggests that the ability to collect large amounts of information on paper affords institutions ever greater power, in proportion to the amount of information (Latour, 1990, 21).

The advances of modern medicine can then be explained as the effect, not of a "new vision, but of the same old vision applying itself to new visible objects that mobilize space and time differently" (Latour, 1990, 33). The use of inscriptions provides a number of advantages for scientific inquiry, since scientific practices become increasingly efficient as inscriptions are mobilised:

> Scientists start seeing something once they stop looking at nature and look exclusively and obsessively at prints and flat inscriptions. In the debates around perception, what is always forgotten is the simple

[1]See Eisenstein (1979) for further discussion of the importance of the printing press.

> drift from watching three dimensional images which have been made less confusing (Latour, 1990, 39).

Therefore, to understand the magnitude of Western medicine's effects, one need not seek grand explanations, but rather, should examine the many skills developed to produce images, and read and write about them (Latour, 1990, 22). Modern medicine, then, is the result of a shift from "small scale practice to large scale manipulation of records", so that

> the same medical mind will generate totally different knowledge if applied to the bellies, fevers, throats and skins of a few successive patients, or if applied to well kept records of hundreds of written bellies,fevers, throats and skins, all coded in the same way and all synoptically present (Latour, 1990, 37).

A complementary framework will be used for the purpose of elaborating this research. Sociologist Anthony Giddens describes the dynamics that have made medicine a modern institution using categories that overlap Latour's framework. Both sociologists consider written documents eminently important, and both attempt to define the particularities of inscriptions (Latour's term) and symbolic tokens (Giddens's term for an abstraction that stands for a phenomena) in relation to modern institutions. While the two definitions correspond in a number of ways, Giddens' work also accounts for the current radicalisation of the institution's practices, and the place of the

individual within the institution. At the base of Gidden's analysis is a definition of modernity as a mode of life, and as an organisation emerging from the seventeenth century onward (Giddens, 1990, 1). Yet modernity also involves the privileging of theory over experience, of objectivity over subjectivity; it further entails a connection of the local to the global. Medicine is one of the many systems through which we are involved daily and that regulate our health, income, travels, and employment. Health care is no longer managed solely in the highly localized context of family or home. Rather, modernity forces us to consider ourselves as part of large organizations and movements. To begin to unravel the many elements of modern life, Anthony Giddens describes modernity through an identification of the main parameters that have brought about its institutions: "We must look in some depth at how modern institutions become 'situated' in time and space to identify some of the distinctive traits of modernity as a whole" (Giddens, 1990, 15).

I will consider how, within medical institutions, the patient file may act as "symbolic token", how technologies may be mobilized to facilitate the formation of the files and how decisions about the health care we receive may be based on these mobilised inscriptions. I will examine diagnostic practices, using the model developed by historian and philosopher of medicine, Lester King, whose straightforward model of diagnostic practice will allow

comparisons between historically distant modes of diagnosis.

This chapter, therefore, will highlight theoretical changes in medicine, namely the advent of pathological anatomy and its impact on diagnostic practices as a medical theory. These changes will be situated within the context of a growing institutionalisation of medicine, and one which privileges diagnosis based on patient files.

Giddens' Theory

Medicine as a modern institution might be understood through consideration of some of the elements identified by Giddens in The Consequences of Modernityas being conditions necessary for the rise of a modern institution. To understand concepts of health care and the role of technology in relation to modernity, it is crucial to examine how a number of elements of modern society differ from life in the pre-modern world (Giddens, 1990, 17). In light of societal trends which effectively increase the pace of change and globalization, modern notions of time and space provide the basis for the mechanisms that enable the existence of large institutions.

In a modern setting, separating time and space from their particular contexts, their standardization or "emptying", necessitates a separation of time from a

particular time of day or occupation,[2] and separation of space and place. Time, in pre-modern life, was conceptualised as the temporal setting for social activity. Once emptied, time becomes a standardised unit, and does not require a context to be understood. Similarly, while place is a physical setting associated with social activities, space is a standardised concept independent of context (Giddens, 1990, 18). Time-space distanciation is relatively low in pre-modern society, while it exists to a greater degree in a modern one (Giddens, 1990, 101). In our present society, this distanciation is extreme, as highlighted by the fact that mechanisms that separate time and space are called upon to play such a large role in medical institutions.

To apprehend how medicine has developed in the modern world, a key notion of disembedding must be considered. Disembedding refers to "the 'lifting' of social relations from local contexts of interaction and their restructuring across indefinite spans of time-space" (Giddens, 1990, 21). Given the possibility of disembedding, caring for the sick can become a set of standardised procedures, with all the potential benefits and disadvantages that this implies. This abstraction enables coordination by institutions in many respects.

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[2]I find the French words *heure* and *temps* helpful in understanding the distinction Giddens makes here, as parallel to those of space and place.

Furthermore, time-space distanciation allows a reordering of presence and absence. It comes into play in two forms: first as symbolic tokens and next as expert systems, "systems of technical accomplishment or professional expertise that organize large areas of the material and social environments in which we live today" (Giddens, 1990, 27). The process of selection of certain elements is crucial to enabling coordination by institutions; phenomena must be made into a manageable object. Symbolic tokens and expert systems which handle them are the necessary elements for the formation and sustaining of modern institutions.

Symbolic tokens

Symbolic tokens are particularly important in this discussion. Giddens defines the symbolic token as "media of interchange which can be 'passed around' without regard to the specific characteristics of individuals or groups that handle them at any particular juncture" (Giddens, 1990, 22). The predominant symbolic token in medicine is the site where body and disease become discursive entities: the patient file. The use of the patient file to substitute for the patient, and for illness, is deeply entrenched in contemporary health care institutions, though it is sometimes resisted or refused by patients, as well as by practitioners. However, abstraction is a dominant trend in

medical diagnostic practices and this abstraction has particular consequences in terms of patients' well-being.

Written Records

The symbolic token in medicine, the file, takes the form of the *written record*.[3] Giddens himself notes the importance of writing to achieve the modern state: "Writing expands the level of time-space distanciation and creates a perspective of past, present, and future in which the reflexive appropriation of knowledge can be set off from designated tradition" (Giddens, 1990, 37). Written documents are a source of both rupture and continuity with the past. But they can also be what provides continuity between individuals being treated as patients in the medical system, as noted by Latour. As the health care system moves from a private, restricted practice to caring for large numbers in institutional settings, disease is detected, and related among patients. The clinic is the site of this new medicine, and there the patient has become "*l'objet relatif [du regard] puisque ce que l'on déchiffre en lui est destiné à mieux connaître les autres*" (Foucault, 1988, 84). The condition of the patient as described in the file enables comparisons to others who may be sick elsewhere, be of a different sex or considerably older.

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[3]The term written document includes a number of types of information and observations which can be numerical, graphic or linguistic, the support of which may range from paper to computerized file, etc.

This practice of comparison implies and is the result of a number of changes that I will sketch below.

In Gidden's theory, the power of medicine in the case of diagnosis resides in the fact that information contained in the file remains relevant to the institution no matter what the time and space of the patient's illness may be. In order to achieve this coordination, the notion of disease must also remain constant, regardless of time and space in which it may be found; disease must be abstracted from the spatial and temporal setting of social relations.

Diagnosis as a Concept

The transformation of medicine into an institution, and a body of knowledge that depends largely on disembedding practices for diagnosis, took place over the past two centuries. Indeed, modern medicine began with the problem of metaphorically identifying the place of the body in the conception of disease and subsequently the actual place of the disease in the body. First, the body had to be conceived as the support of the disease. Disease was then an entity located in the structures of the body. The next step was to consider that disease consisted of the changes in function or structure of the affected body part.

Although interactive views of disease which consider that the body is sick in relation to its environment have surfaced from time to time within the institution, these

notions remained largely subsumed to mechanical views of disease, which see the body as sick onto itself (Cassel, 1986).

The past two hundred years have also seen the growth of the power of the medical institution to regulate our daily lives (Foucault, 1979). Medical evaluations and diagnostic labels have tremendous consequences for individuals. (These consequences are examined in chapter four.) In Western society, medicine and science have such power because they serve as the basis for evaluations in many realms which are not strictly medical. Furthermore, labels of fitness and inadequacy carry tremendous weight, and affect quality of life, freedom of movement, and access to education, employment and life or health insurance.

In order to contrast the evolving shape of diagnostic practices, I have chosen a fairly general framework for comparison. I will use King's framework to discuss diagnosis in relation to medicine, and show how symbolic tokens (mainly the patient file) have come to play such an important role in the practice of medicine.

There are three components of diagnosis. The first is the framework within which a choice is to be made, namely the types of categories used. The second is the particular object to be categorised; it must be determined (patient, specimen, x-ray). Finally, there is the process of decision-making itself, by which the object is categorised (King, 1982, 91). The three areas are related, and shifts

in one provoke changes in the others, as diagnosis-making in the early decades of the eighteenth century in France will demonstrate.

In my discussion of the second element of King's framework, the object to be categorised, I do not intend to show a total disappearance of the "subject" or the "body", nor will I argue that medicine currently operates without patients. Rather, I wish to show how the diagnostic process has shifted, and operates through categories and objects which are created by disembedding and are thereby somewhat removed from the embodied experience of persons seeking health care. By identifying *what* is evaluated, I hope to point to some of the consequences of making judgements of illness and health, fitness and disability, based on an abstracted collection of information.

Therefore, in referring to a disembedding of knowledge and categories, or of elements separated from particular time and space, I do not propose that medicine has become timeless and space-independent. Institutions and practices are always contextual, and much can be gained by a thorough understanding of them as such. Rather, I suggest that disembedding refers to the distanciation from the everyday of what counts as evidence for medical diagnosis.

Changing Concepts: Pathological Anatomy

Several of the developments that have allowed for the constitution of the patient file, as well as a process of

diagnosis based on the contents of this file, arose during the eighteenth and nineteenth centuries, within French medicine. Some of these changes were social and economic in nature, while others arose out of the changing status of scientific knowledge and instrumentation.

Foucault's Naissance de la clinique describes how disease began to be abstracted from the person in the eighteenth century. Rather than take into consideration the conditions of time and place, it is to better discard them:

> *Pour connaître la vérité du fait pathologique, le médecin doit abstraire le malade: Il faut que celui qui décrit la maladie ait soin de distinguer les symptômes qui l'accompagnent nécessairement et qui lui sont propres, de ceux qui ne sont qu'accidentels et fortuits, tels que ceux qui dépendent du tempérament et de l'âge du malade* (Foucault, 1988, 6).

The disease, therefore, holds a truth independent from the embodied experience of health or illness, which is apprehensible once the phenomena is purified of the accidental person in whom it manifests itself. Diagnosis must separate essence from phenomenological expression, and seek the immutable disease, and not the lifestyle or elements pertaining to a particular time and space. As will be made clear below, the body and disease share a different relationship; the body as anatomical structure becomes the locus of disease. As the disease comes to correspond to the body, so the body will come to correspond to the disease, according to the logic of pathological anatomy. Throughout these transformation, the symbolic token plays a

progressively more important role as a disembedding mechanism.

The methods used for diagnosis in French medicine have been examined by Gunter Risse in a comparative study that shows the distinct character of French methods, in relation to those of the Edinburgh Hospitals between 1770 and 1800 (Risse, 1984, 115). Risse considers that the differences between the two schools are "significant enough to alter the entire structure and organisation of knowledge" (Risse, 1984, 115). I argue that this reorganisation of knowledge is the beginning of a widening gap between medical decision-making and considerations of the time and space of the patient. It is this discrepancy that eventually leads to an overinvestment in the contents of the medical file, with dire repercussions for both physicians and patients.

Risse describes the English mode of diagnosis in hospitals as closer to the private practice model, wherein patient history played an important role: bedside manners dictated whether the physician was to be called in again (Risse, 1984, 117). The establishment of such a relationship in the process of history-taking was difficult to effect in hospitals, for several reasons. On the part of the physicians, there was some distrust of the judgement of the lower classes, and linguistic barriers frequently interfered. Moreover, as a result of admission policies, patients frequently altered their complaints (Risse, 1984, 120). Careful history-taking seemed arduous. Class

distinctions changed the doctor-patient relationship and physicians came to occupy a place of institutional, economic and educational superiority. As a result, doctors were no longer required to exercise such caution with regard to their patients' sensibilities, and physical examinations were introduced. They served both to verify the reports of patients and to fill in incomplete or suspicious patient histories. In private practice, the object to be diagnosed had been predominantly the patient, as projected by herself through her description of her illness and symptoms. In a hospital setting, the object of diagnosis became the information obtained through history-taking. The patient's history was elicited through the physician's questions, which often required nothing more than a 'yes or no' answer. Such answers were further verified by the attending nurses who had the opportunity to observe the patients, and through physical examination (Risse, 1984). Practices of decision-making were therefore altered by a change in location of the doctor's work, from private homes to hospital.

In Edinburgh, Cullen's classification of disease, published in 1769, viewed the disease as an entity (therefore, separable from time and space):

> physicians had clearly adopted an ontological viewpoint about individual diseases, proceeding as if such diseases were real entities rather than idealised abstractions from phenomena observed at the sickbed (Risse, 1984, 123).

Thus the classification of diseases mirrored the classification of fauna and flora. This type of classification of disease had originated in the work of English physician, Thomas Sydenham, whose own work was modelled after botanical taxonomy. His method consisted in the search for specific features of diseases, and their subsequent inclusion into categories. Thus, symptoms were observed, and found to belong to two categories: (1) pathognomonic, shared by a group of patients; and (2) idiosyncratic symptoms, unique to an individual. Thus, the "individual expression of illness" was transformed into "the group experience of disease" (Reiser, 1993, 102-3). This initiated a valuation of pathognomonic symptoms over those which separated individuals (Reiser, 1993, 103). Most importantly, and in greatest contrast to the shape of diagnosis in France, Cullen's classification was based on bedside phenomena and humoral pathology.

In France, surgery flourished and students performed numerous dissections (Risse, 1984, 130), which led to discoveries about the lesions associated with certain diseases. In the wake of Laennec's work, the categories for diagnosis were revised, so that pathological anatomy became the most certain guide to diagnosis (Risse, 1984, 130). These findings were incorporated into medical practices, the attempt being to replace the patients' reports and complaints with specific findings by the examining physicians (Risse, 1984, 132-2). Thus, diagnosis operated

with new criteria, requiring physicians themselves to apprehend more specific signs. It must be stressed that the growth of importance of internal anatomical medicine is yet another basis for the construction, and use, of the symbolic token:

> *Il faut donc que le regard médical parcoure un chemin qui ne lui avait pas été jusqu'alors ouvert: voie verticale allant de la surface symptomatique à la superficie tissulaire, voie en profondeur qui s'enfonce du manifeste vers le caché* (Foucault, 1988, 138).

The work of Bichat in France is often noted as a landmark in this proactive approach to illness, since his work insisted on the need for a correlation between observable symptoms and the appearance of internal structure (Reiser, 1978, 19). For Bichat and his followers, it was the body itself which was sick, and he located functions in each organ with great precision (Crary, 1992, 81). Thus, more details about the effects of disease could be gathered by examining the corpse, since the body was the site of disease. In this conception of disease, symptoms were simply exterior manifestations of internal changes, and not the disease itself. Nevertheless, medical practices had yet to be developed to use knowledge derived from corpses and to link pathologies and living patients.

Other factors contributed to an increased focus on the interior of the body. After the 1860s, "increasingly investigators focused on disease as located exclusively

inside the individual.... The growing success of surgery using antisepsis also supported this individualist emphasis" (Star, 1981, 158). The germ theory of disease further strengthened the organism/environment distinction. Skin as limit for analysis, and patient as unit of analysis (Star, 1981, 158), became integral to medical thinking. By the mid-nineteenth century, the body had been defined as an entity and was the object of a thorough inventory, in a manner relevant to the shape of modernity,

> knowledge that also would be the basis for the formation of an individual adequate to the productive requirements of economic modernity and for emerging technologies of control and subjection. By the 1840s there had been both (1) the gradual transferral of the holistic body of subjective experience or mental life to an empirical and quantitative plane, and (2) the division and fragmentation of the physical subject into increasingly specific organic and mechanical systems (Crary , 1992, 81).

The nature of examination was further constrained. Series of provoked signs were developed to detect changes in internal structures. These provoked signs were favoured over spontaneously occuring symptoms. This validation of signs occured shortly before diagnostic instrumentation began to provide more details about the manifestations and signs of disease (Davis, 1981, 145).

Instrumentation

Following the impetus to examine the inner organs, the work of physicians came to resemble that of surgeons over the course of the eighteenth and nineteenth centuries

(Reiser, 1978, 18), in sharp contrast to a predominance of diagnosis based on patient history, urine and pulse (both naturally occuring, unprovoked signs) in the seventeenth and eighteenth centuries. The invention and growing use of several instruments (for auscultation, percussion, etc.) also focused the account of disease as one of report of physical manifestations of internal changes (Reiser, 1978, 29). Instrumentation played a major role in linking the outside to the inner organs, and it was used to capture the language of the disease itself. The stethoscope was one of the first instruments to be widely used in this manner and, like other instruments, it changed the relationship between patient and physician:

> An entirely new set of sensations and findings, elicited by physicians through the skilful application of instruments, made sense only to trained professionals. Translated into an equally new language and diagnostic signs, this exclusive knowledge created a gulf... between the sick and the examiner (Risse, 1984, 134).

It also made information more abstract, rendered it a codified language that had to be developed and learned. Thus, in the first part of the nineteenth century, physical examination took over patient accounts, increasingly considered to be unreliable; more direct links between disease and physician were sought.

A Western notion of universal anatomy that sustains, and is sustained by, a conception of ill health as similar everywhere and for everyone, without consideration of

context, could not exist without the anatomical basis of disease. While these assumptions of a common denominator underwrite the concept of disease in Western medicine, the use of symbolic tokens is nonetheless possible. Disease that has a definite form can be translated into linguistic form:

> *A la présence exhaustive de la maladie dans ses symptômes,*[4] *correspond la transparence sans obstacles de l'être pathologique à la syntaxe d'un langage descriptif: isomorphisme fondamental de la structure de la maladie et de la forme verbale qui la cerne* (Foucault, 1988, 95).

Furthermore, the existence of an abstract notion of disease allowed physicians to share theories.[5] From this anatomical basis for disease arose the possibility of eliciting signs that could be ~~put~~ encoded linguistically, graphically, or otherwise; the written record could function as a symbolic token to stand for the condition of the patient. Thus the solicitation of signs for its constitution of the written record came to occupy a predominant place in medicine.

Generally, the nineteenth-century trend towards a deeper gaze into the body has continued. Following the "*voie verticale*" that investigates the organ, deeper, smaller systems are probed -- organ, lobe, cell, gene,

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[4]Foucault uses the term 'sign' to describe a naturally ocurring manifestation of disease and the term 'symptom' to describe a medical perception. My use of the term is opposite, following Eisenberg's usage (1977).

[5]This has implications for professional coherence, since the more solid the theory about disease, its causes and its treatment, the more resistant the profession (Cassell, 1986, 21).

chromosome, DNA sequence -- all solicited for the messages they might convey. The newest diagnostic tests focus on increasingly more minute structures and physiological processes (Nelkin and Tancredi, 1989, 22-3).

Epidemics

The hardships brought by epidemics in France prompted the development of more abstract notions of disease, which can be understood in separation from a particular time and space. By necessity, epidemiology evaluates disease across individuals and regions. Therefore, while diagnosis aims to label disease in an individual, epidemiology undertakes the same project with regard to an entire population. It is only possible to identify disease in a disembedded state (and determine its presence and the degree to which it affects a population) once definitions of disease have been separated from individual patients. It has been argued that the great discoveries of anatomists could not be brought to bear in medicine until the signs of disease were systematised, so that physicians could recognize when they were dealing with the same problem (Cassell, 1986, 20).

Once disease was seen to have a stable, recognisable shape, reporting became possible. Foucault describes the need for coordination in understanding epidemics:

> *On doit transcrire l'évènement jusque dans le détail, mais le transcire aussi selon la cohérence qu'implique la perception à plusieurs: connaissance imprécise, mal fondée tant qu'elle est partielle, incapable d'accéder*

> *seule à l'essentiel ou au fondamental, elle ne trouve son volume propre que dans le recoupement des perspectives, dans une information répétée et rectifiée, qui finalement cerne, là où les regards se croisent, le noyau individuel et unique de ces phénomènes collectifs* (Foucault, 1988, 24).

Such projects also required institutional coordination. The *Académie Royale des Médecins* organised a project aimed at presenting a global picture of the pathologies affecting the French population in the early eighteenth century. This Rapport Général sur les épidémies qui ont régné en France depuis 1771 jusqu'à 1830 exclusivement was based on reports from local doctors (Goubert et al, 1993).[6] Such endeavours mark the point at which medicine became a "*tâche nationale*" (Foucault, 1988, 19), and, in the case of epidemics, the medical institution joined the police as an institution of surveillance:

> *Ce qui constitue maintenant l'unité du regard medical, ce n'est pas le cercle du savoir dans lequel il s'achève mais cette totalisation ouverte, infinie, mouvante, sans cesse deplacée et enrichie par le temps dont il commence le parcour sans pouvoir l'arrêter jamais: déja une sorte d'enregistrement clinique de la série infinie et variable des évènements. Mais son support n'est pas la perception du malade en sa singularité, c'est une conscience collective de toutes les informations qui se croisent, poussant en une ramure complexe et toujours foisonnante, agrandie enfin aux dimensions d'une histoire, d'une géographie, d'un État* (Foucault, 1988, 29).

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[6]It is interesting to note that the numbers of reports completed varied according to area, with a much greater number of reports available from the Somme, where doctors had been given charts to enter and organise their information (Goubert et al, 1993, 18).

Standardisation across all individuals in the collection of information and the application of health care can therefore be seen to accompany growth of the institution. Mobilised inscriptions give power to the institution, by supporting its claims.

From this point on, the individual is defined in relation to other sick patients, following the logic inherent in Sydenham's and Cullen's classifications:

> One of the conditions that predicates the appearance of the 'sick person' is that the diversity of suffering be reduced by a unifying, general view, which is precisely that of clinical medicine (Herzlich and Pierret, 1987, 23).

This view is possible only when what is evaluated is a series of standardised measurements elicited from the patients' body, matched with definitions of standard symptomatology of disease (Nelkin and Tancredi, 1989, 21). Here, inscriptions allow the growth of knowledge and of its application, since both disease and body share the same degree of abstraction in a written form. A conception of disease based on pathological anatomy has prompted a use of instruments, and a collection of information about disease, that are meaningful across time and space. The use of the file follows these developments.

New Practices: the Use of Forms, Graphs, and Charts

While written documents were used in earlier periods, the file as it developed at the end of the nineteenth century incorporated a greater degree of abstraction. There

is little in common between letters written to physicians to solicit advice and/or a visit,[7] and tests results of which the patient was never apprised, yet upon which a diagnosis is made. Although both practices involve written documents, it is the letters which contain most indications about the particular context of disease, and which deal with the patient's felt symptoms. Diagnosis based on signs compiled in a file subsequent to solicitation by physical examination belongs to a different concept of health, and to a modern institution. Just as certain information is selected to form epidemiological surveys (as seen in the case of epidemics in France), so the constitution of the patient file implies selection of information, the extraction of certain elements from the patient, so that they can be manipulated and understood. Through abstractions, (cases in which the patient is not always present in research or diagnostic situations), the only presence deemed necessary for the practice is that provided by the written record or image. In such instances, however, specific elements are foregrounded, deemed worthy of inscription in records and given further consideration. The manner in which technology in medicine has been used to contribute to this trend will be discussed in chapter two. The following section continues to explore how the institutional practices both favour and shape the

[7] See Goubert et al (1993) for a compilation of such documents.

collection of disembedded information through the use of various types of forms (charts, diagrams, etc.) to establish an object of diagnosis, i.e. the symbolic token.

The form is an instrument that serves both to put down observations and to shape perceptions. It is useful in enabling comparisons, but also implies a limitation of what it can choose to present, to represent. The selection of elements to be considered is related, as discussed above, to the classification of disease. Thus, at the end of the eighteenth century, in France, the medical project sought to link the interior of bodies to the clinical signs available, so that these could be recorded in hospitals and clinical practice (Goubert et al, 1993, 8).

The use of forms was also introduced at the "Fits Hospital" of London. In the latter half of the nineteenth century, early neurologists designed "fits sheets" which were used to report seizures in patients. Attendants, or the patients themselves, could use the checklist to indicate locations of spasms and other factors of the fits: "The forms were also a source of an important transformation of uncertainty: Fuzzy intercategory data were ruled out by the checklist nature of the sheet, forcing observations into a clear taxonomy" (Star, 1981, 72). A correspondence of object of study to classification was therefore established through the abstraction of certain elements. However, as some forms remained incomplete, or only hastily filled out (Star, 1981, 72),

the object of study was imperfectly constituted: physicians did away with the information they did not want, but did not always obtain all that they wanted.

The use of recording materials grew enormously in the second half of the nineteenth century (Davis, 1981, 225). With the rise of specific distinctions between the normal and the pathological, and the increase of quantitative descriptions of the state of health (lab results, measurements), forms were designed to organise such information (Davis, 1981, 225). These forms took various shapes: graphs to plot relative changes in the vital signs, outline diagrams to mark operations, fractures or dental work, charts to instantly compare a patient to the general population. Graphs were especially favoured, so that non-visual elements, such as sounds from the chest or family history, were also noted in graphic form (Davis, 1981, 226). By revealing deviations from the normal, such charts encouraged evaluation of health according to statistically typical patterns (Nordenfelt, 1993, 278).

The advent of the use of the file, and the development of ever more specific signs of pathology, affected the organisation of medicine and related professions. The increased investment in the patient file as a diagnostic object met with some resistance on the part of physicians and, most likely, of patients as well, although these are more poorly documented. The role of the physician's judgement in decision-making was one of the

main concerns of physicians in the face of these new diagnostic practices. If pathology was to be discovered through quantitative, objective signs, therapy might also come to be obtained in this manner, thereby eliding the importance of the physician (Warner, 1991). The professionalisation of nursing staff eventually brought more control to the completion of forms, and patients were soon excluded from the recording of information. Nursing as a profession was also affected by these procedures, since nurses became the ones responsible for gathering and recording information about temperature, diet, sleep, etc. (Davis, 1981, 226). Though they are often the ones responsible for the collection of the signs of disease, nurses, to this day, are limited in the decisions they are allowed to make about patient care,however, in order to preserve the physician's status. The number of medically associated specialties increased with the rise of diagnostic technology, and doctors also came to fear reliance on specialists in interpretating test results (Reiser, 1984, 104; Pasveer, 1989 366-8).[8]

Radicalisation of Modern Medicine

The current radicalisation of the founding characteristics of modern institutions, as suggested by

[8]The tension between the desire to incorporate sience into medicine, and thus raise its status, and physicians'fear of losing their prerogative on therapeutic judgement is further explored in chapter two.

Giddens, are manifest in a number of ways. The form has come to predominate:

> The patient characteristically has access to the physician only through a prefabricated route in which receptionists, secretaries and nurses relate to the patient via forms and records. You are, and are invited to become, only and precisely what the forms say you are (MacIntyre, 1979, 84).

By becoming manageable inscriptions, individuals are subsumed to the symbolic token of the file, which enables coordination by the institution:

> it is the role that matters and not the individual who fulfils it. Roles in a bureaucracy are well-defined if and only if, when one individual becomes unavailable to fill a role, another can be easily found to take his or her place. Without such substitutability, the continuities characteristic of bureaucratic transactions could not be sustained (MacIntyre, 1979, 84)

Finally, bodies once they enter the medical institution are subsumed to institutional organisation. As medical knowledge changes and is based more directly on inscriptions, practices of medicine change correspondingly; control over time and space are not present solely on the level of medical epistemology. In very practical terms, the patient is separated from her time and space, home and daily routine:

> To be a patient one must be patient with the institution and with one's body. That is probably why there are no clocks on patient and procedure floors in hospitals. Or maybe there is an absence of marked time for the same reason that there are no clocks in gambling casinos-- a way of severing patrons from their pre-established habitual temporalities so that they become more malleable to reconfigurations in the

face of a particular form of institutionalization (Singer, 1993, 103).

The subsequent chapters will further explore the constitution of patient files, and will lead to an examination of the repercussions of the use of the symbolic token as disembedding mechanism.

Chapter Two

Objectivity of Diagnosis

On alla chercher un thermomètre. Dans presque toute sa hauteur le tube était vide de mercure. À peine si l'on distinguait, tapie au fond de sa petite cuve, la salamandre d'argent. Elle semblait morte. On plaça le chalumeau de verre dans la bouche de ma grand-mère. Nous n'eûmes pas besoin de l'y laisser longtemps; la petite sorcière n'avait pas été longue à tirer son horoscope. Nous la trouvâmes immobile, perchée à mi-hauteur de sa tour et n'en bougeant plus, nous montrant avec exactitude le chiffre que nous lui avions demandé et que toutes le réflexions qu'eût pu faire sur soi-même l'âme de ma grand-mère eussent été bien incapable de lui fournir: 38, 3.

Marcel Proust
Le Côté de Guermantes I

Numerous visual artifacts inform our lives every day, in both public and private settings, on cultural and affective levels, in realistic or abstract modes. Photographs, x-rays and CAT scans, all are the result of a process of mediation that separates reality and representation. The realm of representation and the realm of the physical are distinct, in that they do not overlap completely -- one cannot account for the other. Materiality of bodies and of the diseases that affect it is lived,

embodied in relation to discourses and representations, yet cannot be reduced to them, or vice versa. However, in certain contexts, such as the modern biomedical institution, the person who becomes a patient is dealt with on the basis of a series of representations; a discursive model of bodies and disease is predominant. Thus, our reality, in terms of medical institutions, is largely articulated by the need for, and production and use of, representations.

Increasingly, medical diagnosis is based on images that represent our bodies and health status. How is the information obtained from these images? What are the elements that validate their use? How have they come to be so predominant? To begin to understand the role of images in medical diagnosis, one must examine the value of images buttressed by a belief in their authenticity. Therefore, I propose to look at the ideology of objectivity and the way it has articulated the production and use of representations in medicine, and to point to some of the knowledge consequences of this type of objectivity. An examination of the mode of mediation provides insight into the desires, ambitions and organisation of scientific and medical knowledge. Thus, the parameters of the production and acceptability of representations will vary according to the function they are meant to fulfil. The esthetic parameters that both organise the production and reflect the use of representations vary according to contexts.

Images are produced in a great number of ways, although the method usually is precise and controlled. Various elements will be enhanced in the image, depending on the values dominant in the scientific endeavour for which representations are produced.

Analyses of modes of representations in the medical field variously labelled these modes as realistic versus graphic, naturalistic versus schematic, artistic versus mechanical (Kemp, 1993; Cartwright, 1992). Yet all these modes are valued differently over time, and the changing labels indicate changing notions of objectivity. In the case of empirical inquiries or medical diagnosis based on images, the justification of the parameters that determine the images is crucial: evaluations of normalcy and pathology are established from these representations. Furthermore, the very notions of normalcy and the definitions of disease are redefined according to the representations available. However, these practices are subsumed to the scientific endeavour and to the institution that organises, promotes and demands visual diagnosis.

Defining Objectivity

Scientific knowledge is granted great authority in Western culture. Scientific access to truth, to the world as it really is, relies on a reassuring notion of objectivity. Such a concept is neither unproblematic nor unidimensional. Objectivity in the sciences has been the

subject of many debates and critiques, and out of these comes evidence of the multiplicity of this term. Objectivity, then, is a layered and plural concept (Daston and Gallison, 1992, 82).

The meaning of objectivity varies according to the context of analysis. Philosophers define objectivity as a question of reference of theory (and experiments) to the world (Hacking, 1983; Knorr-Cetina, 1992). To sociologists, it centres on value-neutrality and functions as a safeguard against the promotion of political interests (Proctor, 1991), while within scientific disciplines, it may focus discussion on the accuracy of a piece of information. I will try to define what objectivity means within modern medicine, and I will show the role that the mobilisation of technology plays in current notions of objectivity in medical diagnostic practices. Technologies considered to be objective will be shown to predominate as tools for obtaining an objective, visual proof to serve as the basis for medical diagnosis.

Knowledge always has a provenance and a context. Without embracing extreme constructivist positions that reduce all scientific knowledge to be a resultant of power moves, it is important to recognize that the elements used as 'proof', or that count as knowledge, are contingent on who wishes to use them, the prior beliefs of these users, where and under what circumstances they are to be used, and the means available to produce these proofs. Therefore, I

will attempt to link the types of information gathered about the body through its representation, and the use of these images in order to map out the notions of health and illness that predominate in Western health care institutions.

Thus, like Haraway who constructs her ideal of a feminist objectivity on the need to recognise the embodied nature of all vision, I will examine how medicine has come to constitute and legitimate a knowledge of bodies. Imaging technologies used to establish this knowledge indicate a point of view. Practices are embedded in the world and located in particular contexts; they activate ways of seeing, and render highly specific visual possibilities (Haraway, 1991, 180). I will discuss the ways in which this vision is partial and how and why it has been and is privileged.

Objectivity in History

I stated above that objectivity is a layered and multiple concept. There is therefore a need to historicise what is meant by objectivity, and to understand the types of efforts deployed to achieve it. Although much has been written about the structure of knowledge and the various forms of the methods and theories used to obtain objective facts, very little has been written about the constitution of objective images, and the dynamics involved in obtaining objective knowledge from an image in a diagnostic context.

For this reason, I focus on the work of Daston and Gallison. Daston and Gallison undertake a history of the term objectivity, decoding its varying meanings by examining illustrations found in atlases. Atlases are conceived and used to canonise knowledge, and they are meant to instruct in clear referential ways. Images contained in atlases are therefore considered to be objective and informative; they answer questions posed by practitioners of a science and can inform of the concepts, values and methods of a field. Similarly, images produced for diagnosis are created to be informative and convey truths about the object of study (the body). Moreover, the past one hundred years have seen the overlapping of the two categories; images in some atlases are similar to the representations physicians use -- atlases of x-rays, CAT scans etc. Particular definitions of objectivity can thus be apprehended from an examination of the representations in atlases, and may be related to diagnostic imaging.

Changing Concepts of Objectivity and Changing Modes of Representation

In a survey of medical, botanical and physics atlases from the sixteenth to the twentieth centuries, Daston and Gallison highlight the negative character of objectivity; objectivity consists in the removal and avoidance of certain subjective influences. The "objective" is defined in relation to the "subjective", and as there are various

forms of objectivity, these correspondingly oppose various forms of subjectivity (Daston and Gallison, 1992, 82). Thus, various aspects of the personal will be censured, according to the ideal of objectivity towards which science strives in a given context. Therefore, the removal of subjective, superfluous elements offers protection against imposing alternately esthetic, moral or theoretical elements on the phenomena studied. In each context, the same negative dynamics apply to image-making, though techniques vary. Daston and Gallison identify three basic modes of objectivity: the type, the characteristic and the individual. For sixteenth-century atlas makers, the idea of truth-to-nature takes the form of a desire to eliminate the idiosyncratic or accidental from the representations (Daston and Gallison, 1992, 84). Thus, illustrators make aesthetic judgements that reduce the variability of the images; the 'raw' nature is digested by observers prior to their inclusion in atlases (Daston and Gallison, 1992, 85). Scientists wishing to learn from the atlas must infer from the representations, the ideal, the type (which corresponds to what nature intended), and relate it to the individual specimen encountered (Daston and Gallison, 1992, 87). The truth-to-nature found in these atlases has no room for the accidental, the blemished, or the diseased. Scientists seek Nature, and thus wish to see beyond its imperfect embodiments.

The next period delineated by Daston and Gallison spans from the seventeenth to the mid-nineteenth century. Atlases tend to depict the "characteristic" as more representative and useful to readers. Whereas the "'ideal' image purports to render not merely the typical but the perfect, ... the 'characteristic' image locates the typical in an individual" (Daston and Gallison, 1992, 88). Among characteristic representations, the naturalistic image predominates, though the idealising tendency is not entirely rejected. This manner of representing objects is considered closer to the artist's work, as opposed to work supervised by an anatomist who imposes scientific content and precision while looking over the shoulder of an illustrator. Representations that include minute details are considered to be useful insofar as they portray an individual which is characteristic of a group (Daston and Gallison, 1992, 91). Naturalistic portraits of the object 'as it is seen' follow certain conventions of course, and 'blood and guts' representations are not necessarily opposed to the more esthetic renditions of idealised types (Daston and Gallison, 1992, 91) -- they are no less mediated.

It is not surprising that pathological atlases were among the first atlases to use "characteristic" representations. The type or ideal cannot substitute for the diseased organ (Daston and Gallison, 1992, 94), and the appearance of lesions and abnormalities is of concern. At

the end of the eighteenth century, there occurs an evolution of morbid anatomy, from an anatomy relying only on the description of structures, to an anatomy based on interpretation of symptoms and their relation to anatomical lesions (Davis, 1981, 145). Medical atlases represent these new findings, that they might be learned and recognised by practitioners. Visual representations convey new knowledge of anatomy as medicine incorporates a need to recognise certain types of visible lesions. Sickness in a patient comes to be recognised from visible signs mapped onto tissues, and the appearances of these signs are learned from atlases.

The characteristic representation is the link between the "ideal" mode of objectivity and a later one of "mechanical truth." In characteristic representations, interpretation is still possible. However, insofar as one must establish the typicality of one specimen over another, judgement is still involved, and this eventually becomes undesirable (Daston and Gallison, 1992, 96). This element was the next to be eliminated in the mutating concept of objectivity.

By the middle of the nineteenth century, technologies were recruited more and more in the production of atlases. Although microscopes and the camera obscura had been available for centuries, it was only once the representation was required to be "judgement-free" that technologies of vision became an essential part of

scientific objectivity. Thus a notion of the automatic representation tied to the mechanical opened the door to the use of many technological means of representation; human subjectivity, unable to refrain from interpretation was to be bypassed (Daston and Gallison, 1992, 100). Photography was used, for example, not only to illustrate, but also to monitor the representational process (Daston and Gallison, 1992, 102). Photographs could also be used as reference for illustrations, to test the accuracy of their representations. Photography could be used to assist the production of ideal types (through composite photography), and assist in the production of abstractions (Daston and Gallison, 1992, 103). It was the policing of the self which was the most prominent element in this new mode of representation: mechanical objectivity seems to present the possibility of eliminating the "subjective".

With the advent of x-ray photography among other technologies, a new level of perception was created. No one could see as the x-ray does, and no one interferes by imposing an interpretation in the making: the representation is therefore 'technological'. Naturally, in order for these images to be meaningful, new ways of understanding, of reading the images have to to be determined and learned by physicians (Daston and Gallison, 1992, 106). In order to be useful in a diagnostic context, "to represent health and disease in a knowledgeable and useful way, the images need a context and intelligible

content. They required a way of seeing, a language by which to communicate" (Pasveer, 1989, 362). As well, correspondence to normality and pathology has to be determined, and shown (Daston and Gallison, 1992, 107). I will return to this point below; one should note here, however, that signposts of normality have to be established, and that the visual is used to determine the presence of disease in relation to norms.

Daston and Gallison note how the mechanically produced image soon found itself in courts. Law and Science are indeed sites where truth, and objectivity, notions of the real must be established. It is not surprising, therefore, that both would mobilise the mechanical mode of representation. The photograph, like the x-ray after it, "...did wield a powerful ideological force as the very symbol of neutral, exquisitely detailed truth. Even if people by then knew better, there remained in the photograph an ineradicable glow of veracity" (Daston and Gallison, 1992, 111). The need to establish the photograph as evidence soon revealed the variations that such technological mediation involve. With the rise of clashing interpretations of x-rays, mechanical representations became as controversial as other types of scientific images had been, and their transparency was contested. To reinforce objectivity, subjectivity was further curtailed by imposing a new level of policing: a more systematic control on the "modalities of distortion" (Daston and

Gallison, 1992, 112). Strict guidelines were imposed to direct the fabrication, disposition and use of medical apparatus and image-making machines. An effect of the increasing standardisation and mechanisation of health indicators is the uniformisation of various systems, for example, the adoption by American medicine of the metric system, as well as various other efforts to find international systems of measurement (Davis, 1981, 224).[9] The use of expert witnesses, to limit the extent of variation in interpretation (Daston and Gallison, 1992, 113) and the growth in professionalisation (Pasveer, 1989, 364-367) also helped curtail some major disagreements about the usability and objectivity of mechanically produced images. The same debates arise with the introduction of new types of images--videos, PET scans, etc.

In spite of disagreements, the machine represented and produced objectivity: "...constitutive and symbolic functions of the machine blur, for the machine seems at once means to, and symbols of, mechanical objectivity" (Daston and Gallison, 1992, 120). It is thus in its production without interference that lies the value of the image, and its claim to objectivity. Marey's project in the nineteenth century was to reduce the subjective element of interpretation and find the language of the phenomenon in

[9]For example, the Physikalisch-Technische Reichanstalt was established in Charlottenburg, Germany in 1887. It served as a model for standards boards in other centers in France and the U.S. (Davis 187).

graphic renditions (Marchessault, 1993, 24). This type of objectivity is distinct from the earlier objectivity that is concerned with questions of verisimilitude or resemblance of earlier image makers (Daston and Gallison, 1992, 120). Likeness, a realistic depiction, and the exact reproduction of details were no longer the prime warrantor of scientific accuracy. To the early twentieth century medical community, an x-ray in black and white was more accurate, useful and objective than a colour drawing. Indeed, in an attempt to understand the esthetic of scientific representations since the advent of nineteenth century physiology, Lisa Cartwright notes the rise and dominance of a 'graphic' mode (as opposed to a naturalistic one), so that what was being produced were graphs, not "pictures" (Cartwright, 1992, 131). This period marked the beginning of optical renditions of non-visual elements (Cartwright, 1992, 134), which were precursors to the latest imaging technologies.

It is important to note that diagnosis based on visual proofs arises with the advent of mechanically produced images (There are other reasons for the growth of this practice which will be considered in the next section). The image produced mechanically is considered to be free of "subjective" judgement, such that it can form the basis of a diagnosis. Of course, a way of seeing is also a way of not seeing, and a number of subjective elements inevitably enter any mediation; the institutional pressures involved

in this process have been well documented.[10] However, once the institution has integrated the procedure, the making of the image is "black-boxed", taken for granted as unproblematic (Pasveer, 1989, 376).

Medicine Grows Closer to 'Science' Practices

If a new type of objectivity arose in the latter half of the nineteenth century, affecting and answering the needs of the western medical community, institutional changes also occured at this time. The role of medicine was transformed, undergoing a shift in terms of its social function. By this time, the physical sciences had gained prestige and they became models for medicine (Reiser, 1984, 179). Until then, medicine had been a gentlemanly profession, in which expertise was acquired over time, based on experience and bedside manners. But the end of the nineteenth century was a time of great optimism for the answers that science could bring to medicine:

> There was a stirring of discontent with the qualitative character of medical data; a feeling that if somehow the techniques of the physical sciences could be harnessed to medicine, it would become transformed from an art dependent on subjective judgement and institution into a science based on experimentally proved theories and quantitatively-grounded evidence (Reiser, 1984, 180).

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[10]Decisions about whether or not to recommend testing are becoming "objective", in the direction described by Daston and Gallison, since subjective elements are being removed. There is an increased use of algorithms and decision trees; these help categorise and channel patients according to statistical probabilities related to their complaints (Nelkin and Tancredi 61).

Other physicians feared the objective wave would threaten their status as decision-makers; they feared that calculation would preclude the exercise of 'moral' and decision-making faculties in clinical practice (Warner, 1991, 462-4).

Among the causes of a shift towards scientific methods were the discoveries made by individuals such as Bernard, Virchow, Pasteur, and Koch, who prized scientific methods and whose endeavours were rigourously 'scientific' (Blume, 1992, 13). Following the examples of medical researchers who applied their laboratory findings to health care, a great deal of enthusiasm for the potential of research arose, and an effort was made to bring into the hospital the notion of clinical research which brought the scientific method into a clinical setting (Blume, 1992, 13). Research in the laboratory involved instrumentation and quantified observation, and its inclusion in the hospital was one of the paths that technology took towards incorporation in the new medicine -- answering medicine's need for objectivity. Another complementary paradigm also comes into play: the doctor as applied scientist who deals with exact data. We have thus inherited

> a view of the patient as essential either as an object for or an exemplification of the results of scientific research. Viewed thus, the patient is no longer envisaged as a whole person, but only as a body; and the body itself is envisaged as a collection of parts and subsystems, each of which may fruitfully be studied in isolation from the rest. According to this view of medicine [that sees physicians as applied

> scientists] the physician reenacts with the part of the patient's body what the scientists had first achieved on the laboratory bench, and it follows that the specific complaints uttered by the patient and the care of the patient are not really part of the genuine practice of medicine at all (MacIntyre, 1979, 89).

This philosophy was further enhanced when technology became important in providing information for diagnostic (Reiser, 1978, 161). We have seen how this has affected the content of the patient file: quantifiable data is privileged.

The demands of the patient on the institution also affected the growth of this new type of medicine. Clinical science came to be associated with transformation in institutions, so that practically distinctive medicine went hand in hand with new technologies (Blume, 1992, 14). Patients seeking the best care wished to be treated by doctors with the latest techniques, using the latest technological improvement: technology stood for science in medicine in popular consciousness (Warner, 1991, 472). Although not all technologies were imaging or visualising technologies per se, their results were usually recorded in visual form, as discussed in the first chapter. Furthermore, the most spectacular technologies were those that provided images of the interior of bodies.

Standardisation

The potential for exact, precise and quantifiable measurement of the state of the body through instruments and technologies answered the requirements of mechanical

objectivity. Clinical science incorporated this mode of objectivity, and brought with it precise and reproducible measurements, and precise and reproducible observation. These could not be performed by the unaided sense of a physician: the establishment of a corpus of clinical scientific knowledge required a technology of observation and measurement (Blume, 1992, 14). Standardisation and uniformity of procedure were available through a mobilisation of technology:

> the capacity of a machine to turn out thousands of identical objects linked it with the standardising mission of the atlas, which aimed... both to standardise and reproduce phenomena. The machine also provided a new model for the scale and perfection to which standardisation might strive (Daston and Gallison, 1992, 100).

Instruments were being created that not only served in various senses to "distance" the physician from the patient (Reiser, 1984, 179), but also provided the physician with (apparently) more precise, quantifiable, and recordable information about the patient's condition. During the last decade of the nineteenth century, many clinical instruments appeared or came into use (Davis, 1981). These constitute what Blume terms the clinical armamentarium (Blume, 1992).

Standardisation of procedures and instruments carried the promise of objective, scientific results. Eduoard Seguin, champion of the use of the thermometer in the U.S., was an advocate of using instruments to give positive diagnoses: "We will soon be able to settle, like

mathematical affairs all questions relating not only to disease, but to vitality, longevity and training, studies, sports, indulgences, labours, individual and social fitness" (quoted in Davis, 1981, 82). This faith in the possibility of exact judgements took the form of biometry, the measurement of health with instruments. From this newly available data, standards set by various organisations shaped notions of good health along parameters furnished by instruments, from the mid-nineteenth century (Davis, 1981, 185). The shift in paradigms in the last decades of the nineteenth century was visible through changing metaphors of medical practice: images of navigation (the particular conditions are primary indicators of how to steer) were replaced by those of engineering, in which laws are strictly followed (Warner, 1991, 458).

Changes in social policy, by shaping the clientele of medical physicians, affected the way medicine was practiced, and favoured the practices of mechanical objectivity. Social policies allowed the less fortunate access to medical care, and a number of institutions incorporated medical examinations (army, schools, health insurance companies). The possibility of repetitive and consistent objective information-gathering was deemed "appropriate for treating large numbers of patients, and technological aids to medicine seemed to hold the answer to the challenge of the need to evaluate the health of greater numbers of people" (Blume, 1992, 18).

Furthermore, at the end of the nineteenth century, several large-scale projects of data collection were under way, and objective measures were found to be most useful for drawing comparisons between large numbers of individuals: "Collective investigations were most conclusive about those answers contingent on physical signs determined by medical instruments" (Davis, 1981, 23). Data that could be collected through methods that answer mechanical objectivity were therefore privileged.

Since the eighteenth century, the body had become the object of greater public control -- what Michel Foucault calls the "micro-physics" of "bio-power" (Foucault, 1979). Although some aspects of control over the body had always been exercised (laws regarding suicide, infanticide, incest), control grew and became more universal (Synott, 1992, 96). The gaze upon the body came to involve the general population, on a number of levels -- government or town authorities, institutions, families.

It is important to note that among the greater number of people involved in receiving attention from the medical institution, many were not consulting due to a sickness (Davis, 1981, 186). As explained above, the desire and the belief in the possibility to regulate social life through medical evaluations of suitability and fitness of individuals expressed itself as a number of social measures. Medical examinations became part of the entry requirements for the army, schools, many places of

employment. As well, the physical examinations set up certain requirements which might or might not be willfully met: recruits not wishing to be enlisted might exaggerate reports of certain symptoms, while those wishing to obtain health insurance might conceal an illness. Given these conditions for the exercise of diagnosis, it was therefore impossible to continue medicine practices that were based on the appearance of symptoms as reported by the patient. Rather, diagnosis shifted and became more abstract, focusing on elicitations of signs of the disease. The disease was to be sought, and was assumed to be latent, deep within the body. In order to be exact, the diagnosis had to be based on signs provoked by the physician, or it must be discovered through subtle variations in measurements of bodily functions (vital signs).

Loss of individuality

The knowledge acquired by a medicine that practices mechanical objectivity was shaped by the mobilisation of technology. If, indeed, standardisation warrants greater stability of medical knowledge at the cost of losing specificity (Rouse, 1987, 112), then the consequences for medicine are that the particulars of a person's situation recede from the limelight of medical attention (Warner, 1991, 463). One can then speak of standardisation in medicine:

> The three forms of standardisation that grew out of the use of medical instruments--health, disease, and instrument standards-- introduced a degree of precision into medical practice that changed the economic, social and personal aspects of medicine. Health and disease were described in greater detail with ramifications for everyone. However, the comparative element introduced into an instrument standardised medicine led to a decreased emphasis on the uniqueness of the individual treated for disease (Davis, 1981, 240).

Where late nineteenth and twentieth century medicine did consider the individual case, as opposed to the type or the characteristic, it was as an individual case evaluated in relation to all other individuals, and only in terms of certain standardised parameters inscribed in the patient file. As described above, the relevance of individual signs was established within a system that based its knowledge on objective, standardised, mechanical proofs, removed from the patient's context, from a particular time and space. This question will be addressed in more detail below.

This type of mechanical thinking about the body was influenced by the increased industrialisation and mechanisation of society: assembly-line production necessitated standardisation. The body-machine was evaluated for its efficiency, and spoken of as a series of systems (Synnot, 1992, 99-100; Martin, 1987).[11]

Definitions Change

Thus, as the individuality of the patient changed, so did the labels assigned. The mobilisation of technology for

[11]See Setzer, Bodies and Machines, for an extensive analysis of the birth of this conception of the body.

medical purposes effected changes in the manner in which diagnostic criteria were established and in the way illness was conceived of and defined (Davis, 1981, 91). The focus is no longer on illness (as the subjective experience of the patient), but rather on "disease" (abnormality of structure or function of organs), an objectively definable entity, following the definitions set by Eisenberg (1977).

The changes brought about by attempts to make medicine objective were multiple: technology changed the characterisation of signs (Davis, 1981, 155), and therefore the systems of diagnosis and treatment. The objectivity that can determine absolute difference does not necessarily detect differences that are meaningful. For example, in cases of cancer-screening procedures, a cell that looks different is not necessarily abnormal, and an abnormal-looking cell is not always a pathological one. Yet the change in the appearance of cells is the marker that an objective medicine has chosen as a sign of pathology. The repercussions of this type of diagnosis will be explored in chapter four. The changes that brought about the predominance of the use of objective proofs are multiple, as I have shown here.

Chapter Three

Visual Evidence

...les arbres, le soleil et le ciel ne seraient pas tels que nous les voyons, s'ils étaient connus par des êtres ayant des yeux autrement constitués que les nôtres ou bien possédant pour cette besogne des organes autres que des yeux et qui donneraient des arbres, du ciel, du soleil des équivalents mais non-visuels.

Marcel Proust
Le Côté Guermantes I

The previous chapters have discussed the need to determine health and illness and the possibility of doing so based on the patient file. The tools used for this purpose have been shaped by, and have shaped, medical knowledge and the medical institution. All these elements have been shown to relate to particular views of the patient and of health. Here I wish to turn to the modes of diagnosis that provide insight because they literally allow sight.

I have documented the growing absence of the self, person and body in favour of an abstract trace (the symbolic token), in relation to Western medical institutions. I have also documented a view that machines

are best able to provide objective accounts of the state of the body. This chapter will examine the use of images in diagnosis in terms of their particularities as visual evidence, and more specifically, the compelling power of images that purports to show the boundary between the normal and the pathological.

To a large (and growing) extent, the tools used to compose inscriptions are technologies of vision which provide visual proofs with which to diagnose. A major component for the building of a scientific and medical vision has been discussed; objectivity finds its expression in the mechanically produced inscription. Many other parameters aside from mechanical objectivity help constitute and organise the use of images.

When the body is visualised in a diagnostic situation, images serve as a source of information about disease which enables the physician to classify it according to the taxonomic systems discussed above. The number of technologies available to assist in this work has been expanding since the nineteenth century, because in the early nineteenth century, "what occurs is a new valuation of visual experience: it is given an unprecedented mobility and exchangeability, abstracted from any founding site or referent" (Crary, 1992, 14). The latest wave of imaging technologies originated with the mobilisation of computers to assist in the making of images: "in the late 1960s, the pace of technical change suddenly accelerated as medical

researchers and engineers began to link computers to an array of old and new data sources to create new imaging technologies" (Barley, 1988, 499). Thus, technologies such as CAT scans and PET imaging involve computers to perform calculations using complex algorithms to organise the data obtained into images.

The ability to generate images has been multiplied by the mobilisation of computers. Technologies of visualisation have embraced all aspects of the natural world and every layer of our bodies:

> the visualising technologies are without apparent limits; the eye of any ordinary primate like us can be endlessly enhanced by sonography systems, magnetic resonance imaging, artificial intelligence-linked graphic manipulations systems, scanning electron microscopes, computer aided tomography scanners, colour enhancement techniques, satellite surveillance systems, home and office VDTs, ... (Haraway, 1991, 188-9).

All these modes of imaging serves to make the world available through a mobile, disembedded vision. Poststructuralist analyses argue that these images refer to, if anything, only millions of bits of electronic mathematical data (Crary, 1992, 2; Kember, 1991). But the debate surrounding the epistemological nature of visualising technologies predates the use of computers to generate images. The nature of x-rays, utlrasounds and illustrations, as shown in the last chapter, has been the subject of intricate debates circling around the accuracy of their reference. As did Donna Haraway, I will focus on

other elements of the medical vision and the images it produces. The question is not so much one of epistemology as it is one of ethics and politics (Haraway, 1991, 187).

Technological objectivity, described in the last chapter as the reigning concept of medical discourse and practices, is often assumed to make evident the usefulness of knowledge obtained through images. Many other practices and values, however, are involved in transforming these images into satisfying accounts of reality. It is by situating these other practices that knowledge obtained through images can be rationally understood, and that its value can be weighed. In fact, denial of any subjective or contingent element in the formation of knowledge results in claims implicated in what Haraway describes as "a search for translation, convertibility, mobility of meanings, and universality" (Haraway, 1991, 187). The move to remove subjectivity from image-making leads not to a universally true body of knowledge, but rather to knowledge that is unaccountable, because it is unlocatable (Haraway, 1991, 190).

To accept the universalising story of a truth of nature involves accepting the accompanying notions of a transparent access to the objects of study. Even members of the scientific community are aware of the dangers involved in this:

> in spite of their attraction, or perhaps because of them, images create dangers for both clinicians and

> researchers--dangers intimately entwined with the benefits that imaging technologies confer. One such benefit is the illusion of familiarity. Unlike a table or chart or graph, an image often seems to be "transparent", giving us the depicted object directly, rather than through the mediation of fallible instruments that incorporate certain types of information and leave out other--perhaps equally important-- kinds of data. An image can delude us into thinking we know an object in a way a graph never can. (Crease, 1993. 561).

A thicker, more comprehensive account of where knowledge comes from and of the practices used to acquire it may lead to a better account of the world.

Such a thick description of diagnostic practices is attempted in this thesis. The past two chapters have located the use of a textual support for the state of a patient and the apprehension of disease, from an institutional and theoretical angle. Here, I continue to map out the constitution of medical diagnosis by examining how the visual technologies have beer mobilised in the medical institution. The next chapter will deal with the effects of such technologies of vision and the accompanying practices in relation to patient's well being and notions of health.

Medical knowledge can be positioned through the tools used to acquire it. The many imaging technologies literally provide *views* of the body and of disease, and are used to shape *medical views* of bodies. While Latour's argument seems to imply that the increased use of technologies can be explained as simply more and more complex ways of obtaining better (more convincing), images (inscriptions),

Haraway insists on the particularities of modes of vision, of ways of apprehending the object of study. These technologies of vision should be treated as highly specific visual possibilities:

> the eyes made available in modern technological sciences shatter any idea of passive vision; these prosthetic devices show us that all eyes, including our own organic ones, are active perceptual systems, building in translations and specific ways of seeing, that is, ways of life (Haraway, 1991, 190).

Therefore, to have knowledge that is responsible, there is a need to consider (1) that these technologies of vision are embodied, that they have a point of origin from which one sees and (2) that this is the case whether vision is organic or technological (Haraway, 1991, 189). Consequently, scientific knowledge must be positioned in relation to the tools used to constitute its views of bodies and disease.

Positioning

Such accounts of the work involved in making representations meaningful have been offered in a number of fields. Anthropology, in its medical and material culture branches, is one such field. Just as collecting and displaying primitive artifacts is not a neutral process, so scientific collection of data is not a neutral act. Just as anthropological collections cannot stand in for "cultures" (Breckenridge, 1989, 202), neither can the images gathered through scientific investigation or diagnostic inquiry

stand in for the person. A positioning of anthropological collections and displays has been carried out in a few instances.[12] The examination of collections for the availability of specimens can inform of the values of the collectors, and the relationship of the collectors, to the groups who owned or crafted the objects (Lawson, 1989, 144-80). It can also highlight the functions these objects were meant to fulfil: proofs of shocking heathenism, recognition of the native's potential for education and "civilisation" (Thomas, 1991, 139). If this type of research is compared to earlier, dominant scholarship that attempted to authentify cultural artifacts, it seems that some anthropological scholarship has taken a turn suggested by Haraway, and moved to considerations of ethics and politics in order to reframe questions of epistemology within a more grounded framework.[13] Yet medical discourse insists on the neutrality of collections and relies more and more on technology to gather information; mechanical objectivity insures the impartial selection of signs.

A tension between the neutrality of the image and its coded nature underlies most discussions of the medical image. The former implies that the image represents

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[12]Barbara Lawson has conducted such an analysis of Reverend Robertson's collection, Redpath Museum, McGill University, Montreal, Canada; and Donna Haraway has analysed some of the displays of the New York Museum of Natural History in Primate Visions.

[13]See among others James Clifford, The Predicament of Culture and Michelle Rosaldo and Louise Lamphere, eds (1974), Woman, Culture and Society, Palo Alto: Stanford University Press.

physical structures or physiological processes directly, neutrally, because it is without subjective mediation (these images are mechanically produced). The latter element implies that the image is coded, and that its code is available to trained, authorised physicians or medical experts. These two features imply a firm (necessary) grounding in the institution which harbours technological means of production and medical professionals who can decode the image, and hold the key to what is to remain a mystery for the lay-person, or even for the physician who is not a specialist.

Making Meaning Means Work

Some sociological accounts of the way new imaging technologies are introduced show both the work that is involved in making representations meaningful in the first instance (Pasveer, 1989; Blume, 1992), and how the variety of strategies that have been used to warrant the use of images are soon taken for granted ("black-boxed"), and erased from discussions of the technologies and of the knowledge they produce (Haraway, 1991; Posner 1991; Dumit, 1993). When this occurs, the image is naturalised and considered to be unmediated, further reinforcing its perceived objectivity.[14] As noted by Cartwright, in her

[14]For examples, from the 1850s, photography was favoured by the scientific community, as "the optical and chemical processes of photography were taken to designate a scientifically exploited but 'natural' mechanism producing 'natural' images whose truth was guaranteed" (Tagg, 1980, 41).

discussion of physiological and functional imaging technologies, such images are also dehistoricised (Cartwright, 1992), so that even histories of the technologies often seem to be cut off from the histories of the development of other imaging technologies.

Consequently, if an image is not considered to have a context of production that warrants attention on the part of medical practitioners, its context of use will not be relevant either. This is the dynamic that Haraway denounces as constituting the myth of the mobility of meaning and the universality of knowledge. Since the image's neutrality is so closely tied to the notion of mechanical objectivity, recognition of the non-neutral work involved in making these images meaningful also involves changing the definition of objectivity.

Decoding the neutral image

The trope of the image that speaks for itself dominates scientific discourse about the results of imaging technologies. Photography was hailed as the ideal technology to obtain objective images, through which disease would be known. Describing the usefulness of making portraits of inmates, a physician wrote to his colleagues that

> the Photographer needs in many cases no aid from any language of his own, but prefers to listen with the picture before him, to the silent but telling language of nature... the picture speaks for itself with the

> most marked precision and indicates the exact point which has been reached in the scale of unhappiness between the first sensation and its utmost height (*Lancet*, 22, January 1859, quoted in Tagg, 1980, 41)

The validity of the x-ray was discussed in the same terms as photographic authority, in the late nineteenth century: "new as this process [x-ray imaging] is, experiments made by scientific men....have demonstrated its power to reveal to the natural eye the entire structure of the human body, and its various parts can be photographed as its exterior surface has been and now is" (Supreme Court of Tennessee, quoted in Dumit, 1993). The scientific image is thus proclaimed to be transparent. But, again, just as objects on display do not provide their own narratives (Breckenridge, 1989, 205), so scientific images do not speak for themselves.

The neutrality of the image that speaks for itself is conjoined with the notion that it does not speak to everyone. Where representations are said to hold all meaning, one must try to find a discursive context which gives meaning to the image.[15] Who, then, speaks for them? Objects circulate among experts, and are subject to evaluation and classification by these experts. Control is exerted on the levels of authenticity (objectivity by another name), and diagnostic meaning, in medical realms, by those who know the code.

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[15]The rise of the provision of explanatory texts (discursive guides) to the interpretation of images has been documented by Babara Stafford (1991), Body Criticism.

The Code

Medical discussion of the image offers the notions of a coded image that has to be decoded by a medical expert. The metaphor of the code has been well-documented by Haraway in her study of the discourses of biology and immunology (Haraway, 1991, 203-30). The code, in relation to that which is visible in the image, implies that meanings are inherent in the images produced, and that diagnostic usefulness is a consequence of having successfully cracked the code. The process may be understood as a neutral coding of the body into a representation that can only be understood by those who have learned to decode it. But the tension between the concepts of a neutral image and encoding become obvious when the hierarchical classification of representations is noted. There are more and less 'obvious' representations. In some discussions of x-rays, the difference between photographs and skiagrams is highlighted:

> though it might appear to be a cognizable object, this code-image can be deciphered and interpreted only by experts. In the language of semiotics, then, these expert images are not analogue, they are digital. They do not merely magnify or make visible, they are transforming or translating a non-visual object into a visual one (Dumit, 1993).

The photograph can be meaningful to anyone, since it is 'realistic', while an x-ray must be examined by a trained professional. While both types of imaging involve

mediation, the interpretive practices surrounding some medical technologies may be more elaborate; hence, medical professionals claim special insight. Yet this quotation highlights once again the tension inherent in wishing to claim a direct access to the world as it is, while maintaining a privileged access to the image for the medical professional. The making of the image is downplayed -- its constructedness is obfuscated, while the image speaks the truth and is given a special status as a medically apprehensible object.[16] In philosophical terms, Feyerabend has described this relationship between phenomena and words as a natural interpretation that is established so that the phenomenon seems to speak for itself, without outside help or extraneous knowledge (Feyerabend, 1978).

Rather than assuming that (visual) evidence is present in the images produced, and that diagnostic usefulness of images is simply a matter of 'cracking the code', Pasveer and others (Dumit, 1993; Cambrosio et al, 1993) prefer to examine the manner in which the context of research practices or image-making have shaped, and in turn, adapted to the technology in question, and to the images. Therefore, as Cambrosio and his colleagues have done, I will approach the meaning of images with the belief that

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[16]For a discussion of this realistic effect in terms of photography and the penal system (and other institutions of 'surveillance') see John Tagg (1980), "Power and Photography: Part One, A Means of Surveillance: The Photograph as Evidence."

"theoretical, experimental and representational elements are best understood as a series of concurrent, mutually constitutive events" (Cambrosio et al, 1993, 11). More specifically, I will attempt to show how

> in order to become of diagnostic value in internal medicine--to become 'true' -- to represent health and disease in a knowledgeable and useful way, the images needed a context and an intelligible content. They required a way of seeing, a language by which to communicate... (Pasveer, 1989, 362).

While Pasveer discusses the introduction of x-rays, these dynamics are the bases for the use of representations in twentieth century diagnostic medicine.

Familiarity Breeds Recognition

The meaning of diagnostic images is built over time and is contingent on the establishment of a relation between image and a known entity, either prior codings (other representations) or actual bodies. In some instances, it is possible to understand the process of representation by comparing the 'original' to the technologically produced image. This strategy is especially useful when physical structures are imaged. It is possible to understand an x-ray in this way, because it represents a physical structure visible to the naked eye, in a postmortem examination, for example. Thus, the introduction of imaging technologies seems to be easiest when what is being represented is better known. The correspondence of x-rays to the bony structure is more easily established

(because of the procedure of dissection), the imaging of live tissues was much less quickly accepted (Pasveer, 1989, 368-9). In surgery, a field where the appearance of the bony structure was well-known, the use of x-rays was adopted relatively quickly, in comparison with internal medicine, where the appearance of the organs was more foreign (Pasveer, 1989, 361).

In the case of functional imaging, through which physiological processes are imaged, those images are said to be models of functions, representations of non-visual elements. Apart from their lack of direct correspondence to visible structures, functional images also differ from other types of imaging because of their temporal component. Images that show the rate of flow of tagged substances cannot be understood along the same lines as the photographic moment, frozen in time. However, such images also depend on the expert's familiarity with what is represented to be meaningful. PET-scan imaging of the brain, in terms of function, was less meaningful to radiologists than to internists, by the specificity of the prior knowledge of each type of specialist (Dumit, 1993).

Imaging Process is Black-Boxed

As the meanings of images become fixed through the development of interpretive practices, the processes of image-making are also stabilized, so that variability in appearance is minimized. While in the introduction of a

technology, methods may vary and be highly experimental, techniques become streamlined in order to allow for comparisons and contrasts of results of imaging attempts:

> after the turn of the century some of the X-ray workers started to formulate their own methods of work in more normative terms: where in the early years they described individual experiments and cases, they now started to write in a different tone. Norms, routines and criteria for competence began to develop and slowly became prescriptive as the significance of the pictures became clearer. Rules which initially were formulated to urge individual workers to work along the same lines, later became part of the tacit knowledge and practices possessed by competent Roentgenologists (Pasveer, 1989, 365).

This process is involved in a feedback loop, in which technological procedures influence interpretive procedures, as well as theoretical assumptions. Professionalisation is an important component of the normalisation of techniques.[17]

Seeing the Normal and the Pathological

Most crucial to the development of diagnostic imaging practices is the normalisation of the appearance of normal and pathological signs. In the case of x-ray images, Pasveer identifies four strategies that were used to mobilize these images in order to distinguish the normal and the pathological. The first was to conduct a broad range of experiments with the technology to "get a feel" for the appearance of the body in terms of the shadows

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[17]See Stuart Blume, Insight and Industry: Technological Change in Medicine for further discussion of the effects of professionalisation on medical technologies.

produced through x-rays. A comparative strategy was then used to understand the appearance of the normal and pathological organs by comparing x-rays of live organs and dead organs in which pathologies had been identified through post-mortem dissection. A third strategy was to compare the x-ray images with the results of other diagnostic technologies (such as palpation or percussion) and finally by comparing the x-ray images among themselves (Pasveer, 1989, 363). Eventually, appearances and meanings of the normal and the pathological came to be assumed:

> technology gradually became part of the art; it became a 'black box' both in radiological practice and in the publications of x-ray workers..... By 1902, for example, it was considered perfectly adequate to elaborate 'for the sake of comparison on the normal chest: while by 1910 it was normal to claim that there was not time to go into the X-ray appearance to be made out in examining a normal chest,' with which most were expected to be familiar (Pasveer, 1989, 376).

Differential Images

The strategy of comparing images between themselves to establish normality is an especially important one. From the earliest uses of cinematography and chronophotography in the study of physiology, an emphasis has been placed on the measurable difference between images. In physiological contexts, the image functions like a marker of quantitative knowledge, a record of change (Cartwright, 1992, 143). The differences between images are what must be recorded, and the significance of these differences must be assessed.

Again, this strategy is especially useful when images are visual renditions of non-visual data, in which what is imaged is a quantitative depiction of properties like density or mass (Cartwright, 1992, 134).

To return to Haraway's methodology, viewing images comparatively is determined by a particular view of disease. Comparisons between the images is a strategy that implies that difference may be pathological, and encourages a comparison between individuals, rather than a definition of the normal (and of health) that is based on individualised criteria:

> the comparison of the shadow-images with each other was an activity that violated the nineteenth-century romantic view of the uniqueness and wholeness of diseases and patients. Patients had to become interchangeable, reproducible, quantifiable and the disease had to be 'isolated' from its bearer (Pasveer, 1989, 374-5).

In terms of diagnosis, the comparative strategy identified in earlier chapters in the use of inscriptions (patient files) and epidemiological findings is further reinforced with this use of imaging technologies:

> Once a diagnostic procedure identifies the markers that are linked with diseases, clinicians tend to classify all those with the same markers in the same way. In time routine use could obscure the uncertainties inherent in tests, their underlying assumptions could remain unquestioned, and the marker could become reified as the disease (Nelkin and Tancredi, 1989, 43).

Diagnostic images are therefore not neutral in relation to patient health. They represent a particular view of the

body, and these views are framed witnin the medical discourse of objectivity.

Finally, even though they may have only limited (experimental) applications, diagnostic tests benefit from the aura of scientific objectivity: "they are thus framing the professional and popular discourse about social and individual problems, shaping both institutional practices and social policies" (Nelkin and Tancredi, 1989, 23). The use of diagnostic imaging is a complex and multi-layered process. By highlighting some of the stories told about the use of images and the strategies used to make images meaningful, I have attempted to sketch the shape of this medical vision in relation to notions of objectivity. The next chapter will deal with the consequences of this mode of diagnosis.

Chapter Four

Diagnostic Visions

Quelqu'un qui a l'habitude de sourire dans la glace à sa belle figure et à son beau torse, si on lui montre leur radiographie, aura devant ce chapelet osseux indiqué comme étant une image de lui-même, le même soupçcon d'une erreur que le visiteur d'une exposition qui devant un portrait d'une jeune femme lit dans le catalogue: Dromadaire couché.

Marcel Proust
Le Côté de Guermantes I

As discussed in the first chapter, there has been a trend toward a greater degree of abstraction in the information brought to bear on diagnosis. The ability to visualize the interior of the body liberated physicians from utter dependence on considerations exterior to it, and provided the foundation for medical knowledge independent of particular patient contexts. Individuals, however, experience health and illness in an embodied fashion. This can create discrepancies between the diagnostic labels affixed by physicians, and the experience of the individual so labelled.[18]

[18]Physicians also practice their trade in an embodied way and do experience difficulties in adapting received medical knowledge to clinical settings. The emphasis here, however, is on the situation of the health care recipients--those labelled; not those who label.

This chapter addresses some of the effects of the trend towards the use of biological testing and visualising technologies to label the health of individuals. In a discussion of the state of current diagnostic procedures, Nelkin and Tancredi have identified the main features of what they term the 'new diagnostics.'[19] These tests aim to discover the truth behind appearances, thus diagnostic discoveries are often of latent, asymptomatic traits or traits that are predictive in nature (Nelkin and Tancredi, 1989, 3).

As mentioned earlier, diagnostic knowledge is based on the "biological and subcellular substrates from which physical and psychological traits emerge" (Nelkin and Tancredi, 1989, 22), and not on feelings of illness. Diagnostic tests may be administered in light of a patient's reported symptoms, but the symptoms are neither considered to constitute disease, nor are they considered to be the cause of it.

Such tests may also provide information about the future. In the case that information obtained is believed to indicate the future state of health of a tested individual, further questions arise as to the meaning of tests. A fast-growing example of the use of information to evaluate future health is susceptibility screening, in

[19]The term designates "the tests that are emerging from research in genetics and the neuroscience (Nelkin and Tancredi, 1989, 3-4)." Like other ("older") diagnostic tests, their use is proliferating in areas that are not strictly medical, including insurance companies, schools, the workplace, etc.

which tests are used to detect markers for Huntington's and other diseases. The tests that provide such future truth have been discussed as *screening* tests. These are said to be relevant to future behaviours, as distinct from the diagnostic tests, which aim to find a deep-seated cause to an immediate ("presenting") set of symptoms (Nelkin and Tancredi, 1989, 25).

Furthermore, the discrepancy between the medical view of patients and their actual situations underlies the diagnostic process: "Diagnosis is at the centre of a contradiction between scientific medicine, involving research on statistical aggregates, and clinical medicine, involving the treatment of idiosyncratic individuals" (Nelkin and Tancredi, 1989, 38).

Specifically, I will show the partiality of the medical vision elaborated in chapter three. Three particular "blind spots" of medical vision will be discussed: (1) the tension between similarities among patients and the particularity of each person's situation, (2) the tendency of diagnostic tests to detect latent, asymptomatic conditions, and (3) the disjunction of patients' present states with diagnostic predictions. I will begin by discussing the theoretical grounding to support a perceptible loss of individuality in the diagnostic process as a result of medical diagnostic imaging. I will proceed to an examination of the discrepancies between embodied experience and medical

labels, in terms of the relevant temporal and spatial contexts, and the values of those whose health is evaluated.

Statistical Vision

Two of the most important areas of diagnostic testing -- imaging technologies and genetic mapping -- depend on a statistical definition of health. More specifically, the usefulness of these diagnostic strategies is warranted by a biostatistical theory of health. Such a theory finds its roots in evolution theories, which assume that "a healthy human being... functions according to the pattern which is typical for the species of man (sic)" (Nordenfelt, 1993, 278). Using such theory as a basis, philosopher Christopher Boorse defines health in the following manner:

> A is completely healthy if, and only if A lacks all diseases, i.e., if and only if his or her bodily or mental functions fall within normal intervals (Nordenfelt, 1993, 278).

The normality of the function is "reasonably" determined through statistics, so that "the species-typical pattern is the statistically typical pattern" (Nordenfelt, 1993, 278). Clearly, health is determined through comparisons across large numbers of people (statistically significant samples) and their "functions" are measured in standardised ways-- practices of data collection are usually organised around instruments which insure mechanical objectivity. Such a

view of health sees patients only in relation to one another and only in terms of measured functions. Again, in the case of diagnostic techniques (from IQ tests to body temperature to sophisticated imaging technologies), the difference between individuals establishes normality and pathology (Nelkin and Tancredi, 1989, 22). Clinical chemists and physiologists also rely on this philosophy to determine "normal or reference values" (Nordenfelt, 1993, 278).

Discussions of the belief systems of medical experts must be tempered, however, by the examination of actual practices. Nordenfelt insists that there is a difference between holding a view and acting on it, and that one may "side with a particular definition but only partly follow it in his or her praxis" (Nordenfelt, 1993, 281). He distinguishes between those most likely to adhere to a biostastistical definition of health and those who take into consideration "human social functioning." The latter group consists of those involved in general practice and rehabilitation, while the biostatistical view is held by those specialists involved in "pathology, laboratory medicine and some other highly specialised disciplines of somatic medicine" (Nordenfelt, 1993, 281). The biostatistical view would then seem to dominate among those who are called upon to make diagnoses, although this question would warrant a much longer discussion than is possible here.

The differences which determine labels of health and pathology are shown in graphic detail when maps or images are involved:

> the statistical findings of these tests, processed by computers and imaged on a screen appear to be objective, neutral, beyond refutation, equivalent to truth. Thus they assume considerable weight in drawing distinctions between normal and abnormal conditions (Nelkin and Tancredi, 1989, 38).

Difference becomes the sign of disease, and the sight of difference can lead to a diagnosis of pathology even though no clinical signs of disease exist. Furthermore, since visual evidence is statistically grounded, it may not be relevant in a particular case (Nelkin and Tancredi, 1989, 43).

The desire to infer from images has been examined by anthropologist Joe Dumit in a discussion of the power of images produced through PET-scans. Although accompanying texts attempt to circumscribe the meanings that are to be gathered from images, reproductions of PET scan images used to illustrate scientific articles are compelling:

> when two images obviously distinguishable are put side by side, with different labels, even if the text describes the data as forbidding going from image to label, the possibility of reading the image as providing the label is manifestly present. Barbara Stafford refers to this as the promise of perfect diagnosis (Dumit, 1993).

Beyond being able to show the functions and structures of the brain, PET images may also provide labels for the types of bodies to which they belong: 'schizophrenic', 'male',

'cocaine-addicted' (Dumit, 1993) so that the image substitutes for the human category. Images are therefore the site of the establishment of boundaries between that which is undesirable, and the normalcy to which the body must aspire:

> these images hopefully produce images of the normal and the pathological: images can function as transformers of statistical norms into ideals or abhorred qualities (Dumit, 1993).

Furthermore, these differences (illustrated in images, and on the basis of which disease is inferred) are found to reside on ever less accessible levels. Imaging technologies and genetic tests

> are increasingly precise in detecting minute individual variations. This has as a consequence to expand the number of persons identified as abnormal (Nelkin and Tancredi, 1989, 22-3).

Furthermore, these new levels of diagnosis increase the sphere of intervention of medicine (Posner, 1991, 169). Efforts to evaluate health by detecting the slightest apprehensible changes introduces a measure of uncertainty into the medical truths available through testing:

> Part of being able to treat previously untreatable illness, to detect slight chemical changes which occur before an anatomical change registers the presence of disease, is being able to visualise the invisible. But our ability to make pictures is greater than our ability to understand them, and our ability to find problems is greater than our ability to solve them (Kember, 1991, 64).

Furthermore, prognostic uncertainty, compounded with diagnostic uncertainty, results in uncertain evaluations of

health. The biological tests are now so sensitive that, in the case of screening practices, "the ability of modern medicine to diagnose has outstripped its ability to prognose: it can detect signs of abnormality but it cannot be sure of their significance, what they mean" (Posner, 1991, 173). Thus, in the case of cervical cancer screening, the possibility exists that the abnormal cells will regress, or that there will be no further development:

> The greyness of the area between perfectly normal cells and frankly cancerous cells, and between the normality--the commonness, of some degree of possibly passing abnormality--is not generally known [to the wider public] (Posner, 1991, 176).

There is a large measure of uncertainty in the use of cells or minute physiological processes as indicators of health.

Highly sophisticated biological tests have created both a certainty gap -- an uncertainty as to the meaning of the signs detected-- and a therapeutic gap; illnesses can be detected but no therapeutic remedies exist. This latter gap has been found to be especially wide in the case of prenatal diagnosis, in which the termination of pregnancy or the preparation for the birth of a child with a condition (often of unknown severity) are most often the only options available to parents (Nightingale and Meister, 1987, 4).

Blind Spots of Medical Vision

If individual differences are downplayed by comparative methods of biostatistical diagnosis which examine only a narrow band of biological evidence, what are the significant individual variations that are elided? There are a number of ways in which the experience of illness varies from individual to individual; however, depending on several subjective factors (the particular environment, the resources available, culturally-determined values), all may affect the relationship of the individual to her or his condition, or the consideration of the condition as an illness. This may be the case despite a physician's belief that she has a clear diagnosis -- and especially so in light of greater social and physical distances between patient and physicians.

Beyond the visions of biological structures and processes provided by tests, illness is a multidimensional phenomenon. Thus Lippman comments that over and above the biological reality of diseases, biological processes and disabilities are "social products with variant shapes and distributions that are fashioned, interpreted and given meaning according to beliefs, attitudes, values and interests" (Lippman, 1993, 53). Information that is read from a genetic map or an image of physiological processes remains information that is "isolated." Therefore, while it is difficult to predict the severity of a condition such as sickle-cell anemia (Lippman, 1993, 54) -- even if the

context is known -- the diagnosis of the condition as a disease may be completely different, even opposite, depending on the living environment of the diagnosed individual.

A number of social and institutional elements can also determine, to a large extent, the experience of illness: "much research shows that disability ...only becomes of major consequence when prevailing social economic and political policies do not allow for a wide range of abilities and convert impairments into handicaps (Lippman, 1993, 50).

The very definition of a condition as a disease may also be contested. In a study of the acceptance and significance of prenatal diagnosis, anthropologist Rayna Rapp found that cultural priorities affected the willingness of individuals not only to accept testing, but also to consider the diagnosis as representing a disease, a negative trait. For a mother of a little girl with Down syndrome, her daughter's normal growth and ability to walk provided much relief. In some communities, physical vulnerability may be regarded more negatively than mental handicap (Rapp, 1988, 153). Some patients reject diagnostic information as politically-loaded. Upon receiving a description of Down Syndrome, a father from New York's Haitian community reacted strongly to specific terms:

> What is this retarded? They always say that Haitian children are retarded in the public schools. But when

> we put them in the Haitian Academy [a community-based private school] they do just fine. I do not know what retarded is.

In this case, the medical definitions were shaped by other cultural and political experiences (Rapp, 1988, 148).

Future Diagnosis, Future Embodiment

In re-examining the familiar notions of illness and disease, a third dimension must be added to the discussion of "sickness" to correspond to new forms of medical evaluations of health. Since Eisenberg drew a fruitful distinction between illness as that which is experienced by the patient and disease as that which is diagnosed by the physician, many examples of the discrepancy between medical and personal reality have been examined, some of which I have described above. Another level of understanding of health has arisen from the development of certain screening tests that make it possible either to detect a growing number of genetic markers in an individual, or to identify visual patterns in scans that can be linked to the potential development of certain conditions. This is also the case in the detection of seropositivity, in which an increasing number of people are receiving one diagnosis that announces another (that of full-blown AIDS) which may be delayed by many years, or possibly indefinitely. The diagnostic labels generated by these markers and patterns are of future, and often merely potential illness, since some individuals may never develop the condition

'detected'. Developments in genetic and screening testing are aligning the genetic definition of health with the biostatistical definition which precludes the presence of disease in a healthy person.

The incompatibility of health and disease is present in the biomedical reactions to the AIDS pandemic. One of the early descriptions of this phenomenon appears in Susan Sontag's analysis of HIV status (Sontag, 1989). In this work, the phrase "future ill" is used to describe those who are infected but not ill, diseased, but not sick. Thus, clinical medicine no longer accepts the possibility that the body might harbour an infection but not be sick. Instead, the presence of HIV infection is linked to 'defilement', to contamination. Sontag's analysis of medical theory regarding infection parallels suggestions that differences indicated in a visualisation are to be considered pathological.

To know about the body in this manner involves the introduction of yet further abstracting features, besides the disregard of the environment and specific context of the individual. Discontinuity of time enters into the operation of diagnostics, and it becomes possible to diagnose, in the present, the future ill. This tendency leads to the inclusion of future possibilities into present knowledge, and consequently, to the requirement to act now on a possible future situation.

These types of future diagnoses often are not precise enough to determine the extent to which the disease will be manifest, or how the felt illness will affect the diagnosed individual. Like diagnostic testing, genetic testing that relies on the presence of a marker does not account for environmental factors which may favour the development of the condition, and often cannot predict its severity. Nelkin and Tancredi therefore suggest that by focusing on a single parameter within a complex etiology, the other variables are minimized (Nelkin and Tancredi, 1989, 43). This overinvestment in the information provided by genetic maps has been addressed by Lippman, who states emphatically that "genes do not 'cause' anything although they do make some things possible. So, even if the DNA pattern is clearly associated with some disease or disorder, knowing where it is will neither predict the severity of the condition nor solve the health problem(s) of those affected" (Lippman, 1993, 54). The disease as medically detected may not develop at all, since many of the genetic markers do not function as guarantees that it will progress into a set of symptoms felt by the individual. As such, screening tests that reveal potential for future conditions sometimes demand immediate action, and individuals are faced with decision-making based on a prediction of highly distant and uncertain events. Yet the truth with which they are faced arises from a medical context, and is thus considered a scientifically derived and objective

possibility. Especially troubling are cases of prenatal diagnoses in which parents are asked to make decisions about the continuation of pregnancies based on information that reveals the possibility of a condition in the fetus, in many cases without knowledge of its severity.

Future Diagnosis, Current Embodiment

Not surprisingly, the possibility of disease influences a patient's current embodied experience: knowing of the possibility of future illness has a powerful effect on the self-image of those screened. In a study of experiences of cervical cancer screening, the majority of women felt differently about their bodies after being told that their smears revealed an abnormality, even though these abnormalities were not indications of pathology or cancer. Most common were feelings of alienation, a sense of defilement and the sentiment that one's body had gone out of control (Posner, 1991, 180). The future ill may also face discrimination in employment, as well as very real difficulties securing health and life insurance (Nelkin and Tancredi, 1989).

Contextual Meaning of Diagnosis

Although I have drawn a distinction between the nature of the medical definition of disease and the individual experience of illness, there is obviously interaction

between the two. A top-down model would suggest that the medical label is all-powerful, and that its meaning cannot be negotiated. Some remain doubtful of the likelihood of resistance to medical labels, and, perhaps because of the 'power' of medical discourse, they believe that there are overwhelming discrepancies between the weight of patients' accounts and those of physicians. In this framework, "screening can be seen as an attempt to assert the dominance of the medical definition of reality based on objective signs rather than subjective accounts. Submitting to screening implies a willingness to accept the medical definition of reality" (Posner, 1991, 170). Other studies of the medical institution have begun to focus on the ways in which diagnoses and scientific facts differ from experience, and have recognised the need to consider how experience resists science and medicine in a number of ways, on various levels (Martin, 1987; Rapp, 1988).

Again, because diagnostic situations are the site of encounters between the institution, medical professionals and medical knowledge, definitions are bound to be negotiated, altered, contested, refined, or otherwise bent out of shape through use. Although the examples I have discussed above show a rejection of biomedical labels in view of the discrepancy between lived experience and diagnosis, the opposite also occurs; a diagnostic label may very well be incorporated in the patient's understanding of self.

Scientific facts do play a role in how we experience ourselves, our bodies and others (Dumit, 1994). The medical label, based on biological findings may alternatively be welcomed as a relief by some individuals, because of the distanciation between the self and the sickness they afford. Thus, in the diagnosis of certain conditions such as depression, based on PET scans, patients reported relief at being able to see the "biological cause" of their illness. The experience of seeing the scans enabled the patients to strengthen the distinction between diseased brain and healthy mind in the self (Dumit, 1994). Similarly, the visualisation of aberrant patterns in some schizophrenic patients has begun a shift in the definitions and etiology of schizophrenia, in which the cause of the condition is shifted from a social (largely familial) context to one of biological imbalance (Dumit, 1994). In these cases, the medical definition is welcomed, because it enables the negotiation of personal responsibility in the cause of disease.[20] It is not surprising therefore that, in some cases, families of patients and mental illness

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[20]Such 'relief' was also an effect of finding biological roots to illness through the earliest pathological discoveries. However, as illness enters the realm of the medical institution, and is no longer tied to "a morality issued from God the Creator and linked to our duty toward him", there is a new set of obligations that arise:

> the individual's responsibility for his or her own body. Henceforth, one could sin against oneself, against one's own biological life, which became charged with rules and value. Such sin was also a sin against others, against their bodies, which one would contaminate, and especially against one's own family , and one's own offspring....(Herzlich and Pierret 160).

activists support this type of research. In finding biological causes to problems, they experience the relief that comes from shedding responsibility (Dumit, 1994).

Images have also been used as part of patient treatment. The early use of photographs in psychiatry in the 1850s was partly justified by the fact that portraits of patients have value 'in the effect which they produce upon the patient themselves.' Photographs function as markers of improvements in mental states in this context (Tagg, 1980, 41).

One of the main arguments used to explain and defend genetic research is the usefulness of such information for individuals, who, armed with information about their susceptibility to a certain condition, will change their behaviour and thus, improve their health. This seem to make good sense: an ounce of prevention is worth a pound of cure. However, just as cure is not universally available, neither is prevention:

> Assuming that knowledge of one's risk status is a motivating factor for change and that behavioural change will reduce one's risk of disease, ... neither desire nor ability to change one's risk is distributed equally among individuals (Lippman, 1992, 1472).

Consequently, this model of health promotion may also transfer accountability and responsibility for health to the individual (Lippman, 1992, 1472).

Conclusion

The present constitution of the (often visual) object of medical diagnosis has been shaped by institutional requirements such as bureaucratisation and standardisation, which are features of the growth of medicine as a modern institution. Concurrently, the mobilisation of inscriptions affected the nature and amount of scientific knowledge, so that disease became an entity recognisable by the symptoms shared by patients. These features constitute the basis of the validation of pathognomonic symptoms which enable comparisons between patients within Western biomedicine.

The present constitution of the (often visual) medical diagnosis has many historical roots in the realms and science. The constitution of inscriptions was affected by the incorporation of scientific methods and values in medicine. Quantifiable and precise measurements were sought to answer the demands for exact knowledge of scientific medicine, and the technologies which provided such exact measurements became more and more important to diagnostic practices. The object of medical diagnosis therefore came to be constituted as sets of quantifiable data, independent of context, of idiosyncratic elements. The development of imaging technologies further shaped medical diagnostic vision, by allowing physicians to seek deep, internal causes of illness, beyond the recording of symptoms. The comparative strategies remain central to the understanding

of diagnostic images, and they underlie the construction of definitions of normality and pathology.

Such are the modes of knowledge which constitute modern biomedical vision. This vision is partial; like any point of view, it focuses on particular elements. In this case, the focus is on patients' biomedical features which are obtained through technological examinations. The comparative strategies which render such images meaningful downplay individual differences. Yet these diagnostic practices firmly locate disease within individual bodies, organs, or genes. Current trends in diagnostic methods not only downplay patients' social and psychological selves, but they also elide the importance of patients' contexts, a dangerously reductive outlook. Considering that the power of medical diagnosis reaches beyond the medical realm to determine many of our opportunities, and affect our quality of life, it is crucial to recognise the basis for such diagnoses. As demonstrated by the variety of domains examined in this thesis, the roots of diagnostic practices are multiple and interconnecting, and run deep in the history of modernity. In the tradition of the influential botanists of the Enlightenment, the various parts must be examined; but the work of current day environmentalists calls for consideration of the 'ecosystem', the context. The call for the contextualisation of health which pervades this thesis is also a call for the contextualisation of medical knowledge. There is a need, therefore, to consider

both the medical institution, in which these practices develop, and society, which influences the organisation of the institution and the people who work within it. A better understanding of the tools leads to a better use of them, and a better understanding must involve mutlidisciplinary work.

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