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Epistemology and semiotics of medical systems: A comparative analysis

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> Features emerging 'upon analysis' is a particular instance of reflexivity. These features exist only within the reflexive work of those researchers who make them exist. This does not deny their reality.
>
> (Mehan and Wood 1975: 18)

Introduction

Different forms of medical practice co-exist in the health care system in many Western countries. Next to 'allopathy' or 'orthodox' Western medicine many forms of 'alternative' or 'complementary' practices are present. The considerable growth of the use of alternative practices within the total spectrum of health care has been documented amongst others by Eisenberg et al. (1993). At the same time, the essence of forms of complementary medicine is not familiar to general practitioners and specialists when they finish their medical training (Berman et al. 1997; Carlston et al. 1997), while patients do receive simultaneously or successively various treatments. This pluriform use in clinical practice could be beneficial to the patients, if a structured communication between the practices would exist (Astin 1998). A structured communication between the different directions in medicine would involve amongst others:

— systematic referral of patients between doctors using different therapies,
— comparative research for certain diseases in terms of clinical effect and cost-effectiveness,
— scientific exchange at a conceptual level for the development of, for example, new therapies for diseases, which have not been treated successfully by either form of medicine until now.

In the Netherlands, the Dutch Health Council (1993) published an analysis of the reasons why so little research is done on the effectivity of alternative practices; one of the conclusions has been that alternative

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medicine and university institutions lack a common meeting ground. The absence of a 'common language' and 'a common taxonomy' were identified as two major barriers to overcome existing prejudices between practitioners in the respective forms of medicine.

Criticism is often expressed by allopathic or orthodox physicians of, for example, homeopathy and Chinese medicine, two major complementary medical systems, in that the latter two would not meet the standards of natural scientific evidence of their working mechanisms, which makes their clinical results implausible.

Recent meta-analyses of homeopathic clinical research show a positive effect of this type of treatment (Kleijnen, ter Riet, and Knipschild 1991; Linde et al. 1997), but these results are considered by opponents as not 'evidence-based' (Langman 1997; Vandenbroucke 1997). An extended American review (National Institute of Health 1997) also shows the clinical efficacy of acupuncture, and moreover, indicates options to conduct research on its physiological explanation. These studies still fail to contribute to an open communication, as they do not provide a 'common meeting ground' with allopathy in terms of a physical and biochemical plausibility of the homeopathic clinical results. An effect is indeniably measurable, but the absence of a working mechanism of homeopathy (and *mutatis mutandis* also for Chinese medicine) in biochemical terms leaves room for speculation about a placebo-effect (Reilly et al. 1994) — without a proper definition of this effect.

Bellavite and Signorini (1995) display some issues in biology, such as complexity, information-processing and energy dynamics of biological systems which need further investigation with regards to the field of medicine. Also, physical, biological and immunological research using animal and physical models indicates how high dilutions such as used in homeopathy can be examined scientifically (Endler and Schulte 1994; Bastide 1997; van Wijk and Wiegant 1997).

This study seeks to contribute to overcome prejudice and distance by the development of a method which considers the exertion of a medical practice as an applied system of thought, implying the use of certain concepts of disease, cure and health in medical diagnosis and treatment. We call this a 'medical system'. This conception of a medical system opens the perspective of using various methods from cognitive sciences, such as epistemology and linguistics, to analyze medical systems in terms of how they acquire and process data to establish a diagnosis. A comparative framework using a semiotic perspective is presented in this article, which may serve to examine if such systems have an inner consistency.

The central research question of this article is: If the concepts used in the frame of reference of a medical system would be described,

would this imply that these concepts are only consistent within that system, or can they claim universal validity, scientifically based, excluding other systems? From here some operational questions can be derived:

1. What are concepts in a medical system?
2. Which method would be necessary for the description of concepts?
3. Is there a theoretical framework which can be used for the development of the method of description?
4. Would the description of the concepts enable their comparison?
5. And what would be the consequences of this comparison?

Before the methodology for researching these questions is displayed, the issue is discussed whether statements made within one medical system have a universal value, i.e., can be generalized to other systems; this, then, is confronted with the assumptions made in semiotics about the tension between the universal validity and the meaning of assertions.

Epistemology and linguistics

The universalist tradition

McMullin (1995) has pointed from a medical-philosophical perspective to the resemblances between the search for objective truth about diseases by Western allopathic medicine and the universalist tradition in Western philosophy. Mullin mentions two central features of this tradition: (1) the search for the universality of truth and (2) the idea that knowledge is acquired only by rational procedures. This opinion conforms with Kirmayer (1988) who reviewed medical-anthropological research to show how some basic notions of Western medicine are embedded in the universalist tradition. This may, however, provoke some problems, as is argued in what follows.

Epistemologically said, a main cognitive activity of medical practice is to establish whether propositions about the condition of a patient such as 'This is disease' or 'This is not disease' are true or not (Wright and MacAdam 1979). Carnap (1935) discerned three forms of propositions: he stated that if the truth-conditions, or circumstances under which a proposition is true, can be defined, then the formulation can be a correct scientific proposition, for its truth may be tested by testing the circumstances — this is a synthetic proposition. If these truth-conditions cannot be described, then the proposition is not useful for scientific purposes, i.e., testing — for then it is either always true or never true (an analytical or contradictory proposition, respectively).

The concern about the truth of a proposition about disease has a very practical basis, as the decision about the truth of such a proposition determines whether a therapeutic action has to be taken or not. Its action-orientedness makes medical thinking quite susceptible to universalistic tendencies, for if this proposition were true in all possible conditions, it would liberate both patient and practitioner from the uncertainty inherent of relativistic and probabilistic reasoning (Benbassat 1994). When discussing the rationalistic element of the objectivist tradition, Gillett (1995) points to the implications for medical philosophy of the epistemological criticism by Rorty (1992) and Kuhn (1971 [1962]) on scientific claims of objective truth. Gillett states that truth-conditions of the best possible medical decision with regard to diagnosis should no longer be determined by pathophysiological arguments only, but also by the life history and situation of the patient. Not the 'objective' knowledge alone, but also the context of the patient should determine the correctness of the decision.

Medical anthropology has criticized the one-sided focus on disease-entities of the biomedical model used in Western university medical training and practice, and pleads for the approach of a patient as a person within the context of her/his own life, thus integrating this aspect into medical diagnosis and treatment (Kleinman 1988). In an effort to trace the origin of the rationalist character of Western medical thought, Gordon (1988) examined the influence of naturalistic philosophy on the epistemology of Western medicine. Nature is considered to be immanent and universal; so aspects of Nature such as diseases can be studied, and finally they will reveal their hidden immanent features and secrets. Also, naturalistic philosophy makes an opposition between mind and body, representing in human existence respectively the rationalistic and intentional pole, in contrast with the involuntary and accidental pole. As a representative of the rational pole, Western medicine has as its objective — by rational reasoning, leaving aside the subjective tendencies of human perception — to acquire absolute knowledge of disease-processes, in order to control them.

And allopathic medicine claims this knowledge to be based on natural scientific data, and together with this claim it is assumed that these data are independent of the context in which they are acquired. Thus, on a meta-level a rationalistic view of medical science is still advocated. Ironically, this view is in a process of being left behind in current natural sciences. Moreover, it can be questioned whether medical practice actually can fulfill the demands, as medical data have some features which do not fit this traditional view of natural science:

1. Many data do not meet the ideal of context-independency, of which an example is the pathoanatomical 'proof' that the existence of disease

is determined by microscopic examination of dead tissues. This ideal runs parallel to the conception of natural science that, for example, in physics data are acquired in studies of dead matter enabling the scientist to control the manipulation to a high degree. Contrary to this, medical data often are 'embodied': cognitive scientists such as Varela, Thompson, and Rosch (1992) indicate that medical knowledge is acquired by means of a living human body with a consciousness which causes a variable reaction to external influence and manipulation. Although natural science should be used as an auxiliary science, and human physical phenomena can be described with the help of hydraulic metaphors such as the pump-function of the heart, this does not suffice to explain all aspects of human disease (Coulter 1975).

2. Medical data such as symptoms can vary over time during a disease-episode, which is obvious in the descriptions of human illness; symptoms cannot be considered as constant phenomena, which undergo only linear and reversible changes such as described in classical Newtonian mechanics. On the contrary, their variability is comparable to phenomena observed in modern physics, with applications in metereology and astronomy. Physicists such as Hess (1978) and Nicolis and Prigogine (1987), have studied so-called 'non-linear' or 'irreversible systems' in physics and chemistry, in which they observed irreversible variations of physical and chemical phenomena during the course of an experiment. Hess (1991) indicated that irreversible systems also exist in human cells, e.g., in the Adenosine Tri Phosphate (ATP)-cycle. Nicolis (1991) pointed to the 'chaotic' or non-linear features of both biological and human information-processing.

Irreversibility is a central feature of human disease-processes, as can be seen in the time-dimension of disease expressed in the term 'the course of the disease'. Medical knowledge is based on observations of occurrences in single persons which are by definition irreversible and unique, although multiple observations of patients can assist in discovering common features of these occurrences and in inducing rules from them. But the extrapolation of these rules to future occurrences is subject to probability, and is not deterministic in nature, as future occurrences will never be identical, as the current ones cannot be repeated (Feinstein 1983a).

3. Medical data are 'contextual': the account of human experience in illness is susceptible in its assumptions and its mode of reasoning to the culture in which these assumptions are formulated, by persons who are part of that culture. This is contradictory to the notion of universally true knowledge, independent of its context (Lock and Gordon 1988b).

The features of medical data make them apt for studying with linguistic techniques which can take their variation into account; modern medicine

should not solely rely on techniques which were adapted by medicine from natural sciences as they existed in the nineteenth century, when natural phenomena were thought to be deterministic and to predictably obey immanent laws (McMullin 1995).

Moreover, although modern natural science has drawn nearer in its assumptions to the practice of medicine as a context-dependent activity, it still does not possess techniques to investigate the vehicle itself of medical communication: language, in the form of discourse and text.

The linguistic challenge and its implications for medicine

From a linguistic perspective, some remarks can be made with regard to the nature of medical knowledge. The patient-doctor discourse can be conceived of as the telling of a narrative; moreover, the clinical theory the doctor uses as the framework to interpret this narrative can be conceived of as a text. Narrative and text can be analyzed by using linguistic techniques such as discourse analysis and text-analysis, and together they constitute an important part of what is considered medical knowledge.

Hunter (1991) has analyzed medical practice from a linguistic perspective, and described many factors which contribute to illness as expressed in the narrative of patients. The description of symptoms is born out of the experience of pain and disability, components of the lives of both patient and doctor. And these lives constitute the cultural context in which these symptoms are perceived (Price 1987).

An example of what the linguistic approach can offer the present discussion about medical propositions, is how the linguist Searle (1980: 226) establishes the relationship between the truth-conditions of a sentence, its meaning and the context of the reader of the sentence. The truth-conditions of a sentence do not depend on its literal meaning but on the 'background-information' we already have of the concepts used in the sentence in question, and of their relation to the central concept about which that sentence provides information.

Searle shows different meanings of the word 'cut' in about eleven sentences, e.g., 'Bill cut the grass' and 'Sam cut two classes last week'. For each sentence truth-conditions can be formulated, and they depend on the different meanings of this common word. In their turn, these meanings depend on our background information about the other words in those sentences, grass and classes. This information is our knowledge about how physical nature is organized (growth of grass) and how our culture is structured (classes in education). This information can be defined as the context of the reader.

Searle's argument can be reformulated for medical epistemology in such a way that the conditions under which a proposition such as 'this is disease' is true, may differ between different medical practices, as they may have different 'background information'. This background information determines different interpretations of the symptoms of a patient. And these interpretations are examined by considering basic notions about what is disease, a central concept within each system. These notions then lead to the formulation of truth-conditions, which make the proposition 'this is disease' a synthetic proposition in Carnap's sense: it can be tested after having formulated precisely the circumstances under which it is true; and these circumstances may differ depending on the medical system in which they are formulated. This very medical system then supplies the background information (cf. Searle) or context (cf. Gillett) of the proposition.

Methodological issues

The comparison of medical systems

A methodological issue of comparing one conceptual system with another is: can concepts and assumptions of one system be generalized to another system?

The approach chosen here is to analyze and compare medical practices by focusing on their cognitive aspect; a medical practice is considered here as the application of a system of thought, this medical system of thought is defined in cognitive terms as the conceptual design of how medical diagnosis occurs within a specific medical practice.

The analysis of the diagnostic aspect of a medical practice should focus on the interpretation of symptoms and on the meaning of diagnostic statements or propositions about these symptoms, rather than on the question whether these propositions are true under all circumstances. The circumstances are the respective assumptions in different medical systems, such as allopathy, homeopathy and Chinese medicine. If they can be defined, the truth of propositions may be established for each system.

A comparison of diagnostic strategies requires a semiotic perspective, to establish the relation between a symptom and a disease-category it refers to as a sign. For what is important in semiotics is not the universal truth of a proposition, but the meaning of a sign as the result of interpretation (Eco 1976). The use of the semiotic approach can avoid universalist discussions about the objective truth of propositions as referred to in the previous section.

When, in accordance with the definition of a medical system, as given above, a medical system is considered here a conceptual design of medical diagnosis, two aspects of such a conceptual design need to be compared: the structural and the decision-making aspect of establishing a diagnosis.

1. The structural aspect deals with how disease-categories cluster symptoms of illness, so the description of the structure implies the description of the categories used in that medical system.
2. The decision-making aspect addresses the selection and attribution of symptoms to disease-categories, and this implies the description of the process of interpretation; this is done by using a semiotic perspective.

The structural aspect is discussed first, and in the next section the semiotic approach of the analysis of the decision-making process is elaborated on.

Concepts and categories

The structure of a medical system consists of concepts about what disease is, what cure is and how it might be achieved, e.g., by interventions such as administration of medicines; but it also contains concepts about diagnosis, how the symptoms of a patient should be attributed to a disease-category, so that this patient can receive a diagnostic label, and can be treated with an intervention, etc. The cognitive analysis of a medical system thus should address the definition and practical use of concepts and categories. This issue refers to the question of their origin.

What is considered to be the origin of concepts, seen as cognitive entities, can vary according to different epistemological traditions. Empiricism stresses that concepts refer to objects 'given' in nature, a priorism that they exist as mental representations in the mind (see for more discussion Chisholm 1986; Fodor 1991; Quine 1969). Both traditions assume that concepts exist objectively, i.e., independently of their observer: they 'wait' to be discovered by the researcher.

The question is whether the notion of objective, observer-independent existence holds for the use of conceptual analysis in different cognitive systems such as medical systems. Again the issue of context arises: is a concept such as a disease-category (originated from either nature or the mind) independent of its context, or is it shaped by the experience of illness?

Medical concepts arising from experience like cough, inflammation or fever, have been categorized into clusters of symptoms or disease-categories, e.g., pneumonia. A medical-diagnostic process is a form of

categorization, for a doctor tries to find an answer to the composite question: 'To which disease-category do I attribute this patient with these symptoms, or is there no disease (as a category) present here, or does the symptom ambiguously refer to more diseases?' (Gale and Marsden 1985). And this question refers to a fundamental issue in categorization: are the properties of a category necessary and sufficient to define the category, or are they not?

This implies the next question: whether a disease-category is a class of uniform instances of diseases, or whether they can vary in the composition of their elements. The first type is called a 'discrete category', the second a 'non-discrete category' (Givón 1989). Wittgenstein (1953) used the notion of 'family-resemblance' for instances within one category; this was elaborated on by Rosch (1975, 1978) and led to the formulation of the notion of 'prototype' categories. One class of a category can have non-identical members (like in a family), and some of these members are so characteristic that they are the 'prototype' for a certain category, the prototype of a category is formed at the intersection of several typical features. Classical discrete categories are the exception rather than the rule of categorization, the majority of categorization occurs by 'prototypical effects' (Rosch 1978), and the majority of categories are 'non-discrete' (Givón 1989).

Medical categorization involves the question whether the central medical unit of categorization — disease — is a prototype or a discrete category — the latter is sometimes named a 'set' in medical texts on categorization (Wright and MacAdam 1979). This question implies:

— Are all instances of diseases within one disease-category (e.g., pneumonia) identical, or are they classified according to a prototype of pneumonia? And

— do all instances of pneumonia contain identical properties, or can these properties vary over several instances?

Summarizing, the analysis of the structure of a medical system has two aspects:

1. Concepts can be considered as fixed entities, existing independently from their context, either in nature, or in the human mind. Findings of research on child-development, such as those of Piaget (1972), however, show the dependence of concepts on context, in that concepts develop by experimentation with nature in interaction with a maturing mind.
2. Categories have traditionally been considered discrete categories; cognitive psychological research indicates that this is the exception of a more general rule which says that categorization occurs by prototype-effect (Rosch 1978).

If medical systems are to be compared, three options can be used:

1. The establishment of a conceptual meta-system

Common concepts then should be designed, to account for and to encompass the variation in concepts of the separate systems. The unification of concepts and categories of medical systems would lead to the creation of superimposed concepts and 'super-categories'; they would be immanent, according to the universalist tradition. The unification denies the character of concepts and categories as described before: categories are protypical, and concepts depend on the context in which they originate and in which they are used. It would also run counter to anthropological findings which show the cultural dependency of disease-categories (Kleinman 1986; Price 1987). Waitzkin and Magaña (1997) examined patients' narratives of traumatic events in different cultures; they relate culture to the expression of different types of somatic manifestation (somatization) of traumatic events. It is difficult to imagine how symptoms of such highly personal experiences could be categorized in cross-culturally, universally valid disease-categories.

The variability of human disease-symptoms and their culture-dependent expression would imply an endless translation of symptoms and concepts into formalized 'super-categories' of the metasystem, for which natural language as spoken by patient and doctor lacks the capacities. This would require the development of a formalized language.

A formalized language is an inappropriate instrument for the description of the variations of manifestations of human illness. The level of abstraction of this option makes it irrelevant for the daily practice, as practitioners would not be satisfied with such an abstract description of very concrete entities such as symptoms and categories.

2. The 'golden standard' option

This option is called metaphorically 'golden standard', as it implies that one system of medicine would function as the superior calibration point, the 'golden standard' with which to measure the validity and consistency of other medical systems. The objective of such a method would be to prove the superiority of one medical system by highlighting its featuring concepts in contrast to the equivalents in other systems. In the case of a medical system, selecting one of its features implies the use of a specific concept about disease or a specific disease-category as the measure with which to assess the validity of concepts or categories in other medical systems.

When the concepts are considered context-dependent and categories subject to variation, the selection of one of their features as the criterion

of comparison runs counter to the results of empirical research in prototype categorization: the use of one feature as a 'golden standard' can only be made by considering this feature valid in all different contexts, and that is exactly what is refuted by the research on prototypes. Because, if one feature of a category is considered to vary across categorizations (as is the case in prototypical categories), it may be present or absent. How can a feature be used as a calibration of other features if it is sometimes absent?

The discussion referred to above, about the lack in plausibility of homeopathy and Chinese medicine in biochemical terms, is, in fact, an example of such an isolation of one feature (in this case from allopathic medicine), which is then used to 'prove' the non-scientific basis of the other forms of medicine. However, in several university laboratories high dilutions, such as used in homeopathic drugs, are the subject of physical, biological, and physiological research. This has led to many publications of fundamental research (Bastide 1997; Endler and Schulte 1994). This research refutes both the claim of some homeopaths that natural science is not a suitable method for studying homeopathy, as well as the allopathic claim that biochemistry cannot lead to supporting the existence of the effect of high dilutions.

Moulton (1983) indicated with 'the Adversary Paradigm' the attitude in scientific debate to exclude other concepts from one's own conceptual model, and then to attack those other concepts. Gillett (1995) has mentioned that this excluding attitude leads to the opinion of allopathic medical researchers that other diagnostic and therapeutic possibilities do not need to be researched. This is not without practical, therapeutic danger as the physicians Querido and Roos (1980) and the physiologist Root-Bernstein (1993) have argued. Moreover, the use of the Adversary Paradigm is in itself a violation of a main principle of an objectivist science — from which the Adversary Paradigm originated (Moulton 1983): the selection of some feature as a standard of comparison has not been subjected to an objective procedure. Does a participant engaged in the debate, necessarily make an objective selection? Popper (1958) pointed out that scientific choices are usually influenced by subjective moments; Kuhn 1971 [1962] went a step further by stating that the process of scientific reasoning itself is influenced by subjective concepts. Also, to date, no publications are known which refute the homeopathic and Chinese medical assumptions by the use of an empirical model. And an a priori rejection of a possible explanation on a theoretical level contradicts the methodological, i.e., empirical framework of allopathy itself.

The approaches of both the meta-system and the 'golden standard' assume that there are concepts and categories with immanent properties which are independent of the context in which they are used.

This is in contradiction with the properties of concepts and categories described:
— the content of concepts depends on their contexts of origin and of use;
— categories do not have fixed properties, but are prototypical.
Therefore, both options do not seem to be the most appropriate methods for the comparison of medical systems. What is even more important, they fail to leave the universalist epistemological tradition behind, as they both still try to establish truth-conditions of propositions — in this case about medical concepts — independently of the specific circumstances (i.e., the medical system) in which the propositions about disease-concepts are formulated. This runs counter to the logico-positivist requirement of defining the circumstances in which a proposition is true (Carnap 1935; Rorty 1992). Therefore, a method is developed here which focuses on the interpretation of symptoms, rather than on establishing whether a proposition about them is true. This method uses semiotics as its theoretical framework.

3. The comparison of similarities and differences in interpretation
According to this option, the medical systems are compared for their similarities and differences between their concepts and categories.

The parameters of comparison are the existing disease-categories within each system, and the process of diagnosis (how symptoms are attributed to those disease-categories).

Three features which medical systems have in common are:

1. the use of language as the main vehicle for the transfer of information.
2. categorization as the decision-making process in diagnosis. Symptoms have to be attributed to disease-categories so that an appropriate therapeutic action can be taken.
3. the use of analogy in the construction of theories of disease. Metaphors used in textbook descriptions of disease-concepts give insight into how doctors in different medical systems interpret information about a similar complaint of a patient. The study of the use of analogy (Gentner and Jeziorski 1995) may show how the same symptoms of a patient can refer to different disease-categories when interpreted by doctors within different medical systems.

These three features are used in the semiotic approach, in which interpretation is the central focus.

Semiotics of medicine

In the part on categorization in the previous section a central question of an examining doctor was formulated about the decision to which

disease-category a certain symptom of a patient should be attributed. This attribution implies the establishment of the relationship between a symptom and something this symptom refers to. A relationship in terms of referral by one thing to another is called a 'semiotic relationship': a sign ('semeion' in Greek) refers to something else, its object. A semiotic relationship in medicine implies that a symptom may function as a sign if it refers to a disease-category. The question can be posed: when does the symptom become a sign, and when does it not? Or, in which way does a symptom become a sign? Several researchers have pointed to the relevance of posing these questions in a semiotic framework to study the practice of medicine (Burnum 1993; Foucault 1975; Sebeok 1991; Sundström 1987; Uexkull 1986).

Peirce, often considered the founder of modern semiotics in the nineteenth century, formulated conditions for when something becomes a sign, i.e., it refers to an object. These three main conditions are formulated here for words in a language. Words have a sign-function:

1. if their grammatical structure is correct,
2. if they can acquire a meaning, and
3. if their meaning can be transferred to the listener/reader of the word.

These conditions are reflected in the concept of the 'semiotic triangle' (*CP* 5.473, 5.484). The semiotic triangle consists of the sign, the object to which the sign refers, and the interpretant (the instance or person interpreting the sign referring to the object). According to Peirce (*CP* 1.339): 'a sign stands for something to the idea which it produces, or modifies. That for which it stands is called its object; that which it conveys, its meaning; and the idea to which it gives rise, its interpretant'.

Why is semiotics chosen as an approach for this comparison?

Eco (1976) compared semiotics with the traditional issues of philosophy, such as the truth of an assertive proposition (Katz 1972), by pointing out that semiotics is not so much concerned with truth as with meaning. For something to be valid as a sign the truth-value is not relevant, such as for a proposition in classical logic, but it is essential that the sign can acquire a meaning, i.e., that the sign can be interpreted.

As it is indicated with Searle's example of the variance of word-interpretation in different sentences, truth-conditions can be formulated for the proposition 'this is disease'. It is questionable if these conditions are valid beyond the specific medical system for which they are formulated. There are no disease-concepts used in medical practice which are universally valid. Is it more important that a symptom has a meaning than that it is 'true'? Doctors and patients can consider the sentence 'this is a disease', (an attribution of a group of symptoms to a disease-category), either as a proposition or as an interpretation of signs.

If the sentence is considered a proposition with a general validity for every system of medicine, universal truth-conditions (conditions under which the proposition is true in all systems) should be formulated (Eco 1976). These conditions might possibly differ between forms of medicine, given the divergent interpretations of the same term 'disease' in each system. If, however, the sentence 'this is disease' is conceived by both patient and doctor as an interpretation, the meaning is the criterion of analysis, and this meaning can differ between medical systems. With regard to truth-conditions it can be said that each medical system contains different conditions under which symptoms can be interpreted to refer to a disease-category.

If they do refer, the interpretation can be considered as a true proposition, but this truth depends on the specific context of one medical system in which it is made. It may not be a true proposition if made in another system of medicine; in semiotic terms, the truth does not depend on 'objective' or universal criteria, but on the correct interpretation within one certain system.

Definitions

The main concepts in semiotics are: sign, sign-production, and codes; these are applied to the medical context. They are defined by Eco as follows (1976: 116) (the medical application of these definitions is also given):

1. A sign is a correlation between an expression and a content.
2. Sign-production is the interpretative process that makes an expression (e.g., a symptom) refer to a content (e.g., a disease-category). Sign-production in medicine occurs when a symptom is transformed into a sign. This happens if this symptom can be provided with the correct coding, so that it can be interpreted by its referral and acquires a meaning. So sign-production is not a self-evident process: interpretation is needed.
3. A code is a marker of the correspondence between an existing system of sign-vehicles (symptoms) and a system of cultural units (diseases) (Eco 1976: 67–68).
4. A cultural unit is a whole of culturally accepted notions about a phenomenon. Anthropologists such as Price (1987), Waitzkin and Magaña (1997) and White and Robillard (1989) describe how disease-stories convey messages about cultural notions. To understand a medical consultation, it is necessary that both speaker and listener share knowledge about the codes of the signs they use: the symptoms which are presented by the patient.

5. The coding of symptoms is made, in semiotic terms, by syntactic and semantic markers (Eco 1976). Syntactic markers provide information about the form of the symptom; semantic markers concern its content (its referral to a disease-category).
6. Peirce discerned between a sign as an 'index' or a 'symbol' (*CP* 2.247); the index indicates a concrete object; the symbol tells in general terms that there exists any object to which is referred; the nature of the object is not necessarily known.

Prototype categorization and semiotics

Rosch (1978) established that most categories are organized around prototypes. This implies that a disease-category has a high chance of being a prototype; not always the same symptoms are included as elements into that category. Therefore, it cannot be said beforehand if a symptom refers unambiguously to one and the same disease-category.

It is therefore necessary to analyze how symptoms refer to disease-categories; and this can be a central focus of comparison between medical systems: how can the referring or semiotic relationship between a symptom and a disease-category be established? It is highly probable that this relation differs depending on how the concept of disease is formulated; e.g., in Chinese medicine several disease-patterns can be discerned within a group of patients with gastric ulcer (Kaptchuk 1983); one category in allopathy, 'gastric ulcer', can be subdivided into several patterns in Chinese medicine. This means that the referral of the symptom 'gastric pain' is different in allopathy and Chinese medicine.

How this referring relationship is exactly established, and how it differs between the three medical systems, depends on:
— which elements compose the prototypes of disease categories, and
— whether the categories are prototypes indeed, or discrete categories.
So, the structure of disease-categories may influence the semiotic relation between symptom and disease-category. Sometimes a symptom may refer to a disease-category, and sometimes it may not. This depends on the variation within a category, and this depends, in its turn, on the notion of what disease is; is disease a process defined to consist of a fixed set of features, independently of its context, the patient, or is it context-dependent, i.e., or do the features of the category depend on the patient?

A patient and doctor can establish a different semiotic relation between a symptom and a disease-category. For example, a patient with an abdominal pain suspects a physical diagnosis; when an allopathic doctor has

done physical examination (eventually complemented with laboratory data) without a result in the form of an anatomical cause for that pain, then the doctor is likely to say: 'I can't find anything'. As allopathic abdominal disease-categories are labeled according to anatomy (Harrison 1994), for this doctor the pain does not become a sign referring to any disease; so in this case there is no allopathic disease-category the pain can refer to. However, the pain does not disappear by stating that it is a subjective feeling for the patient. Doctors sometimes even say 'You can't have pain, as I can't find anything', then the problem becomes a discussion about the truth of a symptom (Jackson 1992).

The possibility of assigning a sign-function to a symptom depends on whether the symptom can be interpreted as referring to a disease-category. If there is no such referral, interpretation is impossible within this particular clinical theory: the symptom cannot become a sign. But it does, however, if the symptom can be incorporated in the disease-category as a variable element. The structure of a disease-category, a prototype or a classical discrete category (Givón 1989) influences the decision-making process, i.e., the interpretation by establishing a semiotic relation between symptom and disease-category.

The comparative model

When the synthesis is made of categorization and a semiotic approach, a working model for the comparison of systems of medicine is presented; a medical system is defined as a conceptual design of how a diagnosis is achieved. This model may function as a start to do research in a field defined here as 'comparative medicine'. In this article the first outlines are set for separate studies with regard to several aspects of medical diagnosis.

It is proposed here to use a semiotic approach for the comparative analysis of medical systems and to perform two operations first:

1. definition of the context of each system
2. description of the unit of the system's prototypical categorization: the disease-category.

Together this leads to the third operation:

3. developing a semiotic process-analysis of medical diagnosis.

The relevance of including each of these three operations is summarized as follows.

1. With 'context' is meant the cultural notions in which the key concepts of the medical theory are embedded, such as for Western medicine the

aim to gain objective knowledge about diseases. The cultural notion may lead to a definition of the disease-concept of the system under study, and this concept influences the nature of the disease-category, and thereby the type of categorization.

2. Whether prototypical or classical discrete categories are used in a medical system is relevant, for their composition determines to which disease-categories symptoms of a patient will be attributed, referring as signs to these disease-categories. The semiotic process (i.e., the referring relation between symptom and disease) depends on the kinds of disease-categories used in that medical system.
3. Context description enables the definition of key concepts (operation 1) which determine the mode of categorization (operation 2), which in its turn determines the semiotic process of diagnosis.

Therefore, by these three operations the internal consistency of a medical system may be examined and described.

A general scheme is proposed here for making explicit the reception and processing of the medical narrative. It is conceived of as a semiotic process-analysis, which takes into account the process of categorization and the influence from the context of the participants in medical practice: doctors and patients. On the basis of the model Eco (1976) developed for sign-production and coding, an application is made in Hunter's (1991) terms for the medical situation. The original semiotic model contains five steps in sending and receiving a message:

1. coding of the sign by the sender
2. sending the message
3. transferring this information, depending on the context
4. receiving the information which includes the code
5. interpretation of the information (Eco 1976: 141, 154).

If this is applied to the medical situation, the model becomes as described in Figure 1: The medical encounter as the starting point of diagnosis and treatment is the focus of attention. The first column of Figure 1 contains the phases Hunter mentions when describing the medical encounter in terms of the encounter of two narratives, of doctor and patient. In the second column the semiotic process is outlined for each of Hunter's phases. The third column mentions the moments where the context exerts an influence on the phase concerned.

The process can be divided into six phases:

1. The narrative of the patient is being told, including its coding (syntactic and semantic markers); the coding depends on the experience of the patient of her/his world. This phase includes steps 1 to 3 of Eco's scheme.

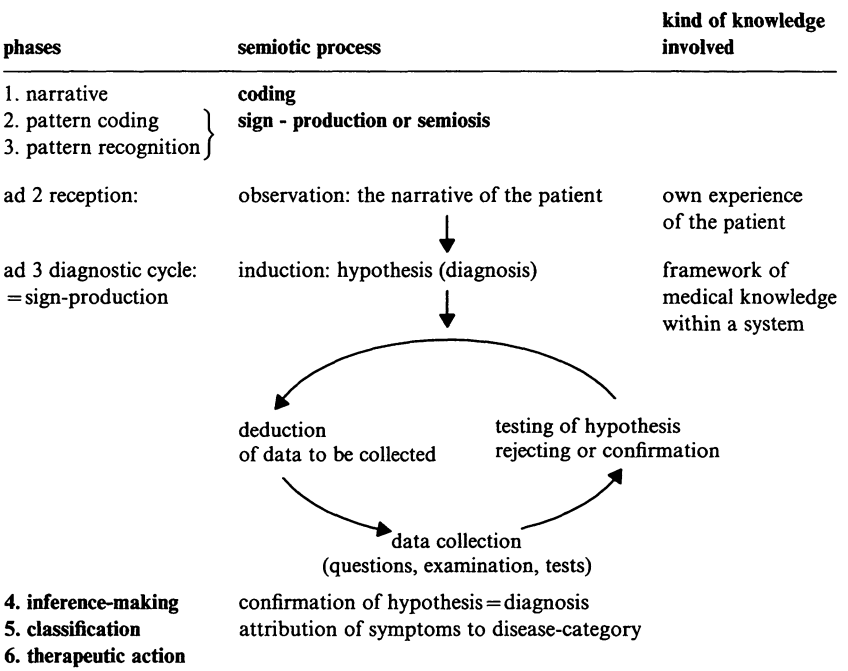

Figure 1. *Process-analysis of medical categorization*

2. By narrating the symptoms, a pattern is being built, some symptoms are emphasized, and others hardly mentioned; this process of selection can be analyzed in the analysis of medical discourse.
3. During this building of a pattern in the patient's narrative, the message is transferred to the listening doctor and received; the reception consists of pattern-recognition by the doctor according to the context of the doctor: personal experience and the form of medicine practiced account for the selection of the information and the possibility of attribution of the symptoms to categories. This possibility depends on whether the symptoms can become a sign. The selection process can be studied, as well as the interaction of selection of signs and the medical context (the main concepts of disease, cure, and health in a particular system).

This phase corresponds with steps 4 and 5 in Eco's scheme.

The second and third phase of the process constitute the actual *semiosis* or sign-production. The framework of the medical knowledge

guides the decoding by the doctor of the patient's narrative, and the synchronous coding of the selected symptoms, so that they can be attributed to a disease category. When a patient starts talking about stomach complaints, most probably the doctor's attention will initially be directed towards this complaint. It depends on the medical framework or available disease-categories, if other symptoms are interpreted to refer to the same category, to complete the clinical picture, e.g., concurrent throat sensations (such as is done in Chinese medicine). This checking of information by comparing it to an existing prototypical disease-category is described here as the hypothetic cycle. This cycle is an alternance of inductive and deductive reasoning. This also implies that the second and third phase alternate, as the doctor may return to the second phase to gain additional information which then may lead to another hypothesis in the third phase:

— With some observations of the patient's narrative, the doctor induces a preliminary hypothesis in the form of a selection of a potential category to which the narrated symptom might be attributed.
— Then, the hypothesis is tested by deductive reasoning by posing additional questions and searching for the presence of symptoms, which, if they are present, would also become signs given the presence of the first sign which triggered the formulation of the initial hypothesis. Together these signs will form a pattern.

Step 5 of Eco's scheme is divided here into the fourth and the fifth phase:

4. If the pattern of signs is present, the inference is made that these signs together form sufficient reason to confirm the hypothesis and to attribute the signs to a disease category: the hypothesized pattern is present.
5. The fifth step is the definite disease-classification, and the retelling of the patient's narrative in the form of a medical story by the doctor to the patient, justifying further diagnostic or therapeutic actions the doctor is about to propose. The patient may have checks of this information. This checking process may be analyzed further in discourse analysis of medical consultations.
6. If this process of negotiation is concluded, the therapeutic action can occur, although the proposal of it by the doctor can again cause a negotiation with the patient. This may provoke a feedback to earlier phases if the conclusion in the fifth phase is not agreed upon.

The exchange of the patient's narrative with the doctor's narrative is a circular movement, in which adaptation occurs as a two-sided process of sending and receiving messages. The two-sidedness, however, depends on the possibilities of both parties to engage in such a process (Brown 1995), and this engagement depends among other things on the possibilities of categorizing the information presented by the patient. A more

detailed description of the limitations of these possibilities can be made by the text-analysis of medical books and discourse-analysis of medical consultations; these can be made in separate studies.

Steps of comparative analysis

In the description of the diagnostic process made above, several aspects can be discerned. These aspects concern the structure, the meaning, and the action of a semiotic process or semiosis. Morris (1971) proposed a division of semiosis according to this tripartition:

1. the syntactic level, where issues of structure are dealt with;
2. the semantic level, where meaning is addressed;
3. the pragmatic level, where the actions are the focus of interest.

The model of comparative analysis is composed according to this three-level structure, enabling the diagnostic explicitation of other medical systems.

Each medical system which is to be compared can be analyzed in separate studies at the following levels:

1. The syntactic level: here the structure is constituted by the elements of the system of signs which is described; in this study this means the definitions of the key concepts of the medical systems concerned. The chosen key concepts are: disease, cure and health. They can be defined for each system, such as for allopathy, homeopathy and Chinese medicine. All three concepts form the basic terms in medical narratives, be it on text- or discourse level. Medicine ultimately is concerned with disease and the process of cure to arrive at a state of health. Their interrelationships can be analyzed, as well as the metaphorical structure of the key concepts. The metaphors refer to the underlying thoughts, which contributed to the origin of those concepts. Together they form the foundation for the second level.
2. The semantic level: here the meaningful relations between the terms disease, cure and health are displayed in the form of a clinical theory. This clinical theory describes how a symptom such as gastric pain may refer to different disease-categories, and these may differ in different medical systems. Without a clinical theory a doctor cannot receive the patient's story nor understand it in a form which enables description, interpretation and treatment of the symptoms.
3. The pragmatic level of the analysis indicates the language actions in the discourse in the way that they can be performed, given the possible relationship which can be made at the semantic level, i.e., the clinical theory. The patient's story is transformed by deletion and selection of

signs depending on the possibilities of interpretation of the doctor (Brown 1995).

Conclusion

It seems feasible to design a framework for analysis and description of the cognitive aspects of medical diagnosis, as such that similarities and differences of the respective systems can be distinguished, without that an a priori position needs to be taken about the validity of a medical system.

When the three levels of analysis, syntactical, semantical, and pragmatical, are used as such a framework, those similarities and differences may enable an explicit comparison, which can provide instruments for a structured communication between practitioners of these systems.

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