The technological invention of disease - On disease, technology and values

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Preface

Why am I preoccupied with such apparently different topics as the concepts of disease, technology and values? The straightforward answer is that health care has become one of the most expansive activities in modern societies, and technology is one of the most influential factors. This modern technological health care, however, faces profound practical, epistemic and evaluative challenges, which has made theoreticians appeal to the concept of disease to find a solution. Hence, disease is conceptually connected to technology and to evaluative issues.

However, there is also another more biographical answer to the initial question. When I became a student I had a hard time to decide whether to study humanities or sciences. I finally decided on the latter and studied physics, electronics and biomedical engineering at the Norwegian University of Science and Technology (NTNU, former NTH). However, even as long ago as when I was studying, I took courses in the humanistic disciplines and read books on these subjects. During my later work, both as a researcher and as a chief engineer at Oppland Central Hospital, I tried to combine my two interests. It was also while working with health care issues that I finished my formal education in philosophy and history of ideas, and some of these studies concerned topics in health care. The forceful critiques of technology and the related ethical issues debated during the 1970s and 1980s had turned my attention to how technology relates to values. I realised that this relationship was particularly perceptible in health care, and I started to study central concepts such as HEALTH and DISEASE.[1] To my great satisfaction I found what I was looking for: a subject matter that exemplified how technology was related to value, and a perspective that acknowledged the practical aspects of concepts and theories. Hence, in the study of the concept of disease and its influence from technology I found a perspective that addressed more general philosophical issues. The topics DISEASE, technology and values are central issues of personal interest, but also pertinent topics in the philosophy of medicine.

The paths to my insights are paved with good advice, critical comments, moral support and rewarding discussions. I would like to acknowledge the assistance of my mentor and *maía*, Jan Helge Solbakk, who has done much more than directing my interest towards the ancient concept of téchne. His encouragement and generosity towards diverging ideas showed me a fruitful attitude to philosophy, which I have greatly benefited from and have tried to adopt. This is a quality that he extensively shares with my second supervisor, Søren Holm, whose clever

[1] A short note on connotation. Words are referred to in the following way: “disease”. Concepts are referred to using capital letters, DISEASE, if it is not clear by the context: concept of disease.

comments, good advice and friendly supervision have been invaluable to my work. Thank you Søren! I would also like to acknowledge the assistance of my mentor in ethics during my student days at the Norwegian University of Science and Technology and later at the Center for Medical Ethics, Knut Erik Tranøy, who has been of great inspiration to me. I am grateful to Reidun Førde and Per Nordtvet for their helpful comments, continuous encouragement and friendly advice. I am thankful to my colleagues at the Center for Medical Ethics for interesting discussions and valuable comments on my work: Berit Støre Brinchmann, Ann Nordam, Åshild Slettebø, Reidar Pedersen, Eirik Pettersen, Venke Sørli, Miruna Sanmarghitan and Homa Hasan. Special thanks to my office-mate, Ståle Fredriksen, for his infectious enthusiasm and infallible optimism. Per Sundström has also taken time to read and to give comments on some of my manuscripts, which I appreciate. I am grateful to the philosophers at Lillehammer College, Trond Gansmo Jakobsen, Terje Ødegaard and Stefan Snevarr, for their hospitality, for offering me an office in their department, and for inspiring discussions on various philosophical issues. Thanks also to Harald Grimen, Halvor Nordby, Edvin Schei, Linn Getz, Anne Luise Kirkengen and Eli Berg for inspiring discussions and to friends and colleagues at Oppland Central Hospital for their continuous encouragement. Moreover, I am indebted to many philosophers and health care analysts who have inspired and influenced me during my work on issues of disease, technology and values. It is of course dangerous to mention anyone in particular, especially, as it might be difficult to identify their influence in this thesis. At the bottom of my heart I am a “skeptikos” in the ancient sense; “an inquirer”. However, it is quite clear that this work would never have emerged without the inspiration provided by Lennart Nordenfelt, Georges Canguilhem, William Stempsey, Lawrie Reznek, Henrik Wulff, Stanley Joel Reiser, Fredrik Svennaeus, Eric Cassell, Langdon Winner and Carl Mitcham, to mention only a few.

Special thanks also to Linda Grytten, who has done splendid work editing my English.

Last but foremost, I am obliged to my wife, Hilde, and my daughter, Helene, for their immense inspiration, for facilitating my work, and for being so happily uninterested in both disease and technology, but being of vital value!

I Introduction

What is it all about?

The objective of this thesis is to investigate the concept of disease, in particular to consider how this concept is influenced by the widespread application of technology in health care. To claim that the concept of disease is value-laden is uncontroversial. To maintain that the concept is constituted by technology is also uncontroversial. However, my main arguments; that technology has an impact on the value-ladenness of the concept of disease, and that technology illuminates the general value-ladenness that forms the basis of any medical activity, are controversial.

In addition to a short outline of the arguments of the thesis, in the introduction I discuss the relationship between the concepts of health and disease, and I try to justify why my arguments focus attention on the concept of disease and not on the concept of health. In the introduction I also give an outline of central terms such as "disease", "technology" and "values", and I identify some important challenges to modern health care that have inaugurated the debate on disease, technology and values. At the end of the introduction I present the abstracts of the papers.

In the second chapter I analyse the debate about the concept of disease, and I describe how the debate involves a wide range of profound philosophical issues. These issues relate to fundamentally different aspects of life. Since DISEASE has a complex extension, it is a complex concept. Many argue that DISEASE is complex, but few have analysed its complexity through the wilderness of philosophical categories applied in the debate.

However, what does it mean, that disease is a complex concept? In Chapter III I present one way of conceiving this conceptual complexity. I argue that the concepts of disease, illness and sickness provide different perspectives on human ailment. Although most philosophers seem to have abandoned the distinction between DISEASE, ILLNESS and SICKNESS, this distinction still appears to be very important in health care practices and in the social sciences. Few have tried to defend it philosophically, and in particular in its epistemic-ethical capacity: the triad represents a theoretical framework for addressing both epistemiological and evaluative challenges to modern health care.

In Chapter IV I raise the question of how technology influences the concept of disease, and I argue that technology establishes the phenomena (molecules, cells, micro-organisms), the signs and markers, and the practice (diagnosis and treatment) that medicine labels "disease". Although several scholars have noted that technology establishes DISEASE, few have addressed this issue

explicitly. The result of this study is a strong claim: that technology constitutes DISEASE, ontologically, epistemologically and practically, and not only that it has a broad influence on our medical conceptions. In this way technology contributes to the complexity of disease, and understanding technology becomes a central part of understanding disease.

What, then, do we mean when we say that technology constitutes DISEASE? Does technology meet the challenges of medicine by making the concept of disease value-neutral, or does it make the evaluative challenges in medicine more serious? In Chapter V, I address this question and I maintain that technology actually aggravates the challenges in medicine. Technology is not a neutral means to valuable ends, and it does not make DISEASE a value-neutral concept. In this chapter, I consider the role of technology in medicine and how technology is related to value. It is argued that technology is value-laden, and that its value-ladenness is related to its function. However, not all value questions related to technology arise from this value-ladenness. Because technology develops the potential of health care, it poses a wide range of issues of value, but only some of these concern the technology *qua* technology. Hence, it becomes crucial to differentiate between situations where *technology poses issues of value* and situations where *technology promotes values*. This conception represents a new and alternative route between the value-neutral dictum and the all-encompassing value-ladenness stance, which distinctively emphasises our responsibility for technology.

How then, are we to understand this value-ladenness of technology, and consequently, the value-ladenness of the concept of disease in particular and of medicine in general? These issues are addressed in Chapter VI. In particular I consider whether ancient conceptions of medicine can be fruitful. However, instead of following the traditional route by returning to the concept of phronesis, I argue that the ancient concept of téchne is more suitable. TÉCHNE provides a framework in which to understand medicine's value-ladenness, and in particular the value-ladenness of medical technology. Conceiving medicine as téchne is not an original idea. Many have followed the Hippocratic main argument in *Peri Téchne*. What is original, however, is the way the concept of téchne is applied as a conceptual framework for explaining technology's value-ladenness and the close relationship between medicine and technology.

In Chapter VII, I carry this reciprocity between medicine and technology one step further and argue that *medicine is a technology*. This is not only because medicine is a functional and purposive activity such as technology, and that it is predominated by technology both in theory and practice, in diagnostics and treatment, but also because medicine, through the concept of téchne, provides a theoretical-practical framework that is suitable for analysing technology. That is, medicine is a theory of téchne, a téchne-logy. Hence, medicine might be applied as a model to

analyse and understand important aspects of human life, and may again be a model to philosophy, as in antiquity.

I conclude that DISEASE is a complex concept that is conceptually influenced by (the complexity of) technology. This, however, does not make it value-neutral: on the contrary, technology contributes to the value-ladenness of the concept of disease. This conceptual tie between technology, medicine and values can be fruitfully analysed within the perspective of the ancient concept of téchne. This perspective appears to be fruitful to the understanding of medicine and technology as evaluative activities, and to the comprehension of the close relationship between them. In other words: medicine is purposive as is technology, and technology is evaluative as is medicine!

Why DISEASE and not HEALTH?

Why then, does this thesis deal with the concept of disease, and not with the concept of health? Or in other words, if I want to discuss essential issues in HEALTH care, why do I discuss DISEASE and not HEALTH? I will address this question by investigating different models for the relationship between HEALTH and DISEASE.

The ideal model: Health as the absence of disease

The simplest model of the relationship between the two concepts is that HEALTH is given by absence of disease. I will call this model the ideal model. If you are healthy, you are not diseased, and conversely, if you are diseased, your are not healthy. This ideal model of the relationship between HEALTH and DISEASE is prevalent among health care professionals. "Diseases are derangements of the structures and functions of the parts of an individual human body. If they are not deranged, they are healthy. Every textbook of human anatomy or physiology is believed to be a portrait of human health. Normality is the absence of abnormality." (Burns 1975: 44). The ideal model is expressed in ordinary language: we talk about dis-ease, dis-ability, dys-function, dis-order, un-pleasantness, and the model can be traced back to antiquity. In the Metaphysics Aristotle states that it is by the absence of health that disease exists (1032b4-6).

According to this model, both health and disease could in principle be the primary concept, and in ordinary language, EASE, as an equivalent to HEALTH, is primary to DIS-EASE. Among health care professionals, however, DISEASE appears to obtain primacy. This is reflected on an academic level by the oft-quoted scholar Christopher Boorse, who defends the ideal model with a primacy to the concept of disease (Boorse 1975;1976).

However, there appear to be some difficulties with the ideal model. It cannot handle situations

where people are not diseased, but where they are obviously not healthy. Health care personnel frequently encounter patients with painful symptoms, but where they cannot detect any disease. That is, an absence of disease does not imply that a person is healthy.

The holistic model: Health as more than the absence of disease

One way of addressing this challenge has been to introduce a different model of the relationship between health and disease, according to which health is more than the absence of disease. The WHO definition of health as "a state of complete physical, mental, and social wellbeing and not merely the absence of disease or infirmity" is an example of this model. The point is that there are criteria to health other than the mere absence of disease. Such criteria might be wellbeing, happiness, ability to realise (vital) goals, or to promote human functioning as a whole. According to such criteria, this model can be called a "holistic model".

In other words, the holistic model says that non-disease is not a sufficient condition for health. It follows logically from this that you can be both non-diseased and not healthy at the same time (See Appendix I). Thus, the model can explain why it does not necessarily mean that you are healthy if no disease has been identified. The point is that there are other criteria for health than the medical criterion of non-disease. According to the holistic model, health is the primary concept.

However, there appear to be difficulties embedded in this conception of health as well. For instance, physicians frequently encounter people that are apparently not healthy according to the holistic model, but for whom they cannot find any disease. That is, the traditional models of the relationship between health and disease, the ideal model and the holistic model, cannot handle situations where the absence of health does not imply disease. We might then instead try to introduce a third model, which I have called the medical model.

The medical model: Disease as more than the absence of health

According to the medical model of the relationship between the two concepts, DISEASE is more than the absence of HEALTH. That is, in order to be diseased there are some criteria in addition to the criterion of not being healthy. Normally such criteria are that disease has to be detected and identified in accordance with some standard methods, for example medical examinations or tests. That is, you are only diseased if disease can be detected by medical methods.

In other words, the medical model says that non-health is not a sufficient condition for being diseased. It follows logically from this, that you can be both non-healthy and non-diseased at the same time. Hence, this model can explain why it does not necessarily mean that you are diseased if you are not healthy. The point is that there are medical criteria for what is disease that are

stricter than the criteria for non-health. According to the medical model, DISEASE is the primary concept, having the strictest criteria, and if disease is detected, the person is not healthy.

It is worth noting that there are some similarities between the medical model and the holistic model. Both explain situations that challenge the ideal model, both explain the situation where one is neither diseased nor healthy, and both introduce special criteria to one of the basic concepts of health care, that is criteria for what is disease and what is health. The medical model points out that the absence of health does not qualify for disease, and the holistic model emphasises the fact that the absence of disease does not qualify for health. However, most people regard the medical model and the holistic model as incompatible. The differences between them relate to the special criteria and to which concept is given primacy (DISEASE or HEALTH).

There is also another aspect of the three models that is important. The ideal model presupposes that health and disease are both exclusive and exhaustive concepts. If you are not diseased, you are healthy, and if you are not healthy, you are diseased. The medical model and the holistic model, however, do presume exclusiveness, but not exhaustiveness. If you are diseased, according to the holistic model, you are normally not healthy. Conversely, many would argue, if you are healthy, according to the medical model, you are not diseased. That is, neither the medical model nor the holistic model can explain situations of both health and disease being present at the same time.[2]

However, are health and disease exclusive concepts? Are there not many situations in which people are both healthy and diseased? In other words, is it not so that health is not a sufficient condition for non-disease, and that disease is not a sufficient condition for non-health? It appears to be quite common to be healthy even if one has a disease. For example, a person who has a positive result, from a genetic test, but who has no experience of disease, is he not healthy? Conversely, a person who feels helpless or unhappy without there being any specific cause, and who due to this feeling is not able to fulfil his obligations to his family or employer, but who has no disease that can be identified, what kind of disease does he have?

Contrary, but partly independent concepts

These situations are not easily resolvable within the framework of the ideal model, the holistic model or the medical model. What then, does this mean? Are health and disease independent

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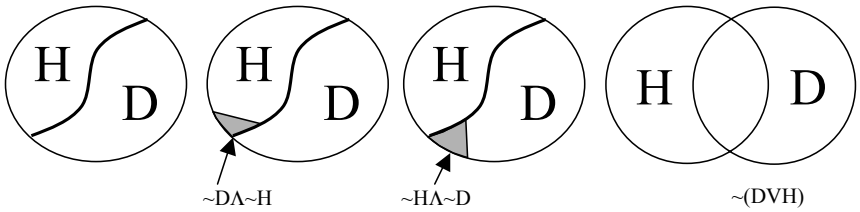
[2] This is the same as saying that none of the models imply that health is a sufficient condition for not being diseased or that disease is a sufficient condition for non-health. Both these statements would allow situations of both health and disease. However, there are holistic interpretations that allow for situations of both health and disease (Nordenfelt 1986; 1987). The reason for this is that ILLNESS, and not DISEASE, is defined in opposition to HEALTH.

concepts? Analysis of the different models shows that the concepts of health and disease are not exhaustive. People can be neither diseased nor healthy. If one wants to explain situations that frequently occur in practical health care, then the concepts of health and disease cannot be defined in terms of each other. I therefore agree with Knut Erik Tranøy, when he says that HEALTH and DISEASE are not inter-definable (Tranøy 1995b:152). Additionally, if one accepts that people can be both healthy and diseased, the concepts are not exclusive either.

There is good reason to believe, however, that health and disease are corresponding concepts.[3] Both are concepts that are frequently applied in health care, and in some way disease tends to reduce health, and health is not a prominent characteristic of diseased people. However, this is not always so. Hence, there are some aspects of the concepts that make them different and partly independent. I will try to refer to some of these aspects in the following section, and I will also argue that these differences justify giving primacy to the concept of disease.



Ideal model	Holistic model	Medical model	Contrary, partly independent
Exhaustive	Not exhaustive	Not exhaustive	Not exhaustive
Exclusive	Exclusive	Exclusive	Not exclusive

Figure 1 Outline of the relationship between health and disease in the different models.

Distinctions between HEALTH and DISEASE

There appear to be epistemological differences between the concepts of health and disease. Disease is an explanatory concept (concerning physiological and psychological disorders), whereas health is not (Engelhardt 1975; 1995). Through their education, training and practice medical professionals get to know about disease entities. They know the symptoms, the signs and the causality of the paradigm cases. In other words, one can be taught to recognise cases of disease (Tranøy 1995b: 152). This does not apply to health. Disease is conceived of as being caused, health is not. That is, disease has aetiology, whereas health has no aetiology.[4]

It can be argued, however, that there are causes to health. Exercise, healthy food and an active

[3] Tranøy therefore argues that health and disease are interdependent concepts (Tranøy 1995b).

[4] See for example (Wulff 1997: 81; Tranøy 1967: 355; 1995b; Engelhardt 1975; 1995).

life without stress, all contribute to one's health.[5] Against this, however, it can be maintained that exercise, food and activity are aims in themselves, and not causes of health, or that they are means to fitness (and not health) or measures to avoid disease.

The difference with regard to aetiology corresponds to the difference between physiology and pathology. It is widely accepted that knowledge of disease precedes and generates knowledge of health – pathology is primary to physiology.[6] This can be related to the ethical appeal in medicine, to be discussed below: The sick person's plea for help is more obligating than the search for knowledge of well-being and bodily functioning.

Related to these epistemological differences, there is also a taxonomic difference between health and disease. Diseases are occurrent and classified, whereas health is not (Tranøy 1967: 355). There is a taxonomy of diseases, whereas there is no classification of health (Burns 1975). That is, the extension of 'disease' comprises many disease entities, whereas the extension of health does not. Likewise, we can show and recognise exemplars of disease, whereas we do not have exemplars of health (Tranøy 1995a).

Furthermore, there appears to be a semantic difference. It is argued that DISEASE is definable, whereas HEALTH is an enigma, and as difficult to define as life itself.[7] This accords well with the common opinion that "it is much less difficult to obtain agreement across social classes and different cultures about those states of the mind and body that constitute diseases than it is to secure agreement about which states are to be viewed as healthy." (Caplan 1989: 55).[8]

Moreover, there are experiential differences between health and disease as well. It is argued that disease is a new and sudden perceptible experience that engenders awareness of the body, whereas health is not. Disease is an occurrent phenomenon whereas health is dispositional (Tranøy 1995a: 132), we can feel disease, but health is not felt, it is the simple awareness of living (Kant 1798: 964). Furthermore, disease is temporal, while health is atemporal (Toombs 1990). It is possible to point out when disease starts and when it finishes, but this is not the case with health. We have to experience disease to experience health (Tranøy 1995a).

We can argue, however, that in some instances health is temporal.[5] In the case of food-poisoning, I may experience that fifteen minutes after eating oysters I start to sweat, feel sick and begin to

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[5] This objection I owe to Søren Holm.

[6] See for example (Kant 1798; Canguilhem 1943; King 1954; Tranøy 1967: 355; Jonas 1985: 147).

[7] See for example (Troels-Lund 1911; Tranøy 1967: 355; Jonas 1985: 147; Gadamer 1987: 258).

[8] Another semantic aspect worth noting is that when lay persons are asked "what is health?", they tend to speak about their ailments (Fugelli & Ingstad 2001: 3601).

vomit. It would be reasonable to say that my health was substantially reduced fifteen minutes after eating the oysters. Correspondingly, I may experience that after two hours I feel much better, stop sweating, stop vomiting and am thus healthy again. However, the phenomena that indicate the cessation and the re-establishment of health are pain and the recognition of an undesirable situation. Hence, even though both health and disease are temporal phenomena, the phenomena that mark the cessation and the re-establishment of health are negative and undesirable phenomena, such as pain, and not positive phenomena such as well-being and happiness. Thus, the temporality of health is given by notions that are applied to characterize disease, that is, the temporality of health rests upon disease and the ideal model. This is because there is a qualitative difference between pain and well-being (Reise 1953). Pain and suffering are asymmetric to pleasure and happiness (Flew 1975: 47). This relates to a basic axiological difference between health and disease.

It can be argued that health and disease relate to different sets of values. According to a widely held theory health is value-laden, while disease is value-neutral. However, even those who contend that both health and disease are value-laden concepts, claim that there is a distinct difference. For example, it is claimed that disease relates to biological values, whereas health includes moral values in addition, being the ultimate goal for human flourishing (Sade 1995). It has also been argued that disease concerns political, social, educational, aesthetic and moral norms, whereas health concerns only aesthetic (and not moral) norms (Engelhardt 1975: 127). This evaluative asymmetry between the concepts of health and disease has been related to a general asymmetry in ethics (Tranøy 1967). There is a higher 'moral weight' attached to negative notions than to positive ones such as good and bad, health and disease, or life and death (Tranøy 1967: 351). It appears to be easier to agree upon the negative aspects of life than on the positive ones (Glover 1999). Thus, the differences between health and disease are rooted in more general ethical distinctions.

Moreover, there is a practical aspect related to the ethical difference between the concepts. Disease is a concept that enjoins to action, whereas health does not (Engelhardt 1995). There is an appeal to professional responsibility embedded in the concept of disease, whereas there appears to be no such responsibility connected to the concept of health (Gadamer 1993; Jonas 1985: 147). The sick person's plea for help is more obligating than the promotion of well-being and bodily functioning. People's diseased conditions allow for experiments and research that are not allowed on healthy persons. Hence, disease requires us to seek an explanation and to take curative action, whereas health does not. Another practical difference is illustrated by the application of technology. We tend to use technology to achieve what we consider to be good in

life, as well as to avoid what we conceive of as being bad. Technology is extensively applied in actions related to disease, but much less in relation to health.[9] Hence, technology points to a profound practical distinction between the concepts.[10]

Altogether, there appear to be epistemological, taxonomical, semantic, experiential, axiological and practical differences between HEALTH and DISEASE. What then are the consequences of these differences? First, these differences confirm the fact that the concepts are different in a wide variety of aspects. That is, the concepts are neither exhaustive nor mutually exclusive. Second, the discussion above provides some serious arguments to support the claim that disease is the primary concept. DISEASE is the epistemologically dominant concept, it is the only one that relates to a taxonomy, it appears to be the less cumbersome to define, the easiest to experience, and the one that directly relates to an ethical imperative. Third, if the concepts are different, they should be treated differently. If there are basic distinctions between the concepts, then these distinctions should be reflected in theory as well as in practice. Health and disease are basic concepts in modern health care. The goal of medicine is commonly conceived of as "to cure disease and promote health". The distinctions between these concepts influence the basic goals of medicine, which are relevant, for example, for the relationship between disease control and health promotion. Here, however, the point is to justify why the focus of attention will be the concept of disease. This is in accordance with the Hippocratic text, *On the art*, where the aim of medicine is to relieve pain and to cure disease.

However, does this primacy of DISEASE not oppose ordinary language? In standard language we use negative prefixes to refer to human ailments, such as dis-ease, dys-function, dis-ability. If disease is the primary concept, should “health” not be denoted as “dis-ailment”? Logically speaking, it should. However I think that this inconsistency with ordinary language is due to an

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[9] We can of course argue that we have a health industry, in which technology plays an important part. (I owe this argument to Jan Helge Solbakk). Furthermore, we can also argue that much of the technological enterprise of modern medicine is applied in order to confirm health instead of to detect and treat disease (Hofmann B. [Ethical challenges with technological development] In Norwegian. Submitted manuscript). This, however, breaks with a common conception of medical technology, as technology intended for somatic use is applied to treat mental conditions such as fear and anxiety. When diagnostic technology is applied therapeutically in this way, one departs from the original technological paradigm in medicine. Moreover, using technology to confirm health is different from using technology to promote health. The first can be conceived of as a negative condition (fear, anxiety), that is, as an ailment, and thus not concerned with health as such. The latter, however, concerns the conception of positive health. However, health enhancement technology is not (yet) as prominent as technology for detecting and treating disease.

[10] Two practical-epistemical arguments may be added. The comprehensive and expanding conception of risk in health care tends to expel the concept of health. We are not healthy any more, but only have risk factors to a greater or lesser extent. Moreover, history shows that academic pursuits of HEALTH tend to end in analysis of DISEASE (Sørensen & Dalgård 1999: 136). However, I believe there are some brilliant exceptions.

inherent conceptual “positivism”. We tend to think in positive terms and conceive of the bad as a deviation from the good and disease as abnormal. However, when it comes to defining terms such as “ease”, “ability”, “health”, “well-being” and “happiness”, we tend to recur to negative notions such as disease. It appears to be circular that positive terms such as health and ease are practically defined by negative terms (dis-ease) that again refer to the positive terms in question. It seems to be important, however, to differentiate between the syntactical and the semantic level. Even if one term (“disease”) originates in the negation of one other term (“ease”), this does not mean that the first might be semantically defined by the second. On the contrary, as argued here, it appears to be less difficult to define DISEASE than EASE or any of its equivalents. Hence, this thesis will focus its attention on DISEASE. But why do we need a concept of disease?

Why do we need a concept of disease?

Why do scholars find it necessary to have a strict, consistent and coherent definition of *disease*? Common answers to this question are as follows: Disease is a central concept in modern health care, it affects society and it is important in the process of discovering and identifying disease entities (Albert, Munson & Resnik 1988). DISEASE has an explanatory and classificatory function for health care professionals and it determines the subject matter of medical science. Moreover, DISEASE has a social function. It is argued that we need a concept of disease in order to decide who is entitled to treatment and to economic rights, who is to be exempted from social duties and who is morally accountable (Nordenfelt 1993a).

Furthermore, the study of the phenomena that we refer to by the term “disease” helps us understand the phenomena we associate with “health” (Canguilhem 1943) and the study of DISEASE is important for gaining an understanding of the relationship between biological events and society (Ackerknecht 1982).

However, DISEASE also has an explanatory function for individual people. People use disease to explain their undesired situation to themselves. We have disease, not to give up hope. (Canguilhem 1943). It appears to be an inevitable fact of life that everyone has to face in one way or another. Disease is something that most people suffer from at some time in their life, that some people have to learn to live with most of their life and that most people die from. Hence, the concept has an existential aspect.

In other words, DISEASE provides a means of dealing with common aspects of human ailment, a means of classifying disease entities, of rationalizing communication about human ailment and for differentiating particular cases. DISEASE is useful for educational purposes as well as for

expressing existential concept. Furthermore, a strictly, consistently and coherently defined concept of disease can help the health care system to face its basic economical, social, epistemological and ethical challenges. In addition, it can help to clarify the goals and limits of medicine.

The basic concepts of the thesis: disease, technology and value

In order to discuss the concept of disease, and in particular its relationship to technology and values, it is important to know what these concepts refer to. As I hope this work will make clear, the concepts of disease, technology and value are not easy to characterize or define, as they are all complex concepts. Basic concepts related to society in general and health care in particular are complex and do not easily lend themselves to definition. It is nevertheless useful to have a tentative notion of these concepts, even though these definitions will be adjusted and modified.

> By **disease** I understand negative bodily occurrences as conceived of by the medical profession.
>
> By **technology** I understand the complex of devices, methods and organizations applied in human purposive and productive activity. Both in terms of devices, methods and organization, technology today is integrated in modern medicine. A defibrillator (heart starter) is not just a box with wires, electrodes and electronic components (*device*). It is a defibrillator on behalf of the *methods* of medical resuscitation applied in an *organization* of health care.
>
> **Value** is an extremely difficult concept with a wide variety of connotations, even within ethics. Within the framework of this thesis "value" refers to issues of the good life. The evaluative is commonly opposed to descriptive issues, and although I wish to scrutinise and criticise this fact-value distinction in relation to disease and technology, it will be my point of departure.

Challenges to modern health care

Debates about the concept of disease (and technology) are engendered and vitalised by epistemological and ethical challenges to modern health care. A concern for these challenges is also the motivation for and the point of departure of this thesis. Modern health care has been accused of making every aspect of human life into a medical issue (medicalization) and of making mental matters into somatic issues (somatization). Accordingly, health care has been accused of over-treatment; both futile treatment and detrimental treatment. Hence, health care appears to be omniscient and knows no limits. These issues are clearly related to the concept of disease.

Furthermore, two main challenges are particularly and explicitly connected to DISEASE: situations of disease without illness and situations of illness without disease. The latter is frequently viewed as a preliminary limitation of medicine: one does not know enough yet, but with further research and new technology one will find the disease that causes the illness. I think

there is reason to believe that this limitation is inevitable and that it is founded on the basic difference between people. You might never be able to explain all aspects of me (not even as a biological being).

The former situation, of disease without illness, completes the technological project of medicine. It renders disease objective by detaching it from human perception, and as such is challenging. Modern technology facilitates the detection of diseases without any perceptible symptoms. Being able to identify risk factors and to predict risk can make people anxious, ill and diseased rather than the opposite. As the goal of developing an descriptive concept of disease is reached, the challenges we face point to the deficiencies of the goal, and to the profound and inevitable moral basis of health care: to heal and to help the particular person in a situation of suffering and pain. It is argued that technologically disease-focused health care is unable to recognise the individual person and that which is personal, which is the pivot of all health care. In other words, there is a paradigm shift when the health care system searches for disease when people do not ask for help.

Although many of these challenges will be addressed, I cannot of course address all of them within the framework of this thesis. However, they are the intellectual and practical challenges that comprise the impetus for this thesis. I will try to explain why modern health care is such a paradox: on the one hand it appears to be the greatest benefit to mankind (Porter 2000) and on the other hand it appears to be a disaster (Le Fanu 1999).[11]

[11] For the conception of health care as a paradox, see (Hofmann 2001d).

Results: Abstracts of the papers

Paper 1: Complexity of the concept of disease as shown through rival theoretical frameworks

The concept of disease has been the subject of a vast, vivid and versatile debate. Categories such as "realist", "nominalist", "ontologist", "physiologist", "normativist" and "descriptivist" have been applied to classify disease concepts. These categories refer to underlying theoretical frameworks of the debate. The objective of this review is to analyse these frameworks. It is argued that the categories applied in the debate refer to profound philosophical issues, and that the complexity of the debate reflects the complexity of the concept itself: disease is a complex concept, and does not easily lend itself to definition.

Paper 2: On the triad disease, illness, and sickness

The point of departure for this article is a review of the discussion between Twaddle and Nordenfelt on the concepts of disease, illness, and sickness, and the objective is to investigate the fruitfulness of these concepts. It is argued that disease, illness, and sickness represent different perspectives on human ailment and that they can be applied to analyse both epistemic and normative challenges to modern medicine. In particular the analysis reveals epistemic and normative differences between the concepts. Furthermore, the article demonstrates, against Nordenfelt's claim, that the concepts of disease, illness, and sickness can exist without a general theory of health. Additionally, the complexity of different perspectives on human ailment also explains why it is so difficult to give strict definitions of basic concepts within modern health care.

Paper 3: The technological invention of disease

Technology has come to play a profound role in medicine since the middle of the 19th century, and many scholars have analysed the role of technology in medicine. Parallel to this development there has been a comprehensive debate on the concept of disease. This article combines these fields and investigates the influence of technology on the concept of disease. With reference to the literature, it tries to elaborate an explicit account of the constitutive role of technology in relation to the concept of disease. It will be argued that technology constitutes the concept of disease in three profound ways. First, technology provides the physiological, bio-

chemical, and bio-molecular entities that are applied in defining diseases. Second, it establishes the way we try to gain knowledge of disease and the way we recognise disease in practice. Technology constitutes the signs, markers and end-points that define disease entities, and it strongly influences the explanatory models of disease as well as of medical taxonomy. Third, technology establishes how we act towards disease: through diagnosis and treatment, technology establishes the actions that constitute the concept of disease. Altogether, this constitutive technological influence on the concept of disease is considered as a technological invention of disease.

Paper 4: On the value-ladenness of technology in medicine

The objective of this article is to analyse the value-ladenness of technology in the context of medicine. To address this issue several characteristics of technology are investigated: i) its interventive capacity, ii) its expansiveness and iii) its influence on the concept of disease, iv) its generalising character, v) its independence of the subjective experience of the patient. By this analysis I hope to unveil the double face of technology: Technology has a Janus-face in modern medicine, and the opposite of its factual face is evaluative.

Paper 5: Technological medicine and the autonomy of man

Is technology value-free or is it value-laden? Do we control technology, or are we controlled by it? These questions, viewed within the context of medicine, are the focus of attention in this article. The central argument is that we need neither to subscribe to the value-neutrality dictum nor to the all-encompassing value-ladenness thesis to explain the pertinent position of technology in medicine. Technology is constitutive of and strongly implicated in difficult questions of value. This, however, does not mean that technology is identical to (or neutral to) these value-laden questions. Technology poses issues of value, but only some of these relate to technology qua technology. Hence, it makes a difference whether we discuss general questions of value posed by technology or whether we discuss the value-ladenness of technology. Admitting technological value-ladenness does not imply that we are subject to a technological imperative that reduces our autonomy, on the contrary, it explains how technology increases our responsibility. This is particularly prominent in medicine.

Paper 6: Medicine as *téchne* - a perspective from antiquity

The objective of this article is to investigate whether the concept of téchne is fruitful as a framework for analysing some of the pressing challenges in modern medicine. To do this, the concept of téchne is scrutinised, and it is argued that it is a complex concept integrating theoretical, practical and evaluative aspects, and that this makes it particularly suitable for analysing the complex activity of modern medicine. After applying this technical framework in relation to modern medicine, some of its general consequences are elaborated. In particular, it is argued that the concept of téchne is appropriate for addressing the constitutive role of technology in medicine. Téchne thus appears to be as fruitful as a philosophical concept today as it was in antiquity.

II On the complexity of the concept of disease

There is a vast and diverse debate on the concept of disease in the literature of medical philosophy. Although the debate brilliantly displays the complexity of the concept, it would be a huge task to refer to it in detail. This would also be beyond the scope of this thesis. An alternative and fruitful way to investigate the complexity of DISEASE is to analyse the conceptual framework of the debate. There appears to be a wide range of issues, perspectives, philosophical categories and positions involved in the debate. Some of the categories are shown in Table 1 in Paper 1. There may certainly be other categories as well. The point is that they illustrate the diversity of the debate, the complexity of the issues, and as I contend, the complexity of the concept itself.

There seem to be many ways to structure and group these categories of the debate on the concept of disease. One way to do this is to identify some of the main philosophical issues that the categories address:

1. *Do different cases of disease have anything in common?*
2. *Why is something called "disease"?*
3. *Is disease a deviation from normal?*
4. *Does "disease" refer to a thing?*
5. *Is disease a matter of fact or of value?*
6. *How can we explain disease?*

These questions touch upon profound philosophical topics. The two first questions can be conceived of as semantic issues, the third touches on both relational and semantic aspects. The fourth is an ontological question, the fifth is evaluative, whereas the last question is an epistemological issue. Although the classical distinctions between ontology and epistemology, description and evaluation, theory and practice have been more or less eroded in (post)modern philosophy, it appears to be difficult to answer all the fundamental questions of the debate within a monistic theory. They address vastly different issues that reveal the complexity of the concept.

Another way to phrase this is to say that the extension of the concept of disease is complex, and that this complexity is unveiled by the profoundly different philosophical categories applied and the issues discussed.[12] Many scholars would accept the view that disease is a complex concept, and many would agree that the debate on DISEASE is complex. However, few have ascribed the

complexity of the concept to the complexity of the extension by means of analysing the philosophical issues at stake. There is something extraordinary about the phenomenon called "disease" that generates logical, ontological, epistemological, and evaluative challenges.

On the practical complexity of the concept

However, although the categories of the debate and the questions above refer to theoretical and philosophical aspects, the complexity of the concept of disease appears to be more than a mere academic issue, and this is reflected in medical practice. Physicians are generally not preoccupied with whether they have an "ontological" or "physiological", "normative" or "descriptive" concept of disease or not. What is important to them in clinical practice however, and what they do discuss, is whether fibromyalgia, pregnancy, infertility, whiplash, or a general feeling of incompetence are cases of disease, and where they should set limits to what counts as disease in cases of hypertension, hypercholesterolemia and diabetes.

Furthermore, the practical classification of disease entities is a great challenge to modern medicine. One could argue that a strict and consistent concept of disease should result in a strict and consistent taxonomy. Or the other way around: a strict and tidy practice would lead to a consistent taxonomy, which would result in a neat and tidy concept with a correspondingly clear-cut definition. However, this is obviously not the case. Disease entities are classified according to symptoms, syndromes, physical signs, paraclinical signs, abnormalities of morphology, physiological aberrations, genetic abnormalities, ultrastuctural abnormalities, etiological agents and eponymic origin (Copeland 1977). Hence, in practice, there is no tidy taxonomy and no clear-cut coherent and consistent definition of DISEASE.

Another practical challenge in medicine is the extensive application of technology. As will be argued later, technology constitutively influences the concept of disease, and the application of technology has become comprehensive. Thus technology significantly contributes to the complexity of DISEASE.

Hence, the theoretical complexity discussed above corresponds to a practical complexity. The theoretical debate has neither clarified the issue nor given practical guidance or a tidier

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[12] Unveiling the complex extension of DISEASE could be done in two fundamentally different ways. One could investigate all cases of disease and try to find out what is common or different in the various cases. This is an impossible job. Even to investigate all the classified diseases, e.g. in the ICD-10, is a tremendous and tedious task, for which I am not qualified (as I am not a physician). Hence, the reason for a theoretical approach to reveal the conceptual complexity is partly pragmatic, partly professional, but also a strategic choice. A complex extension can be revealed by the theoretical issues it engenders.

taxonomy. On the contrary, it confirms medical practice, in pointing to the profound complexity of DISEASE.

Does this mean, then, that it is impossible to define disease? This question is not the issue in this study. However, it has become clear that if it is possible to define disease, the definition has to take into account the diversity and complexity that the concept involves. A simple definition of the concept of disease cannot be made. This concurs with Aristotle's much quoted phrase that no more precision can be expected than the subject matter allows (*Nicomachean Ethics* 1094b11). Disease is a complex concept, that is, it has a complex extension, and it does not lend itself to a simple definition.

How then, can we take this conceptual complexity into account?

III Different perspectives on human ailment

One way in which the complexity is revealed is that there appear to be different perspectives on disease. [13] As argued (in Paper 2), one might apply a personal, professional or social perspective to human ailment. What the individual conceives of as disease does not have to be the same as the physician's conception or what society at large conceives of as disease. Furthermore, it can be argued that the general practitioner's conception of disease does not have to be identical to the specialist's or the researcher's conception.

The reasons for investigating the personal, professional and social perspectives on human ailment in particular are manifold. The distinction between ILLNESS, DISEASE and SICKNESS has been established by health care analysts, and it corresponds to the social structure of health care, representing the perspectives of its main actors. Furthermore, as is the point of Paper 2, the distinction connects evaluative and epistemic issues in a genuine way.

As argued in Paper 2, the different perspectives cannot only be applied in order to clarify some of the fundamental evaluative challenges in modern medicine, but they also explain why these challenges emerge. The evaluative challenges of the concept of disease[13] reveal its epistemic complexity. This will be discussed in detail in Chapters VI and VII. Suffice it here to point out the basic relationship between epistemic and evaluative issues in health care, as revealed through the complexity of the concept of disease.

Although the triad of DISEASE, ILLNESS and SICKNESS is popular among social scientists, it has been given little attention by philosophers, and those who have discussed it have criticised it extensively (Nordenfelt 1993b). However, I believe that there are good reasons to defend the triad, also within a philosophical framework, because of its great explanatory power.

The capacity of the triad also illustrates that complex concepts of health care can be fruitful both theoretically and practically, even without being subject to strict, consistent and coherent definitions. As Major Greenwood says: "The scientific purist, who will wait for medical statistics until they are nosologically exact, is no wiser than Horace's rustic waiting for the river to flow away" (ICD-10, II: 139), or as Oesterlen says: "Deshalb sehen wir uns also ausser Stands, irgend Etwas im ganzen Gebiet des Lebens mit völliger Richtigkeit und Zuverlässigkeit zu definieren, weder eine Funktion, Krankheit noch einen einzelnen Vorgang dabei, und die Wirkungen irgend

[13] Here, "disease" is used in a broad sense, as "disease" is often used to refer to all kinds of human ailment, e.g. illness and sickness. Unless otherwise stated, however, "disease" is applied in accordance with the definition given in the introduction, and is differentiated from illness and sickness (as indicated in Paper 2).

eines äussern Einflusses auf den lebenden Körper so wenig als die jenigen eines sog. Heilmittels bei Kranken." (Oesterlen 1952: 386).

To address the conceptual complexity by identifying different perspectives to human ailment appears to be consequential. As indicated in Paper 2, the term "health care" is misleading. It does not take into account the epistemological, taxonomical, semantic, experiential, axiological and practical differences between HEALTH and DISEASE that were pointed out in the introduction. Furthermore, it does not address the technological-curative dominance over the humanistic care-orientation in modern medicine. However, at least in a principal way, the term "health care" does address the primacy of the personal aspect of how the human being is conceived, if we understand "health" as "well-being", "happiness", "ability" or "goal achievement".

Thus, a consequence of the argument is that the term "health care" should be replaced by more correct terms such as "disease control "[14], "illness care", and "sickness rights ascription". This does not of course mean that one would have to split up institutions dealing with human ailment in different departments, for treatment, care and rights, but only that a linguistic differentiation corresponding more correctly to what goes on in these institutions would be more convenient. Such a conceptual differentiation would correspond better to the different perspectives, would be more explicit about what to expect and would be more appropriate in addressing many of the epistemic and evaluative challenges of modern medicine.

Another important implication is that the perspectivistic emphasis on the complexity of human ailment also says something about the balance between the perspectives. Critics of curative bias will find support in the primacy of illness and in the claim that evaluative and epistemic challenges are generated by modern "health care". Correspondingly, the differentiation would legitimate curative activity as such. In principle, there is nothing wrong in applying accelerators for radiotherapy, and in that some people are experts who perform this task with great skill. However, this technical skill does not free one from addressing the patient's experience of having cancer. Moreover, the perspectivistic conception also points out the social aspect of addressing human ailment: one is not only preoccupied with cure and care, but also with the social status of the patient, that is, rights and obligations.

When the same person, for example a general medical practitioner, has to address all three perspectives, the triad appears to be a fruitful conceptual framework for understanding what is going on in patient-physician communication. Moreover, the discussion of the triad illustrates

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[14] I owe the term "disease control" to Knut Erik Tranøy (1995b). Here it includes both diagnosis, treatment and prevention.

what happens if one ignores one or two of the perspectives in this communication. In particular, the primacy of ILLNESS indicates that, although there may be legitimate reasons to apply a new and effective diagnostic test or treatment for disease, this can contest the epistemic and/or evaluative basis of the diagnostic or curative activity.

Hence, against common philosophical conception, I try to revitalise the triad and investigate its fruitfulness as a semantic distinction with an epistemic, evaluative and practical foundation. It is worth noting that, although I depart from Nordenfelt in several important respects, we agree on important issues. I concur with Nordenfelt's claim that both HEALTH and DISEASE are evaluative concepts and that the individual person plays a constitutive role in the primary concepts of "health care". The important difference, however, is that I think that negative concepts, such as disease, illness and sickness, are constitutive, whereas Nordenfelt believes a particular positive concept, HEALTH, to be constitutive.

Thus, the concept of disease[13] is complex, and one reason for this complexity is the different perspectives on human ailment. Another reason for its complexity is the constitutive role of technology.

IV The technological invention of disease

In Paper 3, I argue that technology constitutes the concept of disease on three different levels, and that as such it has become the measure of all things; a kind of *ars mensura*; the *technê metriké* of the modern age.

The claim that DISEASE is influenced by technology is not new, and Paper 3 is partly a review of the many expressions of this influence. Several scholars would also argue that this influence is strong and fundamental, but few, if any, have focused their attention extensively on the subject and made this claim explicit: that technology constitutes DISEASE. Hence, what I try to do is more than just to aggregate existing observations of the strong influence of technology on the concept of disease. Through the review of these observations, I wish to argue that technology constitutes DISEASE in a basic way, or more precisely, on many fundamental levels: ontologically, semantically[15], epistemologically and practically. Technology is not only constitutive in one of these aspects, as many of the commentators seem to maintain, but in all of them, and this justifies the strong claim of this thesis.

The constitutive role of technology for the concept of disease appears to have many consequences. The technological concept of disease confirms the complexity of the concept of disease, as discussed in Chapter II. Technology is a complex issue involving devices, methods and organization. The diversity of devices, the variety of technologically induced methods and the technologically specialized organization of modern "health care" render DISEASE a complex concept. Hence, DISEASE has a complex extension, so has TECHNOLOGY, and the complexity of technology contributes constitutively to the complexity of the concept of disease.

Furthermore, the complexity of the concept of disease and the influence of technology is revealed through a philosophical scrutiny of the ontological, semantic, epistemological and practical perspectives. That is, the complexity in extension is disclosed through the fundamental philosophical issues that DISEASE and "health care" technology pose.

Moreover, the constitutive role of technology on the concept of disease renders technology a crucial topic for the vast and versatile debate on DISEASE. However, technology has scarcely been discussed in this debate, and when it has, mostly in terms of comments and notes. One consequence of my argument is that the fundamental role of technology will be essential to the debate on the ontological, semantic, epistemological, and practical status of the concept of

[15] As the entities that *define* disease are technologically perceived.

disease. Hence, technology is highly relevant to the debate about the concept of disease.

However, in Chapter II the complexity of DISEASE was also revealed by evaluative issues. This has not been addressed in the discussion on technology. Does this mean that evaluative issues are not relevant for technology's constitutive role for DISEASE? It does not! On the contrary; as will be argued in Chapter V, technology enhances the evaluative aspect of DISEASE. Hence, the complexity of DISEASE is confirmed by the constitutive role of technology and is revealed by the profound ontological, semantic, epistemological, evaluative and practical issues it raises.

Moreover, the analysis illustrates the importance of paying attention to technology in the general discussion of medicine. Technology – constituting medicine's basic concepts, its knowledge and its actions – has become crucial to the understanding of modern medicine. That makes technology essential in order to understand crucial challenges of modern medicine, such as medicalization, somatization, paternalism and patient autonomy in a more basic way, and not only as neutral means to an end or as a powerful imperative. These issues will be discussed in Chapters V and VII. In other words, if DISEASE is an important feature of our culture, one should study it through another fundamental feature of this culture: technology.

The main argument, then, is that *technology constitutes DISEASE*. However, why is this expressed by the phrase that technology *invents* disease? Is this a constructivist position, arguing that technology is part of the social construction of DISEASE? The phrase "technological invention of disease" does not refer to a particular stance in the realist/anti-realist debate. It might as well have been called "the technological discovery of disease". However, whereas science discovers, technology tends to be invented and its products to be constructed. The constitutive role of technology, ontologically, epistemologically and practically, can be read within a realist perspective, as well as within an anti-realist perspective.

The reason why I do not explicitly take a stance on this issue is because the objective of this thesis is to investigate how a technological constitution of DISEASE influences evaluative issues (both with regard to DISEASE and technology). If one subscribes to a constructivist stance, it is obvious that both disease and technology are value-laden concepts. My point, however, is that even within a realist conception, technology, and hence disease, are value-laden concepts. Hence, regardless of position in the realist/anti-realist debate, technology makes disease a value-laden concept. How I can claim this will be discussed in Chapter V.

It is also important to note that it is not accidental that DISEASE is influenced by technology. Technology was defined in the introduction as purposive human activity. Medicine is also a purposive human activity, and as will be argued in Chapter VII, it is therefore akin to

technology. Whereas it took almost 300 years before the discoveries in the natural sciences had any practical impact on medicine, it took only a few years for technological inventions to gain medical applications.

Why then, does it not follow from the conclusion that DISEASE is constituted by technology that disease is a value-neutral concept? Why does technology not render DISEASE value-neutral?

V On the value-ladenness of technology

Technology and value

I have argued that disease is constituted by technology (Paper 3) and that technology is value-laden (Papers 4 and 5). What, however, does this value-ladenness mean? How is technology value-laden? This has not been dealt with in detail in the papers, but deserves thorough scrutiny and will therefore be addressed at some length in the following sections.

What, then, is the relationship between technology and values? There appear to be two fundamentally different ways in which technology relates to values. Technology can pose issues of value, and it can promote certain values. In the first case it poses general issues of value that are not specific to the technology in question, and in the latter it urges specific values constitutive to the specific technology.

Technology posing value issues

Technology faces us with a series of value issues: For example, is it "good" to clone human beings, and should we perform ultrasound screening of foetuses before the time-limit for abortion on demand? These are general issues of value: is it "good" to create "identical" human beings, and should we allow selection of foetuses (for example on the grounds of sex, minor deficiencies or suspicion of defects)? These issues are not related to genetic technology or to ultrasound as such. Modern genetic technology is used for other purposes than to clone human beings, and diagnostic ultrasound machines are not only used for screening foetuses before the time-limit for abortion on demand. The general issues of value, however, are brought to our attention by the technologies in question.

If we allow the use of genetic technology (technology that isolates, characterizes and modifies DNA) we do not implicitly allow cloning. However, before genetic technology made it possible to produce identical human beings, we were not urged to address the issue of whether it is good or bad to make "identical" human beings. Hence, technology, through its action potential, poses general value issues, and this is why we often connect certain value issues to specific technologies.

Technology promotes values

What about bacterial weapons and respirators? Can they be used for different purposes, and do they therefore pose general value issues as well? It is hard to find other purposes for bacterial weapons than hurting people by making them diseased. Correspondingly, respirators artificially maintain respiration and can only be used for this purpose (as respirators).

Hence, bacterial weapons and respirators do not pose other general issues of value, but they promote particular values, that is, that it is good to hurt people (defined as enemies) by making them sick, and that it is good to maintain respiration artificially. These value issues are related to technology in a profound way and are not only posed by it. If we have chosen to implement the use of respirators, and if we are prepared to use them, we cannot say no to maintaining respiration artificially. Conversely, it is difficult to use bacterial weapons (as bacterial weapons) without hurting people by making them sick. This would be to contradict our values.

What then is the difference between genetic technology and bacterial weapons, between diagnostic ultrasound and respirators? All appear to be technologies that can be applied for good and for bad purposes. The point is that genetic technology and diagnostic ultrasound are examples of general technologies that can be applied for many purposes, and not only for cloning human beings and for selective abortion. Hence, more general value issues are involved with these technologies: is it good or bad to isolate, characterise or modify DNA, and is it good or bad to produce an image of intracorporal anatomical structure by means of ultrasonic reflections? Bacterial weapons and respirators, however, are not related to such more general value issues. The former can only be used for hurting people by making them sick, and the latter can only be used to maintain respiration artificially.

The point is that bacterial weapons and respirators have been described by their constitutive functions, whereas cloning and ultrasound screening of foetuses before the time limit for abortion on demand are only specific examples of the many applications of genetic technology and diagnostic ultrasound, respectively. It may be useful already at this stage to note that the term “function” is used differently here than in biology and in the social sciences. Technological function is intentional, whereas “function” in biology and the social sciences tends to refer to something non-intentional.

Hence, my objective is not to differentiate between certain types of technology or to generate a certain typology of technology. Instead, it is to point to something general for all kinds of technology: Technology poses issues of value, which are general in the way that they are not genuinely related to a particular technology. Other technologies may pose them as well. There might be other technologies for cloning humans or other methods for facilitating selective abortion that we are not aware of. However, there are some issues of value that are specific for a given technology, and that cannot be separated from the technology without abstracting the issue from the technology itself, and that are value issues related to the technology's function. Hence, technology poses general issues of value, and is generally value-laden through its constitutive function. Every technology has a function, and every function is related to a purpose and a value.

However, is the difference between ultrasound machines and respirators that the first is multifunctional and the latter monofunctional? If this is so, ultrasound machines promote many values according to their many functions.[16]

Function and purpose

There appears to be a difference between the many "functions" of an ultrasound machine and the function of a respirator, as described above. A (diagnostic) ultrasound machine can be used for many purposes: it can be used for diagnosing cancer, for examining joints, for screening pregnant women, and for guidance and orientation during surgery. Accordingly, one can group such purposes into even more general groups of purposes, such as diagnosis of diseases, screening and assistance during treatment. Furthermore, one can continue this generalization of purposes, and end with the most general purpose of an ultrasound machine, without which it would not be an ultrasound machine, such as for example to produce images of intracorporal structure by means of variation in ultrasonic reflections in tissue.

This makes the function of a technology its most general and characteristic purpose. Hence, the value issues related to the many specific purposes have to be addressed in relation to the specific purposes. Whether it is good or bad to diagnose cancer is not a value issue that is genuinely connected to ultrasound technology. Again, many other technologies might do the same. Correspondingly, screening of pregnant women is a value issue, but it is not genuinely a value issue related to ultrasound technology. However, the value issues related to the ultimate and most general purpose of an ultrasound machine cannot be distinguished from the technology in question.

However, what about diathermy? Modern diathermy equipment has two "functions": it can cut, and it can coagulate. Does this not demonstrate the fact that some types of technology can have multiple functions and thus that technology might promote multiple values? To this one could answer that some technologies are constituted by the combination of two technologies with distinct functions, and that they have to be judged as two different technologies in one casing. For example, diathermy is a combination of high frequency electro-cut and high frequency electro-coagulation. The value-ladenness of diathermy is thus given by the combination of the functions of cutting and coagulation.

This answer would be tenable if one attached an ultrasound machine to a respirator. In the case of diathermy, however, I believe that the issue has to be addressed differently. The purposes of

[16] I owe this argument to Søren Holm.

cutting and coagulating are both part of a more general purpose, that is, the function of high-frequency electro-thermal cell destruction. Hence, even in the case of a diathermy machine, which we would like to think of has two functions, it has really only one function. It has two effects (which might be blended) and it has to be evaluated as such.

Thus, a specific technology can be used for many purposes, all posing important value issues, but it is only the most general purpose, its function, that promotes value. However, what about hidden functions? Can technology not have hidden functions and therefore hidden values?

Hidden functions

What about some of the nazi concentration camp shower rooms? They apparently had the function of washing people, but actually functioned as gas chambers. Was their extinctive function not a hidden function, promoting hidden values? The issue of hidden functions can be addressed at different levels.

One can argue that functions are (ultimate) purposes, and thus have to be intentional in some way. Therefore they cannot be hidden from everyone, and in the case of the shower rooms, the nazi officers knew that they had the function of gas chamber. More precisely, their *purposes* as gas chambers were known to the nazi officers. That is, their extinctive purpose was hidden to the people to whom the technology was applied , but not to the people who used the gas chambers for this purpose.

Thus, "hidden" functions are not hidden from everyone, and therefore they only promote "hidden" values to the ones to whom the function is hidden. In other words, technology has no unknown function. There has to be at least one person who knows or has known the function of a technology. Hence, hidden purposes do not change the value-ladenness of technology, and they do not reduce the responsibility of the ones that use the technology. This only shows that technology (through its functions) can be (mis)used by hiding its purposes.

What, then, about unexpected functions? Did not Conrad Wilhelm Röntgen discover a new and unexpected function of discharge tubes: to make a barium platinocyanide screen light up? It appears to be important to distinguish between function and effect. Whereas it is quite possible, and not at all uncommon, for technology to have unexpected effects, there can be no unexpected functions. Since function presupposes purpose, and a prerequisite for purpose is intention, there can be no unexpected function. If the function of a x-ray tube is, say, to make certain types of screens light up, this function did not exist before it became a purpose. Before Röntgen's experiments with discharge tubes and barium platinocyanide screens, the fluorescence of the screen were unexpected effects, but by his active experimentation it became a purpose, and was

thus of value.

Thus, there appear to be no hidden functions. There are, however, hidden purposes and hidden effects. These are certainly related to values. The hidden purpose of the nazi shower rooms was obviously fatal for the people who went for a shower, and the unexpected effect of the discharge tube turned out to be "good" and useful for diagnostic x-rays. These values, however, are related to the function of the technology: gas chambers (and not showers) and x-ray tubes (and not discharge tubes).[17]

Thus, the distinction between a technology's function and its purpose(s) confirms the difference between advancing and promoting values. Before beginning a more detailed investigation of the relationship between technology, function and value, the fundamental difference between posing issues of value and promoting values calls attention to two fundamental fallacies in the analysis of technology and value.

Two fallacies with technology and value

According to the above analysis, there seems to be a paradox in the relationship between technology and values. On the one hand issues of value that normally are related to a particular technology, such as cloning, are only posed by this technology and are not "genuinely technological", and on the other hand technology is profoundly value-laden through its function.

The fact that technology poses general issues of value advocates the stance that technology is value-neutral. This, however, ignores technology's constitutive relationship to value through function, and it makes technology promote covert (functional) values. If we implement the use of respirators without discussing whether it is good or bad to maintain respiration artificially, for example because the technology is available, the very implementation of the technology will promote these values. If we believe that technology is value-neutral, for example because it only poses general issues of value, then we are subject to covert compelling values. This might be termed *the fallacy of technological value-neutrality*.

Conversely, over-emphasis on the inherent values of technology advocates the stance that all value issues related to technology are due to its value-ladenness, and that technology promotes

[17] Even the issue of unexpected effects and side-effects is related to the function of the technology in question. The potential for unexpected effects appears to be related to the potential of the technology. From powerful technology we anticipate consequential (expected and unexpected) effects. Possible negative effects are evaluated against expected benefits. Thus, even the issue of how to handle unexpected effects is related to the technology's function.

its own values independent of ours.[18] It is hard to see, however, how technology could promote values of its own. The all-encompassing value-ladenness stance appears to ignore the fact that some value issues are only posed by technology and not promoted by it. Genetic technology does not promote cloning, it only facilitates it. Genetic technology is a general method for isolating, characterizing and modifying DNA, and even if we find this valuable on a general level, this does not mean that cloning is of value to us.

Hence, the all-encompassing value-ladenness stance ignores an important distinction and tends to make all value issues into questions of technology. Whether it is good or bad to produce "identical" human beings, or whether it is good or bad to allow selective abortion, are value issues that are important to discuss on a general basis, and that cannot be reduced to technological issues.

Thus, if general value issues posed by technology are ignored, neglected or omitted, technology itself may appear to promote values. If we do not discuss the general issue of whether it is good or bad to produce "identical" human beings, but uncritically apply genetic technology for all purposes, the application of technology promotes such values. These values, however, are general values that are not related to technology (in other ways than that they are posed by it). But, if these general values are reduced to issues of technology, the all-encompassing value-ladenness stance becomes a self-affirming prophecy: General issues of value will be discussed as being technological issues, which makes technology all-encompassing value-laden.

Thus, there appear to be at least two omissions regarding technology and value, one being to ignore the fact that all technologies have a function and that this function is related to value, and the second being to ignore the fact that some issues are general issues that are posed by technology.

Hence, the value-ladenness of technology, as analysed in this thesis, is based on the evaluative concept FUNCTION. How, however, is the relationship between function and value? As this is a key question in establishing the value-ladenness of technology (and hence, also of disease), and as it has not been treated explicitly in any of the papers, it will be dealt with at some length here.

Function and value

That the value-ladenness of technology can be identified through one of its key characteristic,

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[18] A brilliant expression of this view is found in Cassell (1991): "In medicine, whenever something reduces uncertainty, physicians (and laypersons) will follow values inherent in and the dictates of the technology involved. … Once again, the specific effect of technology (…) has been to maintain the focus of doctors on the object of the technology (…) and on the values of that technology – what is good or bad in terms of technology – rather than on the person or the values of the persons …" (Cassell 1991: 91-2).

function, requires some qualification.[19] First, is it true that function is constitutive to technology? Second, is it the concept of function that is value-laden or do functional concepts only entail issues of value?

The first question will not be addressed in any detail, as there appears to be a reasonable agreement that technology is constituted by its function. Every technology has a function *qua* technology. The second question however, whether functional concepts only entail value issues, and are not value-laden as such, has to be addressed in further detail. As a point of departure I will follow the argumentation of Stempsey (1999).

From different positions it has been argued that functional descriptions bridge the fact-value distinction because they entail evaluations. Cragg maintains that functional concepts entail negative evaluations. From the premises "this auger will not bore holes," and "to bore holes is a necessary condition of being a good auger", he argues that it is valid for us to conclude that "this is not a good auger". According to Cragg, the description of a functional fact implies evaluation. However, as Stempsey also points out, the second premise is an evaluation, as it contains a specification of what it means to be a good auger (Stempsey 1999: 91). Thus, it does not follow immediately from Cragg's argument that functional concepts entail negative evaluations. Moreover, Cragg claims that functional concepts also entail positive evaluations of at least a comparative type. Given the factual premises "A and B are augers", "A drills holes in wood" and "B does not drill holes in wood", as well as the analytic premise "any object which fulfils its function is better than an object of the same type which does not fulfil its function", Cragg derives the evaluative conclusion "A is a better auger than B". I agree with Stempsey, who argues that one still needs to specify the conditions for being a good auger, that involves value judgements about the function (ibid.). An example of such a premise would be that a good auger is able to drill cylindrical holes in wood without much effort and without producing too much heat.

Moreover, if the function of an auger is to drill holes (in wood), and a particular item, although it looks like an auger, does not drill holes (in wood), I would argue that it is not an auger. Like a child's plastic toy that looks like an auger, it is a simulacrum. When Cragg discusses the worse or better auger he refers to something that is not an auger. A bad auger may be unbalanced, shaking, requiring much force to make the hole, producing much heat, and resulting in an asymmetrical hole. However, it may still produce a hole. Hence, if it is not able to produce a

[19] Here, function is conceived of as the action for which a person or thing is specially fitted or used or for which it exists. FUNCTION implies a definite end or purpose that the person or the thing in question serves or a particular

hole, it is not a bad auger, it is not an auger. The difference between a good and a bad auger is not whether or not it is able to drill a hole (in wood), but rather an evaluative premise of what an auger is.

Thus, Cragg compares an auger with something that is not an auger and concludes that the non-auger is not a good auger and that the auger is better as an auger than the non-auger. This, however, appears trivial, and does not imply that functional facts entail evaluations. Rather, the evaluative premise of what an auger is shows that function is evaluative.[20]

Correspondingly, MacIntyre claims that arguments involving functional concepts make it possible to move from factual premises to evaluative conclusions. Factual premises, such as "this watch is grossly inaccurate and irregular in time-keeping" and "this watch is too heavy to carry about comfortably" validly entail the evaluative conclusion that "this is a bad watch" (MacIntyre 1984: 57-8). Hence, "ought" follows from "is". MacIntyre's main argument is that the fact-value gap rests on an assumption that no moral arguments involve functional concepts, and that the gap can be bridged by a teleological framework for human life.

Again, the argument rests on a premise including a value judgement of a watch. To be able to conclude that "this is a bad watch", we have to presuppose that a good watch keeps accurate time and/or can be carried about comfortably. Furthermore, Stempsey argues that MacIntyre succeeds in showing the intimate union of fact and value in function, but that he does not succeed in providing a way to derive values from facts. He claims that MacIntyre's relationship between fact and value amounts to a linguistic argument. The "goodness" of a watch stems from the conformity of the watch with a definition that merely stipulates its function. Hence, the evaluative aspects is related to the definition and not to the function.

Stempsey's point is that functions are essentially value-laden, and that the values cannot be known just from knowing the definition of an item that has the function. Values are embedded in functions because we share certain values, for example for a watch to keep good time. That is, there are certain values that make something a function, and functions do not exist without such values. According to Stempsey, values are not derived from facts about an item; the values are already parts of the facts about an item. This, however, is a way of saying that values entail functions. Hence, Stempsey applies the opposite strategy as the "is" implies "ought" stance,

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kind of work it is intended to perform.

when he concludes that "facts about functions presuppose values" (Stempsey 1999: 92). He seems to claim that "ought" implies "is".

Function does not entail value, as the "functional is" implies "ought" stance appears to contend, and values do not entail function, as Stempsey seems to claim, but value is constitutively inherent in function, in terms of its purpose. This is because function is a teleological concept, as it implies a definite goal, and as such is evaluative (Schaffner 1993: 403-4). The function of an ultrasound imaging machine, for example, is to produce images of intracorporal structure by means of ultrasonic reflections in tissue. We cannot separate the action of generating images of intracorporal structure by means of ultrasonic reflections in tissue from the value it has. It is its value that makes us recognise the circumstances as an action. Furthermore, it is also value that makes us conceive of something as a technology. For example, if Wilhelm Conrad Röntgen had not ascribed any value to the fluorescence of a barium platinocyanide screen that happened to lie near a discharge tube in his laboratory, he would not have started the experiments that led to the development of the x-ray machine. The ability to "look into objects", or, more precisely, the ability to display intracorporal structure by means of a medium that is sensitive to electromagnetic waves of a certain frequency range, is the function of medical x-ray imaging. At the same time this ability expresses the value of the medical x-ray imaging device.

An argument that to some extent parallels mine can be found in a parenthesis in Mitcham's *Thinking through technology* (1994). Here Mitcham identifies three different kinds of *use* of technology: with reference to (1) its *function*, (2) its *purpose* or (3) with reference to the act of using it in order to perform its function (1) or to realise some purpose (2). Mitcham points out that while it is possible to defend value-neutral use of technology in (3), this is not the case in (1), and that many fail to acknowledge the difference between (1) and (3). "The polluting car pollutes whether it is used to take sick people to the hospital or to rob a bank." (Mitcham, 1994, pp. 231-2). I depart from Mitcham's argument in that I claim that technology is value-laden in (1), (2) and (3), but that the values in question in (2) and (3) are values that are not constituted by the technology in question. That is, whether the polluting car is used to take sick people to the hospital or to rob a bank are issues of value, but they are not genuinely related to the technology in question (the car).

Hence, the value-ladenness of technology is related to its function, and function is related to

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[20] It is worth noting that Cragg's theory also enforces the asymmetry in ethics (Tranøy 1967) discussed in introduction. He intends to show that functional concepts entail evaluations. He thinks he is able to do this with negative evaluations. Regarding positive evaluations, he is only able to establish the relationship between functional

value through its constitutive purpose. That is, functional concepts are teleological, and as such, evaluative. Maybe the reason why we have such difficulties with handling the moral challenges of modern technology is that teleological thinking is strange to modern ethics. Here MacIntyre appears to have a point. Modern ethics has excluded teleological thinking, and functional concepts threaten the cardinal distinction between "is" and "ought". However, I do not agree with him that functional concepts entail evaluations and that virtue ethics is the only proper way to incorporate a teleological thinking into ethics.[21]

Function and disease

However, FUNCTION is not only constitutive to technology's value-ladenness, it also connects technology and the concept of disease. "Function" appears to be a central term in definitions of DISEASE, whether the definitions are factual or evaluative; "naturalistic" or "normative". DISEASE is frequently defined as deviance from or disorder of normal function in some way or another. The above discussion indicates that functional concepts are value-laden, and Margolis has argued extensively that function makes the concept of disease value-laden (Margolis 1976). Hence, FUNCTION is a concept that constitutes both DISEASE and TECHNOLOGY and renders them value-laden.

My intention is not to conceal or ignore the theoretical challenges raised by the concept of function. However, the point here is not to enter into a detailed discussion about FUNCTION, but rather to point out that it is constitutive to both TECHNOLOGY and DISEASE, and that this influences the evaluative status of these concepts. One important issue that has to be addressed, however, is whether TECHNOLOGY and DISEASE refer to the same concept of function.

Since the writings of Galileo, Descartes and Baligvi, it has been argued extensively that the human body can be conceived of as a machine, and the literature is full of technological metaphors for human functioning. Technology constitutes our models of the human body (von Engelhardt 1995: 1085; Engelhardt 1995: 1103). These models have changed with technological development. "The ear, originally a harp (according to Helmholtz) became a telephone and is now known to be an advanced stereophonic hi-fi system. The brain, viewed by Descartes as a hydraulic network, has since been recognised as a telephone exchange, a computer and, more recently, a holographic data storage system. The eye was once a telescope, then a simple camera and is now known to be a very elaborate camera, with the original zoom lens and through-the-

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facts and evaluations for comparative evaluations. Hence, the negative evaluation (bad auger) does follow easier from functional concepts than positive evaluations (good auger).

[21] This argument is elaborated in further detail in (Hofmann B. Medicine as Phronesis. Paper submitted to *Poiesis and Praxis*).

lens exposure meter, producing instant three-dimensional pictures in colour on re-usable film." (Lenihan 1984:862). Hence, the concept of function in technology has been applied in medicine to define and understand DISEASE.

In biology, the concept of function is frequently defined in terms of survival and reproduction, which are not suitable characteristics of today's technology, especially not technology seen as devices.[22] The function of a car is given in terms of human transportation, and not of its survival and reproduction. Hence it can be argued that, although both TECHNOLOGY and DISEASE are constituted by FUNCTION, they refer to different concepts of function. The immediate answer to this is that even though FUNCTION might be different for technology and disease, they are still value-laden, supporting the point that FUNCTION causes technology and disease to be value-laden concepts. In other words, it is not accidental that FUNCTION is central to the understanding of both DISEASE and TECHNOLOGY, because in both cases it appears to link the factual and the evaluative.

Moreover, it can be argued that there are important similarities between the concept of function that constitutes TECHNOLOGY and the one that constitutes DISEASE. Margolis differentiates between the function of an organism, an organ and a machine. The function of living organisms is understood in terms of their goal-directed activities. The functions of organs, however, are not construed as goal-directed themselves, but are teleologically defined in terms of the whole organism's goal-directed activities. Furthermore, while the function of an organism is related to its "natural" goal, the function of a machine is related to a deliberate plan (Margolis 1976: 248). The point is that the functions of an organism, an organ and a technological device are related to human purpose.

Correspondingly, Schaffner argues that FUNCTION, in biology as with human artefacts, is constitutively related to a *human* goal. FUNCTION has a weak empirical content in explaining evolution, but a strong empirical content in explaining what is useful for an organism. Hence, because organs and organisms possess strong analogies with human artefacts, FUNCTION is a heuristically useful concept in biological contexts (Schaffner 1993: 389; 404).

Thus, the functions of the human organism, of organs and of technology gain their purposiveness from human beings. We cannot think of a function of any organ or technological device that does not serve a human purpose in some way or another. There may be parts of the body that do not have a purpose, for example the appendix. However, we tend to ascribe to the appendix some

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[22] There are exceptions: 3rd order Von Neuman Machines repair themselves and are self-reproducing. I owe this point to Søren Holm. My point here is related to technology as we know it today.

previous purpose and function. Besides, such parts of the body do not count as organs. Correspondingly, we can argue that assembled manufactured parts exist that do not have a purpose. However, they are not technology if they cannot be related to human purpose in some way or another.

Moreover, there may also be another connection between DISEASE and FUNCTION. It has been argued that DISEASE does not easily lend itself to definition. This, however, does not make the concept useless, irrelevant or obsolete. DISEASE plays a functional role in medical language and in ordinary language. It structures and guides the conceptions and actions of "health care" professionals and helps patients to understand their situation. As such, DISEASE is a "functional concept".[23] It has a purpose: to heal and to help patients.

Hence, despite the difficulties in defining human function, it is purposive, and as such determining to the function of both organs and technology. Again, both TECHNOLOGY and DISEASE are constituted by FUNCTION, which makes them value-laden.

Function in the philosophy of science and the social sciences

It is important, however, to notice that this analysis of the concept of function is not a contribution to the general discussion of FUNCTION in the philosophy of science, or in the social sciences. The focus of attention of this study has been to scrutinise FUNCTION in relation to specific human behaviour (using, but also designing, producing, commercializing and implementing medical technology).

The teleological aspects of technology, as analysed here, differ from those of the social sciences and the philosophy of science. In the former, functional explanations are intentional, whereas in the latter two they tend to be non-intentional. In other words, whereas technological function is *purposeful*, the function studied in the social sciences and in the philosophy of science is *purposive* (von Wright 1971: 59-60)[24]. Finding the purpose in biology, such as the purpose of an organ or a species, appears to be challenging, whereas finding the function of a respirator

[23] I owe this concept to Trond Gansmo Jakobsen.

[24] Von Wright's use of the terms "purposeful" and "purposive" can appear confusing, as "purposive" is defined in Merriam-Webster's dictionary as "serving or effecting a useful function though not as a result of planning or design", whereas "purposeful" means "having a purpose, intentional", that is, the opposite of von Wright's conception.

appears to be less cumbersome.[25]

As my point is to put emphasis on the human responsibility for technology, and thus on the concept of disease, the intentional conception of technology's function has been the focus of attention. This does not of course mean that technology cannot be explained functionally in the non-intentional interpretation of the social sciences, or that disease cannot be explained by biological (non-intentional) functions. The (technological) function of a car is to transport persons and a limited amount of luggage by means of wheels. Its social function might be to gain social status.[26] There might even be social pressure on the individual living in a modern western society to own a car. This, however, does not change the individual's responsibility for buying and driving the car.

Hence, social and biological functional explanations, although they are interesting and relevant to the study of technology and social change, have not been the focus of attention of this thesis. My very restricted analysis of FUNCTION is that it relates values and technology through purpose, and as such clearly addresses human responsibility for technology.

The point is that functional explanation in the social sciences deceptively reduce our responsibility, because technological change is explained as a social mechanism that seems to excuse individual action (I have to buy a car because "everybody has a car", "we have to do therapeutic cloning because everybody else is going to").[27] Correspondingly, one might argue in line with certain theories of science that technology is a means to increase survival and reproduction (people with cars survive and reproduce at a higher rate than people without cars),

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[25] Correspondingly, a functional explanation in the social sciences depends on such notions as unintended actions (von Wright 1971) and unrecognised causal feedback loop (Elster 1983: 57; Grimen 1999). Accordingly, if intended actions are included in social explanations, they are not functional, but intentional explanations. Hence, to explain the function of the atomic bomb as a means of threat in the Cold war is not a functional explanation, but an intentional explanation in the social sciences. According to my analysis, however, the atomic bomb explained as a means in a "terror balance" is a functional explanation precisely because it was intentional, and there appears to be little doubt that we are responsible for it. Additionally, there might be a second order function of social explanations. If we believe that a particular technology has a function in the non-intentional sense of the social sciences, the functional explanations of the social sciences might make us act intentionally with regard to technology, and hence qualify for intentional explanations. Hence the limitation between functional and intentional explanations in the social sciences (as discussed here) is blurred and depends on the "function" of the social sciences.

[26] Although, if the owner consciously buys the car mainly in order to gain social status, then the explanation of his buying of the car, according to the social sciences, is not functional but intentional.

and that this is thus part of our genuine nature, for which we cannot be blamed. I wish to reject both these chimeras and explicitly to address responsibility in a functional conception of technology. Thus, social and biological functional explanations of technology seemingly reduce responsibility through the impression of (social or biological) intentionality, that is, it appears as though technology, society or the human organism have intentions of their own. The functional explanation discussed here, however, is explicitly intentional and emphasises human responsibility. Thus it is believed to be particularly fruitful in ways that will be outlined below.

So I have argued that technology is value-laden through its purposive function. However, how does this value-ladenness matter? The most interesting issues concerning technology appear to be issues of whether technology determines and controls us (Smith & Marx 1997), and not whether it is value-laden. Even explicit debates on technology and value focus their attention on the question of whether technology controls us (Schrader-Frechette 1997). It can be argued that the issue of control is independent of technology's value-ladenness. Let me therefore address this issue at some length.

Value, control and responsibility

There appear to be at least four positions concerning value-ladenness and control, as indicated in Table 2.

	Value-neutral technology	**Value-laden technology**
We control technology	Value-neutrality dictum (a)	Axiological choice (b)
Technology controls us	– (c)	Technological determinism (d)

Table 2 On the relationship between value-ladenness and control of technology

Claiming that technology is value-neutral and controlled by us (a) corresponds to the value-neutrality dictum, that claims that we control technology as a value-neutral means to an external end or value. Technology is not good or bad, and whether we use it in a good or a bad way is

[27] It is interesting to note that functional explanation in the social sciences explain the effects and not the causes: They explain why certain technologies have become predominant, for example, because they have the effect that serve the interests of a certain social class (Rothman 1997). Because technology has a certain social effect, it is selected ("negative feedback loop"). The challenge with this interpretation of functional explanation is the mechanism of selection. What makes certain social effects selected? How can we explain, not to say predict the selection? Is the selection not intentional in some way or another? Are the selecting agents then not responsible in one way or another for this selection? The process of selection appears to be the weak point of functional explanation in the social sciences, both with respect to its explanatory power and its normative relevance. I owe this way of phrasing the argument to Harald Grimen.

entirely up to us. All value issues related to technology are human issues.

It can be claimed that technology is value-neutral, but that it still controls us (c). We are controlled by natural phenomena, such as earthquakes, hurricanes and tornadoes. They are value-neutral, but they change our lives. Correspondingly, one might argue, it is the same with technology: It is value-neutral, but it strongly influences our lives. This argument does not seem tenable. Earthquakes, hurricanes and tornadoes are certainly issues of (negative) human value, which is why we try to forecast and avoid them. Besides, as I have argued in Papers 4 and 5, technology is value-laden and this becomes particularly clear in medicine. Hence, both positions (a) and (c) have to be dismissed. What, then, about (b) and (d)?

It is frequently claimed that technology is value-laden and that it controls us (d). Technology's values enforce our actions, and we are subject to what has been called "technological determinism". It is argued that there are technological values external to human values that enforce our actions: There is a technological imperative (Wolf & Berle 1981; Tymstra 1989), technology is rampant, perpetuating, self-augmenting (Cassell 1993; Davidson 1995) and autonomous (Ellull 1964; Winner 1977).[28]

However, there is also a positive kind of "determinism" claiming that technology is value-laden and that it controls us. It is frequently argued that "we can't stop progress", that "we have to follow the development" and that "we go where technology takes us". In some respects these claims are an expression of a technological imperative and an expression of the way in which technological values determine our actions, but in contrast to the negative interpretation discussed above, these claims are positive: Technology promotes progress. That is, technology enforces certain values, but these values and their corresponding actions are conceived of as good.

Is the result of this study, then, that the value-ladenness of technology makes technology control our actions? I do not think so, because, as I will argue, although technology is value-laden, we control it (b). The reason for this is related to the concept of responsibility.

If we are really controlled by technology, that is if technology compels our actions, then our responsibility for these actions is reduced correspondingly. We are fully responsible only for our free actions. Hence, implicit in the claim that there is a technological determinism (d), either in the positive or in the negative interpretation, there is an evasion from responsibility. If we are

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[28] For a more detailed account of the technological imperative in health care see (Hofmann B. The technological imperative in health care, accepted for publication in International Journal of Technology Assessment in Health Care).

determined by technology, whatever our values and will might be, then we cannot be fully responsible for technology. However, it appears to be difficult to comprehend how we cannot be fully responsible for the technology that we design, construct, produce, commercialize, promote, implement and use.

Hence, although technology is value-laden, it does not control us. Technology is inherently value-laden, and when we choose a technology we accept its values. That is, we cannot accept dialysis machines but reject (at least in one case) the use of machines that expel metabolic wastes and maintain the body's fluid balance. As the function of a dialysis machine is to expel metabolic waste and to maintain fluid balance, this is the value we accept when we implement and use dialysis machines. It is because a dialysis machine has this value, that we use it. That is, we use technology specifically because it has a value to us, and the choice is ours, as well as the responsibility. We are not controlled by technology or by its values. We chose it because of its inherent (functional) values. We can call this the "technological axiological choice".

It can be argued, however, that although it is correct that we choose a specific technology for its inherent values, and that we control it and are responsible for it, as a whole and as a system technology controls us. It is so complex and comprehensive, and as such, it cannot be comprehended and controlled. However, this argument rests on an untenable premise: that technology as a whole is something different and more than the sum of the single technologies. As I have argued in Paper 5, this presupposes a "ghost in the machine", that technology as a whole is autonomous.

Although it appears to be very difficult to philosophically defend this "ghost", it is still extremely dangerous.[29] The belief in a technological control of man, that we have no choice, or that "we cannot stop progress" and that "we have to follow the development" is a mental spell that erodes our responsibility. If we believe that we are not responsible for technological development, because our individual decisions do not matter, then our choices and actions may become irresponsible. In this manner, the technological imperative can become a self-affirming prophecy.

Moreover, there is another way in which this belief in technological determinism is dangerous. As argued earlier, if we believe that technology is value-neutral, we may be (covertly) coerced by its inherent values. In the same manner the belief in a technological imperative may be a way to promote certain values. Persons or groups may introduce technology in order to promote

[29] For a more detailed account of "the ghost in technology", see (Hofmann 2002).

certain (inherent) values under cover of a technological imperative: “we have no choice”.

Hence, the question of whether technology controls us or whether we control technology is related to the issue of whether technology is value-laden or not. As argued, technology is value-laden and as such promotes certain actions. Respirators promote the values of artificial respiration. The point is, however, that we can choose these values. If we use respirators, we accept certain values, and conversely if we accept the values of artificial respiration (in particular situations) and respirators are available, then we are obliged to use them. We control technology by choosing it according to its (functional) value. If we ignore this, however, we might go astray. If we neglect the *choice*, we end up by being subject to what looks like a technological imperative, and if we disregard the *value*, we are subject to certain (functional) values promoted by technology.

So, technology is constitutively value-laden through its function. This, however, does not mean that all issues of value are “technological values”. Technology also poses general issues of value through its vast action potential. We control technology by choosing it according to its values. However, if we do not distinguish between issues that are posed by technology and values promoted by technology, we might be subject to a “technological imperative”. Moreover, the value-laden conception of function constitutively relates DISEASE and TECHNOLOGY.

VI Medicine as téchne

How then, can we understand the value-ladenness of technology and disease within one theoretical framework? How can we conceptualize the functional is-ought connection and how can it be integrated in the medical self-conception? There appear to be many alternative frameworks for dealing with these conceptual challenges. Various theories and models in health care management, in organizational theory or in philosophy have been applied. Some promising approaches refer to conceptual frameworks from antiquity. One frequently followed approach has focused attention on the ancient concept of practical wisdom (*phronesis*) (Pellegrino 1979a; Pellegrino & Thomasma 1981; 1993; MacIntyre 1985). There appear to be several profound problems and pitfalls with such an approach, which are discussed elsewhere[21] and which have made me pursue another approach: the concept of téchne.

But first, why should we look backwards to ancient medicine to find a framework for facing the challenges of modern technological medicine? I think the answer to this question can be found in the complementarity of ancient and modern medicine. The ancients had no developed techniques or technologies in the modern sense. Whether this was due to the socio-economic structure, for example, because they had slaves to do the practical work, so that they had no impetus to engage in practical issues, or it was because of a certain ideology, for example their high esteem of purely speculative science and corresponding disregard of work, is hard to tell (Canguilhem 1992). Nevertheless, they were in the possession of an advanced theory about téchne, that is, they had a logos of téchne, in the ancient sense. Hence, although the ancients were underdeveloped in practical technical issues, they had developed a highly sophisticated theory of téchne that included theoretical, practical and evaluative aspects. Today, although technology is highly sophisticated, its theoretical framework (as applied science) appears to be surprisingly simple.

The point here is that these two perspectives can enrich each other and they can fruitfully meet in medicine. Medicine, being a sophisticated technological activity, inevitably poses practical and evaluative challenges, displaying the need for a philosophical foundation of technology.

What then, was TÉCHNE? Téchne appears to have been a concept with a wide range of connotations in antiquity, but there seems to be reasonable agreement about some key characteristics. In particular, the Hippocratic concept of téchne was characterized by the following features:

i. Téchne is knowledge of a specific field. That is, it has a determinate subject matter (*pragma*) and it studies the nature (*physis*) of this subject matter.

ii. Téchne is oriented towards a specific end.

iii. It produces a useful result (*ergon*).

iv. Téchne requires mastery of general rational principles that can be explained and therefore taught.

Within the framework of medicine, the specific subject matter (i) was the diseased human body. The end of medicine (ii) was to heal and to help the patient, and the product of medicine was health for the individual patient (iii). Medicine was based on general principles and was able to give a rational account of the actions performed (iv).

This framework of *téchne iatriké* integrates theoretical, practical and evaluative aspects, which makes it suitable for structuring and analysing a complex activity such as modern medicine. Moreover, the concept of téchne is particularly suitable for investigating the influence of technology in medicine, as medicine and technology share the same origin as a *téchne*. Furthermore, medicine provides a framework for analysing the evaluative aspect of technology in general.

This *techn*ical approach employs concepts from medicine itself, and is not based on external philosophical theories that are applied and adjusted to the case of medicine. This shows that medicine can provide its own conceptual framework for facing its challenges. In the same way as philosophy finds its conceptual origin and inspiration in antiquity, medicine may find that ancient medicine represents something more than just a source of remarks for festive occasions.

Moreover, the analysis of the concept of *téchne* reveals a specific relationship between medicine and philosophy. On the one hand, philosophy can still be of value to medicine. In the same manner as ancient philosophers applied medical metaphors in order to argue that philosophy was useful, modern philosophers can argue that philosophy can be of value to medicine. That is, philosophy can be important to medicine in that it addresses some of medicine's pressing problems and presents a theoretical framework for their solution. In particular, a philosophy that takes into account theoretical, practical and evaluative issues appears to be particularly appropriate to analyse the complex activity of modern medicine. Hence, philosophy can be applied again to conceptualizse and legitimate medical actions as it did in antiquity. On the other hand, it illustrates that medicine can still be of importance to philosophy. Medicine, through its basic concepts and evaluative actions, can gain a pertinent position in philosophy and "save" more than just the branch of moral philosophy, as suggested by Toulmin.

In other words, there appears to be a fruitful reciprocity between medicine and philosophy, today

as in antiquity. Medicine can be applied evaluatively in philosophical argumentation, and philosophy can be fruitful to the analysis of fundamental challenges to medicine.

In antiquity the physician was also a philosopher and as such a prominent person (Solbakk 1995). Today the physician is mainly conceived of as a technician or an engineer (Hofmann 2001a). The point here is that the evaluative aspect of medicine has to be acknowledged, particularly in technological medicine, where the concept of disease is constituted by technology. Hence, the modern physician cannot be only a technician or a philosopher. In order to help the patient, she has to be both, that is she has to be a *téchnites*.

In other words, the widespread application of technology in medicine has necessitated philosophical reflection. The thing that differentiates modern medicine from its ancient ancestor, in other words technology, has reinforced the relevance of ancient forms of medical self-reflection. The point, of course, is not that ancient medicine represents a "gold standard" for medicine that every subsequent medical activity has to be compared to. It is rather that ancient medicine provides a conceptual framework for analysing modern medicine because of its complementarity and because it represents a reference for both medicine and technology, and for philosophy. Thus, it represents a framework for understanding the relationship between disease, technology and values.

It is important to note that the ancient concept of téchne is only one perspective for explaining the relationship between medicine and technology. If anything, it is a sufficient perspective, but of course not a necessary one. As I have argued, medicine and technology are value-laden activities that are constituted by function. The ancient perspective is only one way to join the epistemic and evaluative aspects of medicine and technology.

What then, are the consequences of such a perspective, and in particular, how does this perspective contribute to the understanding of the relationship between medicine and technology? This issue has not been discussed in the papers, and is investigated at some length in the following chapter.

VII Medicine as technology

As argued, technology has a constitutive role in modern medicine; epistemologically, practically and evaluatively. One phrase that could be used to summarize the main argument of this thesis would therefore be that *medicine is technology*.

To conceive of medicine as technology is of course not original, but to give technology the meaning that it is given here, is original. Before I explicate my conception of *medicine as technology*, let me explore some of the other contentions. One reason why medicine has been conceived of as technology is because technology has been a model for medical thinking.

Technology as a model for medicine

In antiquity the function of man was to fill a set of roles, each of which had its own purpose, for example, the roles of family member, soldier, philosopher (MacIntyre 1984: 58-9). Aristotle starts his ethical enquiry by defining the function of man to be to "live well", analogous to the function of the harpist to be to "play well" (Nicomachean Ethics 1095a16). Today the function of the human organism is apparently not defined so much in social terms, but in technological terms.

This, however, is not a new conception. As the quote by Lenihan (p.35) illustrates, technology has been a model for the human organism and its functioning throughout history. From Galileo, Descartes, Baligvi, La Mettrie and to Watson and Crick, technological models of man have been constitutive to medical theory and practice. Hence, due to the mechanistic, reductionistic and deterministic models rendering a technological conception of man, medicine has become a technology.

This technological model of the human body goes one step further and is reflected in the sciences of man: biology and the social sciences.

Technological models for biology and society

Technology is a model for medicine also in a more covert and indirect way. Technological models are important in evolutionary and functional explanations. Such explanations appear to be of low empirical content, but heuristically very valuable in biology and medicine (Jakobsen 1998). Hence, when explaining human organs and human disease in terms of evolutionary function, we frequently rely on a technological model. Such explanations are epistemically useful in medical theories (Wulff 1994: 15) and they are analogous to human purposive activity. That is, there is a technological model at the basis of medical theory, reinforcing the conception of medicine as a technology.

Also on the societal level, technology provides a model for medicine. In the social sciences, social phenomena are studied in terms of "mechanisms", "negative feedback", and by using "functional" and "deterministic" explanations (Elster 1983; 1989; von Wright 1971). These technological models are also applied in the study of medicine as a social activity. In many aspects medicine is conceived of as a technocratic activity ruled by instrumental rationality. In this indirect way medicine is conceived of in technological terms.

Altogether, technology appears as a model in medicine and for medicine, and as such medicine can be conceived of as technology.[30] Many arguments could be framed against such "technological" conceptions of medicine. I will not discuss these here, but rather present the alternative, which comes out of this study.

Medicine as technology

As argued, basic concepts in medicine, such as DISEASE, are constituted by technology. This makes medicine a technological activity. Technology is not only an external means to medicine's internal end, but it actually constitutes the phenomena that are applied to define diseases, it establishes the way we try to gain knowledge of disease and the way we recognise disease in practice, and the subject matter of medicine is established by technological treatability. Again, ontologically, epistemically and practically, technology constitutes medicine's goal and its actions, and hence, makes medicine technology.

Furthermore, technology confirms and reinforces the practical and purposive aspects of medicine. Medicine is defined by its practical purpose (Wulff 1994: 11), and is widely acknowledged as a knowledge-based purposive human activity. So is technology. According to the definition in the introduction, technology is a complex of devices, methods and organizations applied in human purposive and productive activity. This concurs well with a common conception of medicine.[31] Thus, technology is a complex issue that embraces devices, methods and organization, and constitutes medicine on all these levels.

In particular, technology highlights the purposive aspects of medicine through its function. As it is maintained that medicine has lost its ends and goals (Hanson & Callahan 1999), the function

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[30] Against this we might argue that technology as a model for biology and social activity misses an important point discussed earlier, that there is a difference between the conception of function in biology, the social sciences and studies of technology. When technology is a model of biology, the basic difference between technological and biological function is ignored. Correspondingly, when social activity such as medicine is modelled by technology, the fundamental difference between technological and social function is ignored.

[31] One could of course argue that it is not accidental that medicine fits my definition of technology. To the man with the hammer everything looks like a nail. However, the definition is in accordance with generally accepted conceptions in science and technology studies (STS).

of technology can contribute to clearing and reinforcing the purposive aspects of medicine. The function of a pulseoxymeter is to display an estimate of blood oxygenation. If we do not want or need to know this, we should not use pulseoxymeters.[32] In this manner technology can actually emphasise the purposive aspect, and hence also the evaluative aspect of medicine.

Issues of the purpose of medicine are issues of value, and the conception of medicine as technology highlights medicine's evaluative aspects. Traditional conceptions of medicine as technology, as discussed above, imply that technology conceals or violates the evaluative aspects of medicine. I have tried to argue that technology poses value issues and that, in a specific sense, it is value-laden.

Hence, medicine is technology in a more profound sense than only through the technological models that it applies. However, the important move is that, in order to conceive of the evaluative aspect of technology, we can turn to medicine, in particular to ancient medicine. The ancient concept of téchne represents a conceptual framework for understanding the evaluative aspects of technology, and hence also modern medicine.

Hence, in order to understand medicine as technology in the way in which it is interpreted here, we can turn to medicine itself, at least to an ancient conception of medicine. This points to an important reciprocity between medicine and technology. Medicine can be understood as technology. However, in order to explain the implications of such technological medicine, we can turn to medicine itself. Technology represents a conceptual framework for analysing the purposive and evaluative aspects of medicine, and (ancient) medicine provides a conceptual framework for understanding exactly these aspects of technology.

Medicine as a model for technology

Hence, in order to understand technology as an evaluative activity we can turn to medicine. As argued (in Paper 6), téchne iatriké has a subject matter, is oriented to a specific end, has a useful result and can give a rational account of its activity. Hereby it integrates epistemic, evaluative and practical aspects that provide a fruitful framework for understanding technology.

At a time when technology is a complex affair and the differences between particle accelerators, computer simulations and genetic engineering are more obvious than the similarities, téchne represents a conceptual framework for recognising and discussing technology.

It is noteworthy, though, that technology itself does not qualify to be a téchne. Technology, in

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[32] For example, it is argued that under anaesthesia the pulseoxymeter has no outcome for the patient (Pedersen, Dyrlund Pedersen, Moller 2001).

general, does not have a limited subject matter, and it is not oriented to one specific end. Hence, in general, technology does not conform to the criteria for being a téchne, whereas the particular technology might conform.

Furthermore, medicine, through téchne, can be a measure of technology. If what we conceive of as a technology does not have a specific subject matter, if it does not have a clear end or a useful result, or if we cannot give a rational account of its activity, we should be alert.

Moreover, medicine clarifies and addresses evaluative issues in ways that are highly illustrative for technology. First, medicine poses issues of value. The asymmetry between physician and patient, the potentiality of doing good, but also of doing harm, urges us to address evaluative matters. Is infertility a medical matter? How should one prioritize? To what extent should health care services take the initiative to investigate people who themselves do not perceive that they are ill? How far can medicine go in altering human beings? Is patient autonomy respected?

In no other sphere is it so clear that medicine poses evaluative issues as in modern technological medicine. The parallel to medical technology, posing a wide range of value issues, is obvious, for example, in environmental pollution and military technology. However, medicine can contribute to reinforcing the evaluative aspects of all types of technology.

Moreover, medicine does not only pose issues of value, it is constitutively evaluative. Medicine is concerned with helping the particular patient, and has health as its end. Its moral foundation constitutively makes it evaluative. Correspondingly, using a technology will have a purpose and be evaluative. Medicine can make this purposive character clearer. Many technologies, such as televisions, cars and telephones, have become so common to us that we seem to have forgotten their purpose. This makes us vulnerable to the critique that with technology we have confused means and ends (Winner 1977). Medicine can remind us of technology's inherent purposiveness.

Thus, medicine illustrates the ways in which technology is related to values. Medicine poses issues of value and at the same time is value-laden. Technology does not free medicine from value-ladenness. On the contrary, technology confirms medicine's value-ladenness, which makes medicine a showcase for technology's value-ladenness. Hence, whereas technology has been a (mechanistic) model for medicine, medicine can be an evaluative model for technology.[33] This reciprocity between models of technology and medicine confirms the connection between these disciplines and advocates the conception of medicine as technology. Furthermore, it shows that a

[33] One could also say that whereas technology has been a (mechanistic) model for the functioning of the human organism, the (evaluative) functioning of the human organism can be a model of the value-laden function of technology.

medical framework can be fruitful in the analysis of technology in general.

Technology (such) as medicine

Hence, medicine is a technology, not only because of the technological models it applies, but also because it is inherently evaluative. That is, because medicine is more overtly evaluative, it is a paradigm of technology. Accordingly, medicine can make technology's purposive characteristics, and the connection between function and value, clear.

In other words, medicine depicts the value-ladenness of technology. As technology contributes to the epistemological development of medicine, medicine can advance the axiology of technology. More generally, medicine is a complex subject matter that challenges the organization of human knowledge in a basic way, and it has, together with biology, contributed to substantial advances in the philosophy of science. Medicine and biology can serve as paradigm sciences because they address issues that are of greatest interest to us as biological beings.

However, the argument here is stronger than only to point out that there is reciprocity between the models of medicine and technology. I argue that the relationship between medicine and technology is a more profound epistemic-evaluative relationship typical for knowledge-based purposive practices, for which we can find a fruitful conceptual framework in the ancient concept of téchne.

Medicine and technology as expressions of biological norms

It can be argued that even this conception of medicine as technology is not original and that it parallels the conception of George Canguilhem. Canguilhem conceives of medicine and technology as spontaneous efforts to dominate the environment. Mechanical devices and processes are parts of organic life, and technology is a phenomenon, which can only be understood within the framework of biology. Technology promotes human values as a living being, and medicine is a brilliant example of this (Canguilhem 1943; 1995).

To some extent Canguilhem's position resembles the Hippocratic concept of téchne iatriké, where medicine is a means in the struggle for survival (*On Ancient Medicine* III). However, there is a distinct difference between Canguilhem's position and my understanding of medicine as technology. According to Canguilhem, the values promoted by medicine and technology are biological values promoted by man as a biological organism. While Canguilhem's aim is to show how *biological norms* are constitutive to human activity such as technology and medicine, I have tried to illustrate how medicine can make us aware of the *human norms* that prevail in

technology.[34]

This theory of technology, where medicine appears to be a paradigm case, as in antiquity, might be called "genuine technology". As Mitcham points out (1994), the term "technology" is an odd combination of "téchne" and "logos", and TECHNÉ contains most of the theoretical aspects that we ascribe to technology today. Hence, "the logos of téchne" appears tautological. The theory promoted here, however, is a logos of téchne, a techne-logy in the sense that it is a theory of the cardinal character of téchne.

Medicine as a model for philosophy

The discussion of medicine, technology and values illustrates that medicine is not only a fruitful framework for analysing technology, but that it can be fruitful for philosophy in general. As alluded to above, the epistemic and evaluative challenges in medicine (and biology) have greatly contributed to the advances in the philosophy of science. For example, medical cases are applied to clarify the complex issue of causality. "The connection between causes and probabilities is … like the connection between a disease and one of its symptoms. The disease can cause the symptom, but it need not; and the same symptom can result from a great many different diseases."[35]

Today few philosophers would advocate the argument of the author of *On ancient medicine*, who argued that medicine was the basis for any understanding of man (*On ancient medicine* XX). To be able to discuss general issues concerning human beings, one had to know the art of medicine. Medicine was basic to philosophy. However, the ideal of usefulness that we find in ancient and modern philosophy clearly finds its analogy and model in medicine: "Empty is that philosopher's argument by which no human suffering is therapeutically treated. For just as there is no use in a medical art that does not cast out the sickness of bodies, so too there is no use in philosophy, unless it casts out the suffering of the soul." (*Epicureus*)[36]. Correspondingly, Wittgenstein argues in *Philosophical Investigations*: "A philosopher's treatment of a question is like the treatment of an illness". The philosopher, like the physician, diagnoses and aims to eradicate misconceptions and cognitive and cultural unpleasantness.

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[34] With Schaffner one could argue that what is conceived of as "biological values" in various versions of evolutionary theory, are covert anthropomorphisms (Schaffner 1993). The values that we identify in biological organisms are our own values.

[35] Cartwright, N. How not to get from probabilities to causes. Unpublished paper presented at Theory of Science Studies Seminar in Oslo, September 12, 2001.

[36] (Usener, 1887, p.221), here cited from (Nussbaum, 1994: 13).

This relationship between philosophy and medicine, however, appears to be more than a metaphorical one. In order to be "useful" and "practical", philosophy needs to relate to what people conceive of as challenges in their life-world. Medicine, in a unique way, provides such challenges. It involves existential questions, as well as theoretical, evaluative and practical challenges. Medicine gives practical relevance to issues such as "what is a human being?", "what ought we to do?" and "what difference does it make?" Medicine can provide fruitful conceptions and salutary examples for philosophical debates, both in theoretical philosophy, in the philosophy of science and in axiology. Hence, medicine might gain a pertinent position in philosophy and "save" more than just the branch of moral philosophy (Toulmin, 1982).

In other words, there appears to be a fruitful reciprocity between medicine and philosophy, today as in antiquity. Philosophy can be fruitful to the analysis of fundamental challenges to modern medicine, and medicine provides relevance to philosophical argumentation.

Hence, the theory of téchne presented in this thesis is not only a tool for analysing challenges in medicine, but it represents an alternative conception of medicine and technology, and as such makes a contribution to the philosophy of medicine and to the philosophy of technology. How then, does this theory of *medicine as technology* correspond to established theories of technology?

Techne-logy versus technology – on traditional theories on technology

At least four main positions in the philosophy of technology can be recognised in the health care debate: technological determinism, social determinism, social constructivism and a phenomenological position.

Technological determinism

According to *technological determinism,* human activity is governed by technology (Smith & Marx 1994). Corresponding to the technological imperative, there seems to be a variety of "technological determinisms". Common to these conceptions is that human actions appear to be compelled by technology.[37]

One form of technological determinism conceives of technology as an *autonomous agent* (Ellul 1964; Winner 1977). Cassell (1993) and Reiser's conceptions of technology (1978) appear to be

[37] No scholar identifies himself or herself explicitly with a strong version of "technological determinism". One reason might be that if man really were determined by technology, a critique would be in vain. No matter what we said, wrote or did, we would still be governed by technology. Still, a variety of "technological determinists" might be identified in the literature.

akin to this sort of technological determinism.[38] This kind of determinism has been discussed in Paper 5. Another kind of determinism has been called *normative determinism* (Bimber 1994). According to this position, we are subject to technology by abdication. The issues (and norms) that govern technological development are removed from the political discourse and have been replaced with instrumental concerns. According to Bimber, Habermas is the foremost representative of this account. Normative determinism can also be recognised in the health care debate. For example Wolf and Berle's point (1981) that technology appears to confuse our means and ends, which concur to Winner's concept of "reverse adaptation" (1977) has affinity to this position.[39]

"Social determinism"

Opposed to the different conceptions of technological determinism, there is what might be called "social determinism", which claims that technology is determined by our choices. We choose the technology we need for the purposes we want.

This position apparently rests on the value-neutrality dictum. Questions of value are human issues and are de-coupled from technology. Whether we apply a respirator or an atomic bomb in a particular case is a matter of value, but it is not inherent in the technology – it is up to us. In fact human autonomous action with technology presupposes value-neutrality. The value that technology has is not an issue of technology as such, but a question of the good life and human value altogether.

It can be argued that "social determinism" is a version of social constructivism, because in both cases the values and choices concerning technology are genuinely human. However, I believe that there are good reasons to differentiate between the positions. Some of the differences between them are that the values in the one case are overt, but in the other are more or less covert, and that the one causes suppression and compelled activity, while the other does not. Besides, many of the proponents of "social determinism" are certainly not social constructivists.

On the social construction of technology

The *social constructivist* theory of technology claims that technology is developed and governed

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[38] In this connection it is noteworthy that Cassell's discussion of human deficiencies corresponds to Ellul's analysis (Ellul 1964).

[39] Bimber also mentions two other kinds of technological determinism (Bimber 1994). According to nomological determinism, technology follows some kind of natural law or inner logic. The last kind of determinism is due to unintended consequences. Technology inevitably has unintended consequences, which makes it appear to be determined by some unknown force. Although some of the commentators have similar interpretations of technological determinism, no author appears explicitly to submit to technology's law-like appearance or its dominance by unintended consequences in the health care literature.

by man himself through various social interactions (Bijker 1987). The way this happens can be more or less covert. If the way technology is managed is hidden, technology can appear to be an imperative. The crucial question then becomes how and by whom technology is controlled.

In the various explanations of the technological imperative, we can recognise several social constructivist approaches. It has been argued that the development and implementation of technology in "health care" is a result of professional decisions (Bennett 1977), of industrial interests (Vos 1991; Payer 1992; Moss 1991) or of the intimate collaboration between the medical profession and industry (Blume 1992; Hiddinga & Blume 1992). Others have argued that the application of technology in health care is determined by certain interest groups or particular social classes (Foucault 1991; Rothman 1997)[40]. Only through understanding the social and cultural context can we understand the development of technology in medicine (Koening 1988). The social context, however, does not only conduct the technological change, but also the structure of medical knowledge (Barley 1988). For example, what a radiologist sees in the shadows of his X-ray is to a large extent a professional convention (Pasveer 1989).

Phenomenological technology

Phenomenological theories of technology differ from technological and social determinism as well as from social constructivist theories. They conceive of technology as an existential category (Mumford 1934; 1967; 1970; Heidegger 1962; Idhe 1990). Technology is grounded in man and is part of his existential structure. It is our current cultural *clearing,* within which we see the world. Technology can be freeing and contribute to our *Being*, but can also restrict us by its cognitive framework *Gestell* (Heidegger 1954; Dreyfus 1997).

In particular, medical technology represents an embodiment in the being of the professional. It has become part of professional coping. "The technology becomes transparent and *embodied* much like the cane for the blind. ... From this it can be seen that the gastroenterologist, going about his work with the endoscope, *embodies* the perceptions derived from the endoscope in his very being as a gastroenterologist." (Cooper 1996: 392).[41] Few others in the field of medicine, however, appear to follow such a line of thought, in particular not in the critical sense of

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[40] Foucault has argued that institutionalized knowledge of physiological, anatomical and biochemical conditions is part of social individuation and differentiation. This "medical gaze" is constituted by particular institutions. There are hospitals for particular diseases and departments for particular technologies, e.g. X-ray departments, departments of chemical analysis, pathology departments. The physiological, biochemical and biomolecular states and processes of medicine are the institutionalized knowledge of medicine, but also its socially differentiating power (Foucault 1991).

[41] This technological shaping of man can also be seen in a biological sense. Through its interventive capacity, medical technology changes the human environment and the human being itself. Canguilhem has claimed that medicine *is* a technology applied to adapt us to the situations of life (Canguilhem 1989: 99, 198, 201, 228).

Heidegger.

Thus, the discussions on technological issues in the literature in medical philosophy correspond to general theories in the philosophy of technology. Furthermore, they represent profound and distinct theories of technology, all addressing the issue of value. According to technological determinism, technology enforces external values on human social life. According to “social determinism”, values are indifferent to technology altogether. Within the framework of social constructivism, the values related to technology are human values that are formed and distributed more or less covertly. According to the phenomenological account, technology is related to values through the phenomena that constitute our life-world.

How then, does my own analysis relate to these theories? I contend that technology is inherently value-laden, and can therefore be characterized as a technological determinist. On the other hand, I claim that a certain group of value questions are indifferent to technology (questions not concerning function). Accordingly, I could be characterized as promoting "social determinism". However, the values in question have clearly been denoted as human values, and as such, my position might be characterized as a social constructivist. Correspondingly, I would argue that the values constitutively related to technology are not only rational or cognitive, but also emotional and experiential. Thus, I might also be identified as a phenomenologist.

This illustrates that the theory of *medicine as technology*, or *téchne-logy*, is a *quintum quid*. It provides a unique way of relating value to technology, that is, through the purposiveness of its function. As such it conjoins elements from established theories without submitting to any of them in particular. That is, it points out how these theories have grasped important aspects of the relationship between technology and value, and explains why none of them have come to dominate the philosophical debate. The relationship between technology and value appears to be of a complex kind that cannot be fully explained by any of the dominating monistic theories. The value-ladenness of technology cannot be studied as an external, social or personal phenomenon alone, but relates to all these aspects.

Furthermore, the techne-logy presented here does not try to conjoin or mediate between the established theories. It is not another eclecticism. The theory is independent of the established theories of technology, and it finds its theoretical foundation in ancient medicine and philosophy, but perceived from the third millennium.

Medical ethics

At the outset this was not intended to be a thesis on medical ethics. I started by discussing basic issues in the philosophy of medicine and then turned to issues of the philosophy of science and technology. However, during this move the focus of attention became issues of value, and towards the end, theories of value.

I have argued that medicine is a value-laden activity, and that this value-ladenness is inherent in two constitutive aspects of modern medicine that are often considered to be value-neutral: the concepts of disease and technology. As value is a central concept of this thesis, of which important values are moral values, it naturally relates to ethics.

The value-ladenness of DISEASE and TECHNOLOGY has been identified in the concept of function, being constitutive both to DISEASE and TECHNOLOGY. FUNCTION integrates epistemic and evaluative aspects of human activity, and the ancient concept of téchne provides a theoretical framework for conceptualizing this relationship between fact and value. Hence, in the same manner as the logos of téchne provided an adequate model for ethics in antiquity, this thesis provides a theory of technology and value.[42]

Moreover, the evaluative aspect of technology has been related to FUNCTION, which is frequently conceived of as a teleological concept. Correspondingly, the conception of medicine as a téchne is in part a teleological perspective. Furthermore, the values related to DISEASE and TECHNOLOGY extensively include moral values. Does this mean, then, that my analysis presupposes or promotes a teleological ethics? Do we have to subscribe to consequentialism or to virtue ethics? More precisely, because I have pointed out some of the difficulties with virtue ethics[21], is consequentialism the only viable position in medical ethics to address the issues discussed in this thesis?

I do not think that this conclusion follows from my analysis. First, in the literature there is a vigorous debate on the relationship between FUNCTION and teleology. I do not want to enter this discussion, but only to indicate that it is far from clear that functional explanation is the same as teleological explanation (Beckner 1969; Wright 1976: 74; Schaffner 1993: 405-10). However, I believe that functional explanations are related to teleological explanations. Second, even if goal-directedness or purposiveness are included as evaluative components in an analysis, this does not automatically imply that such a teleological aspect should direct the perspective in normative ethics.

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[42] Although many authors have discussed Socratic epistemological ethics, I was made aware of the fruitfulness of this perspective by Jan Helge Solbakk (1992, 1993).

What I do think my analysis implies is that teleology is a central part of the value-ladenness of medicine and that teleological ethics is therefore one important perspective that has to be integrated in ethical considerations in medicine. In particular, teleological conceptions that acknowledge the purposiveness of medical activity appear to be necessary for adequate evaluative judgements. In other words, to understand and address the moral issues of modern technological medicine, we have to recognise its teleological characteristics. Technology and the modern concept of disease pose a wide range of moral issues that cannot be adequately addressed if their teleological aspects are not recognised and understood. However, this does not mean that such a teleological aspect is the only relevant ethical perspective in medicine.

IX Conclusion

In this thesis I have argued that it is more appropriate to address issues of ailment than of health. Although the concepts of human ailment are complex and difficult to define, they appear to be easier to address than HEALTH. One consequence of this is that the term “health care system” is misleading. “Disease control, illness care and sickness rights system”, in short “Disease care (and rights) system” or “ailment aid system”, might be more appropriate.

Moreover, the complexity of the concept of disease has been explained by the complex extension of DISEASE. One reason for this complexity is that disease always occurs in individual patients, and these patients are not only particular objects with statistical variation. Thus, the thesis supports Gorovitz and MacIntyre’s concept of medicine’s fallibility. Medicine is not only fallible due to ignorance or negligence, but because it in principle deals with particulars.[43]

Furthermore, the thesis emphasises the perspective of patients as persons. One consequence of this appears to be that, although it is important for many reasons to focus on DISEASE, the attention, aim and action of health care professionals must always be directed towards the diseased person. Although this appears to be obvious, it is not. Modern medicine focuses its attention on technologically provided “objective” measures, sometimes at the cost of the personal perspective of the patient.[44]

Medicine is a complex activity and its basic concepts are complex. This complexity is constituted and enhanced by technology. Correspondingly, medicine is a value-based activity, and its evaluative issues are constituted and enhanced by technology. Hence, medicine and technology are constitutively related. One common constitutive aspect of technology and medicine is that they are both teleological activities. Medicine and technology are characterized by their purpose and function. Furthermore, this teleological aspect relates fact and value, intention and responsibility. This makes medicine a brilliant area for studying one of the most influential aspects of modern life, technology.

Philosophy can learn from medicine in several ways. First, in medicine pathology precedes physiology. Modern technological medicine has become extremely successful in defining,

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[43] The thesis does not, however, support Gorovitz and MacIntyre's view that this fallibility is inevitable. It appears to be difficult to find the stance where it can be declared that it necessarily has to be like this in the future.

[44] This, however, does not mean that when medicine attends the individual distinctiveness, medicine becomes perfect. Even if medicine is committed to the prospering and flourishing of the patient, medicine is fallible (Gorovitz & MacIntyre 1976: 64). The personal perspective is as fallible as the technologically dominated medical perspective because they do not recognise the complexity that is involved in the task of helping a suffering person.

identifying and treating diseases, and from this, in learning about the functions of the human body. That is, conceptions of negative bodily occurrences guide our conceptions of positive human conditions, and they guide our action in life in general, as they do in medicine. This concurs with an asymmetry in ethics (Tranøy 1967), and accordingly, it appears to be more fruitful to discuss "the bad (unwanted) life" than the "good life".

Second, in medicine it becomes clear how technology constitutes science. If it were not with the aim of helping people, medical knowledge would be vacuous. This purpose of medicine legitimates its activity in general, and its search for knowledge of the human body in particular. Medical knowledge is purposive, and as such medicine is technology. Pursuing pure knowledge becomes immoral. This can teach us that technology is not only applied science, but that technology is purposive knowledge. Technology, although it generates scientific knowledge, for example about neutrons and protons, RNA and DNA, has a given end. In this manner technology is one way to reveal the value-ladenness of science.

This points to the third general lesson learnt from medicine; how its activity is constituted by its purpose, which makes it constitutively related to technology. As such, medicine provides a conceptual framework for analysing technology, or more precisely, techne-logy provides a conceptual framework for analysing both medicine and technology.

Moreover, I believe that the study shows that epistemic and evaluative issues are inter-related in a profound way. The traditional clear distinction between fact and value, between knowledge and judgement, appears to cause challenges which become particularly clear in medicine. Hence, medicine demonstrates a link between is and ought which can be of great importance for philosophy in general.

As DISEASE is constituted by technology and technology is value-laden, it becomes important to know how technology relates to value. It follows from the thesis that it is essential to address the value issues posed by technology explicitly, and to avoid allowing technology to promote values we do not have. If we do not discuss whether it is right to carry out foetal sex selection, but uncritically to implement ultrasound screening before the time limit for abortion on demand, then technology can come to promote foetal sex selection. Thus, ignoring the issues of value posed by technology can make technology promote these values.

On the other hand, there appears to be some issues of value which we cannot discuss separately from the technology. The function of a given technology constitutively relates it to value. Hence, it becomes important to acknowledge the value-ladenness of technology and to acknowledge these values. Otherwise technology can come to promote unrecognised values. Hence, medicine

provides a framework for addressing the relationship between technology and value. In particular the techne-logical approach accepts technological determinism of the kind that claims that certain technologies promote particular values and it accepts the version of traditional "social determinism" that claims that technologies pose general issues of value that are distinct from technology.

Moreover, the functional aspects of technology that are studied in this thesis are intentional. This does not mean that technology cannot have non-intentional functional aspects, such as those studied in biology or in the social sciences. The point in this thesis, however, has been to analyse the evaluative aspects of technology with respect to human responsibility. This is done in order to avoid the pitfall of traditional approaches that tend to result in a reduced responsibility for our actions with regard to technology.

There seem to be many more connections between disease and technology than those that have been emphasised here. Technology itself has been conceived of as a symptom and as a disease (Romanyshyn 1989). What has been stressed in this thesis is that technology is a prominent factor in modern western society in general, and in health care in particular, and that any analysis of this society or of its health care systems that ignores technology, misses one of its constituent characteristics. Even more: any analysis of values in modern health care that ignores the difference between technology as posing value issues and technology as value promoting misses something important. Hence, if a symptom is that which characterizes a situation and that which makes a difference, then technology can very well be conceived of as a symptom. The point is that technology is a key characteristic of modern western civilization that should not be ignored in basic analyses of this civilization.

Hence, DISEASE is constituted by technology. However, this does not make it a value-neutral concept. On the contrary, technology highlights important evaluative characteristics involved in health care. Interestingly, medicine itself is brilliant for elucidating the relationship between technology and value. Technology, then, becomes important to the philosophy of medicine, and medicine becomes fruitful to the philosophy of technology, in the same way as there is a reciprocity between medicine and philosophy in general.

X Limitations and further research

Although this thesis presents a completed study of DISEASE, TECHNOLOGY and values, there are, of course, many relevant subjects that I have not been able to investigate in detail, and some fields appear to be particularly fruitful for further research.

The issue of the constitutive function of technology could be elaborated on. Studies of particular kinds of technologies with an emphasis on their functions would be highly interesting to do. One important point to investigate would be the evaluative aspect of very general technologies - in particular to analyse how useful the notion of value-ladenness is in such cases. It might turn out, for instance, that the evaluative function of general technologies covers general and quite interesting axiological and epistemological issues.

The thesis has pointed out the importance of the concept of function, for understanding both TECHNOLOGY and DISEASE. In particular I have argued that FUNCTION illustrates the link between factual and evaluative aspects of TECHNOLOGY and DISEASE. The concept of function, however, has been applied in a variety of ways in various disciplines, such as biology and the social sciences (von Wright 1971; Elster 1983) and to technology. In this thesis I have limited myself to a teleological and intentional conception of function, because the focus has been our moral responsibility to technology applied in medicine and the consequent conception of disease. A broader analysis of the relationship between biology, the social sciences and technology would need a wider investigation of FUNCTION than has been done in this thesis.

Throughout the study I was overwhelmed by the richness of ancient literature. An elaborated version of the techne-logy presented here would, of course, require extensive studies of ancient texts. It would be particularly interesting to investigate the Hippocratic texts further, as well as the Epicurean, Stoic and Platonic texts.

It could of course also be argued that my recourse to ancient medicine is an anachronistic approach. I would agree with such a contention. However, what I have tried to show is that it can still be fruitful as a tool to analyse challenges in modern medicine. I do not believe, as some philosophers appear to believe, that all important philosophical issues have been dealt with in antiquity and that no better answers have been provided later. However, I do think that the ancient conceptual framework reveals some nuances and combinations of rational categories that have been ignored in our modern conceptions, and that antiquity is so distanced from, but at the same time profoundly related to, our modern world view that it can serve as a reference and as a rational reflector. In this context it is not crucial whether our conception of téchne is precisely

the same as the conception that a particular Hippocratic author had at a certain time in his authorship. This will always be a controversy. The important point is whether the concepts and conceptions that are kept for our modern times can be of any use to us today.

This indicates another area that the thesis opens to exploration: the relationship between function and concepts. It is argued that concepts can be conceived of as capacities or skills (Ryle 1949: 133-4; Nørreklit 1973). Having a concept, such as DISEASE, means that we are skilled in recognising instances of DISEASE, and that we are able to use the word "disease" adequately. Hence, concepts appear to have an end (communicative action), a subject matter (their extension) and a result (communication), and they require that we are able to learn what they are and to give a rational account of them. That is, concepts are tools. In other words, they are functional.[45] If concepts are tools, then the knowledge of concepts can be denoted logos of téchne, or "techne-logy". Hence the term "technology" is ambiguous, as it can mean both the teaching of téchne and the technique of using words.[46] The point here is that these interpretations appear to be closely connected through FUNCTION. The teaching about technical things, in particular the teaching that includes the constitutive value-ladenness of technical things, will address their functions, and the teaching of the technique of using concepts addresses the function of concepts. This, however, is the subject of another study.

[45] The phrase that concepts are functional I owe to Trond G. Jakobsen.

[46] This corresponds to the ancient conception of *logos of téchne* (Mitcham 1994).

Appendix: On the logic of the concepts of health and disease

In the introduction, I argued that it follows logically from the medical and holistic models of the relationship between health and disease that a person can be both non-diseased and non-healthy at the same time. What is the logical issue behind this argument?

If we recall, the models were given as follows:

1. The medical model of the relationship between health and disease says that non-health is not a sufficient condition for being diseased.
2. The holistic model of the relationship between health and disease says that non-disease is not a sufficient condition for health.

If we follow traditional modal logic, starting with the *sine qua non*:

A is a *sine qua non* for B means that without A there is no B. In other words, A is a necessary condition for B, i.e. A NC B.

This is the same as saying that if B is true, then A is also true, i.e. if B, then A. This means (by definition) that B is a sufficient condition for A, i.e. B SC A.

Furthermore, A NC B is identical to B SC A, which can also be realised by analysing the truth table (see below).

How then, does this relate to the models of the relationship between health and disease?

According to the medical model, non-health is not a necessary condition for disease, in other words, not H is not an SC for D, or as a logical sentence: ~(~H SC D).[47] That is, A is not a sufficient condition for B is the same as ~(A SC B), which is the same as ~ (If A, then B), which is the same as A and not B. (See the truth table).

In relation to (1) we get that non-health is not an SC for D ≡ ~H Λ ~D, that is, one can be both not diseased and not healthy. The same result follows from (2).

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[47] ~SC is not a logical term, and ~H ~SC D cannot be a proper logical sentence because If ~H, not then D is not a logical sentence. What is meant by the sentence non-health is not an SC for disease, then, must be ~(~H SC D).

A	B	A NC B	If A, then B	If B, then A	B SC A	Not (If A, then B)	A and not B
T	T	T	T	T	T	F	F
T	F	T	F	T	T	T	T
F	T	F	T	F	F	F	F
F	F	T	T	T	T	F	F

It can be argued that the NC and SC are not proper logical terms for characterizing the relationship between health and disease, and that INUS would be more appropriate. This touches upon a basic discussion on modal logic, which is beyond the scope of this thesis. For the purpose of my argument, NC and SC are sufficient to make the point that the medical and the holistic model both allow for situations without disease or health.

Literature

Ackerknecht EH (1982). Causes and Pseudocauses in the History of Diseases. In Stevenson LG (ed.). A Celebration of Medical History. Baltimore: The Johns Hopkins University Press: 19-36.

Albert DA, Munson R, Resnik MD (1988). Reasoning in Medicine: An Introduction to Clinical Inference. Baltimore : Johns Hopkins University Press.

Album D (1991). [The prestige of diseases and medical specialities]. Tidsskr Nor Lægeforen; 111: 2127-33.

Almond B (1988). Philosophy, Medicine and its Technologies. Journal of Medical Ethics; 14: 173-178.

Anderson WH (2000). Perception of Disease and its Meanings. Lancet 2000; 354: SIV49.

Anonymous. The Concept of Disease.[editorial]. *British Medical Journal* 1979;6193: 751.

Araya RF (1996). The Outlook of the Teckhne Iatriké. Theoretical Medicine; 17(2): 163-173.

Barley SB (1988). The Social Construction of a Machine: Ritual, Superstition, Magical Thinking and other Pragmatic Responses to Running a CT Scanner. In Lock M, Godon DR (eds.). Biomedicine Examined. Dordrecht: Kluwer Academic Publishers: 497-539.

Baron RJ (1985). An Introduction to Medical Phenomenology: I Can't Hear You While I'm Listening. Ann Intern Med; 103:606-11.

Bechtel W (1985). In the Defense of a Naturalistic Concept of Health. In: Humber JM, Almeder RF (eds.). Biomedical Ethics Reviews – 1985. Clifton, New Jersey:131-70.

Beckner M (1969). Function and Teleology. Journal of the History of Biology; 2: 151-64.

Beninger JR (1986). The Control Revolution: Technological and Economic Origins of the Information Society. Cambridge MA: Harward University Press.

Bennett IL (1977). Technology as a Shaping Force. In: Knowles JH (ed.). Doing Better and Feeling Worse. New York: Norton & Co: 125-133.

Beresford EB (1996). Can Phronesis Save the Life of Medical Ethics. Theoretical Medicine; 17(3): 209-24.

Bijker WE, Huges TP, Pinch TJ (eds.) (1987). The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology. Cambridge, Mass.: MIT Press.

Bimber B (1994). Three Faces of Technological Determinism. In: Smith MR, Marx L (eds). Does technology drive history?: The Dilemma of Technological Determinism. Cambridge, Mass.: MIT Press:79-100.

Blume SS (1992). Insight and Industry. On the Dynamics of Technological Change in Medicine. Cambridge Mass: The MIT Press.

Boorse C (1975). On the Distincion Between Disease and Illness. Philosophy and Public Affairs;5: 49-68.

Boorse C (1975). On the Distincion Between Disease and Illness. Philosophy and Public Affairs; 5: 49-68.

Boorse C (1976). What a Theory of Mental Health should be. Journal for the Theory of Social Behaviour; 6: 62.

Boorse C (1977). Health as a Theoretical Concept. Philosophy of Science; 44: 542-573.

Bosk CL (1995). Health and Disease - Sociological Perspectives. In Reich WT (ed.) (1995) Encyclopedia of bioethics. New York: MacMillan: 1092-7.

Boyd KM (1994). Health Care Ethics, Health and Disease. In: Gillon R, ed. Principles of health care ethics. Chichester: John Wiley & Sons: 807-18.

Boyd KM (2000). Disease, Illness, Sickness, Health, Healing and Wholeness: Exploring Some Elusive Concepts. Medical Humanities; 26(1): 9-17.

Brown WM (1985). On Defining 'Disease'. Journal of Medicine and Philosophy; 10, 4: 311-28.

Burns CR (1975). Diseases Versus Healths: Some Legacies in the Philosophies of Modern Medical Science. In: Engehlardt HT, Spicker SF. Evaluation and explanation in the biomedical sciences. Dordrecht: Reidel: 29-47.

Callahan D (1996). The Goals of Medicine: Setting New Priorities. Hastings Center Report, November-December 1996.

Callahan D, Parens E (1995). The Ends of Medicine: Shaping New Goals. *Bulletin of the New York Academy of Medicine.* 72, no. 1, (1995): 95 (23 pages).

Campbell EJ, Scadding JG, Roberts RS (1979). The Concept of Disease. Brit Med J ;2: 757-62.

Canguilhem G (1943). Le normal et le pathologique. Paris: Presses Universitaires de France. English translation: Canguilhem G (1991). The Normal and the Pathological. New York: Zone Books.

Canguilhem G (1992). Machine and Organism. In: Crary J, Kwinter S. Incorporations. New York : Urzone.

Caplan AL (1989). The Concepts of Health and Disease. In: Veatch RM. Medical Ethics. Boston: Jones and Bartlett Publishers: 51-63.

Caplan AL, Engelhardt HT, McCartney JJ (1981)(eds.) Concepts of Health and Disease: Interdisciplinary Perspectives. Reading, Mass.: Addison-Wesley.

Cassell EJ (1984). The Healer's Art. Cambridge, Ma: The MIT Press.

Cassell EJ (1991). The Nature of Suffering and the Goals of Medicine. Oxford: Oxford University Press.

Cassell EJ (1993): The Sourcer's Broom. Medicine's Rampant Technology. Hastings Center Report, 23; (6): 32-39.

Clouser KD, Culver CM, Gert B (1997). Malady. In: Almeder RF, Humber JM (eds). What is a disease? Totowa, NJ: Humana Press: 173-217.

Cohen H (1961). The Evolution of the Concept of Disease. In Lush B (ed). Concepts of Medicine: a Collection of Essays on Aspects of Medicine. Oxford: Pergamon Press.

Cooper MW (1996). The Gastroenterologist and his Endoscope: The Embodiment of Technology and the Necessity for a Medical Ethics. Theoretical Medicine; 17: 379-98.

Copeland DD (1977). Concepts of Disease and Diagnosis. Persp Biol Med; 20: 528-38.

Cragg AW (1976) Functional Words, Facts and Values. Canadian Journal of Philosophy; 6: 77-94.

DAmico R (1995). Is Disease a Natural Kind? Journal of Medicine and Philosophy; 20: 551-69.

Davidson SN (1995). Technological Cancer: Its Causes and Treatment. Healtcare Forum J; 38(2): 52-58.

Delkeskamp-Hayes C, Cutter MAG (1993) Science, Technology, and the Art of Medicine:

European-American Dialogues. Dordrecht: Kluwer Academic.

Diepgen P, Gruber GB Schadelwalt H (1969). Der Krankheitsbegriff, seine Geschichte und Problematik. In Büchner F. Handbuch der Allgemeinen Pathologie. Berlin: Springer Verlag; vol. I: 1-50.

Downie RS (1998). Medical Technology and Medical Futility. Ends and Means 2(2): 15-18.

Dreyfus HL (1997). Heidegger on Gaining a Free Realtion to Technology. In: In K. Schrader-Frechette and L. Westra, *Technology and Values*. New York: Rowman & Littlefield Publishers, pp.107-14.

Dworkin G (1970). Determinism, Free Will, and Moral Responsibility. Englewood Cliffs, N.J.: Prentice-Hall.

Ellul J (1964). The Technological Society. New York: Alfred A. Knopf.

Elster J (1983). Explaining Technical Change: a Case Study in the Philosophy of Science. Cambridge: University of Cambridge Press.

Elster J (1989). Nuts and Bolts for the Social Sciences. Cambridge: University of Cambridge Press.

Emson HE (1987). Health, Disease and Illness - Matters for Definition. Canadian Medical Association Journal; 136: 811-13.

Engel GL (1960). A Unified Concept of Helath and Disease. Perspectives in Biology and Medicine; 3(4): 459-485.

Engelhardt HT (1974). Explanatory Models in Medicine: Facts, Theories, and Values. Texas Reports on Biology and Medicine; 32: 225-239.

Engelhardt HT (1975). The Concepts of Health and Disease. in Engehlardt HT, Spicker SF. Evaluation and Explanation in the Biomedical Sciences. Dordrecht: Reidel: 125-41.

Engelhardt HT, Spicker SF (1975). Evaluation and Explanation in the Biomedical Sciences. Dortrecht: Reidel.

Engelhardt HT, Wildes KW (1995). Health and Disease - Philosophical Perspectives. In Reich WT (ed.) Encyclopedia of Bioethics. New York: MacMillan; vol.2: 1101-6.

Fabrega H (1972). Concepts of Disease: Logical Features and Social Implications. Perspectives in Biology and Medicine. 22: 583-616.

Fabrega H (1979). Scientific Usefulness of Illness. Perspectives in Biology and Medicine. 22: 545-58.

Feenberg A (1991). Critical Theory of Technology. New York: Oxford University Press.

Feinstein AR (1967). The Human Regulation of Technology. In: Clinical Judgment. Baltimore: The Williams and Wilkins Company: 353-80.

Flew A (1973). Crime or Disease? New York: Barnes and Noble.

Foucault M (1991). Birth of the Clinic. London: Routledge.

Fugelli P, Ingstad B (2001). Helse – slik folk ser det. [A lay perspective on health]. Tidsskr Nor Lægeforen; 121: 3600-4.

Gadamer HG (1987). Gesammelte Werke. Tübringen: Mhor, Vol.4.

Gadamer HG (1993). Über die Verborgenheit der Gesundheit. Frankfurt aM: Suhrkamp.

Gillett G (1995). Virtue and Truth in Clinical Science. J Med Philos, 20(3): 285-98.

Glover J (1999). Humanity: a Moral History of the Twentieth Century. London : Jonathan Cape.

Goethe (1948). Gedenkensauskabe der Werke, Briefe und Geschpräche. Zürich: E.Beutler, 1948.

Goosens WKI (1980). Values, Health and Medicine. Philosophy of Science; 47: 100-15.

Gorovitz S, MacIntyre A (1976). Toward a Theory of Medical Fallibility. The Journal of Medicine and Philosophy. 1: 51-71.

Greaves D (1998). What are Heart Attacks? Rethinking some Aspects of Medical Knowledge. Med Health Care Philosophy; 1: 133-41.

Grimen H (1999). Causally Inefficient Knowledge and Functional Explanation. Social Sience Information; 33(1): 117-27.

Grmek MD (1989). Diseases in the Ancient Greek World. Baltimore: Johns Hopkins University Press.

Habermas J (1968). Technik und Wissenshaft als “Ideologie”. Frankfut am Main: Suhrkamp.

Hanson MJ, Callahan D (1999). The Goals of Medicine: The Forgotten Issues in Health Care Reform. Washington: Georgetown University Press.

Heidegger M (1954). Die Frage nach der Technik. In Heidegger M. Vorträge und Aufsätze. Pfullingen: Günther Neske. Translated by William Lovitt under the title “The question Concerning Technology” In The Question Concerning technology and Other Essays. San Francisco: Harper & Row, 1977.

Heidegger M (1962). Die Technik und die Kehre. Stuttgart: Verlag Günther Neske.

Hellerstein D (1983). Overdosing on Medical Technology. Technol Rev; 86(6): 12-7.

Helman, CG (1990). Culture, Health and Illness. London: Wright.

Hesslow G (1993). Do we Need a Concept of Disease. Theoretical Medicine; 14: 1-14.

Hiddinga A, Blume SS (1992). Technology, Science, and Obstetric Practice: The Origins and Transformation of Cephalopelvimetry. Science, Technology &Human Values; 17: 154-79.

Hofmann B (1993). Klinikkens fødsel - i et idéhistorisk perspektiv. [The Birth of the Clinic]. Tidsskr Nor Lægeforen; 113: 3575-7.

Hofmann B (1994). Klinikkens fødsel. Tidsskr Nor Lægeforen; 114; 202.

Hofmann B (1995). Normalitet og patologi. [The Normal and the Pathological]. Tidsskr Nor Lægeforen; 115: 3800-2.

Hofmann B (1997a). Helhetlig helse og spesifikk sykdom. [Holistic Health and Differentiated Disease]. Tidsskr Nor Lægeforen; 117: 2478-80.

Hofmann B (1997b). Medisinsk utstyr - feil, årsaker og risiko. [Failure of Medical Equipment and Risks Involved in its Use]. Tidsskr Nor Lægeforen; 117: 3510-3.

Hofmann B (1998a). Den teknologiske sykdom. Prosa; 3: 12-19.

Hofmann B (1998b). Medisinsk utstyr - gammelt, dårlig og farlig? [Medical Equipment in Health Care - Risk Versus Age]. Tidsskr Nor Lægeforen; 118: 2646-8.

Hofmann B (1998c). Sorte bokser og hvite elefanter. Tidsskrift for Helse Medisin Teknikk; 4: 30-32.

Hofmann B (1999). Helse, sykdom og kampen om 'det gode liv'. Nytt Norsk Tidsskrift; 1: 74-80.

Hofmann B (2000a). Dyd av digital nødvendighet – om bildehåndteringssystemer i radiologi.

Tidsskriftet Helsetjenesten Medisinsk Teknikk; 1: 18-22.

Hofmann B (2000b). Innføring av ny teknologi i helsevesenet. Tidsskriftet Helsetjenesten Medisinsk Teknikk; 3: 32-6.

Hofmann B (2000c). Nyttig ny teknologi. Tidsskriftet Helsetjenesten Medisinsk Teknikk; 4: 20-3.

Hofmann B (2000d). Teknologisk medisin i et nytt millennium. [Technological Medicine in a new Millennium]. Tidsskr Nor Lægeforen; 120: 94-8.

Hofmann B (2001a). Legen som kropstekniker. [The Physician as a Technician]. Tidsskr Nor Lægeforen; 121: 1266-9.

Hofmann B (2001b). Medisinens vekst og fall – en kritikk av kritikken. Bibliotek for læger; 193(2): 147-65.

Hofmann B (2001c). Teknologitilpasning – en dekonstruksjon av en ”konstruktiv teknologivurdering”. Tidsskriftet Helsetjenesten Medisinsk Teknikk; 1: 30-37.

Hofmann B (2001d). The Paradox of Health Care. Health Care Analysis; 8: 17-29.

Hofmann B (2002). The Myth of Technology in Health Care. Sience and Engineering Ethics; 8: 17-29.

Hofmann B. Is There a Technological Imperative in Health Care? International Journal of Technology Assessment in Health Care. In press.

Hofmann B. Respect for Patients' Dignity in Primary Health Care - a Critical Appraisal. Scandinavian Journal of Primary Health Care. In press.

Hood WF (1983). The Aristotelian versus the Heideggerian Approach to the Problem of Technology. In: Mitcham C, Mackay R (eds). Philosophy and Technology: Readings in the Philosophical Problem of Technology. New York: The Free Press: 355-60.

Hudson RP (1983). Disease and Its Control. London: Greenwood Press.

Illich I (1973). Tools for Conviviality. London: Calder/Boyars.

International Statistical Classification of Diseases and Related Health Problems, IDC-10 (1992-4). Geneva: World Helath Organization.

Jakobsen TG (1998). Realism, Relativism and Functional Realism: an Interpretation of Biological Kinds as Functional Kinds. Thesis. Tromsø: University of Tromsø.

Jennett B (1984). Inappropriate Use of Intensive Care. British Medical Journal; 289: 1709-11.

Jensen UJ (1983). Sygdomsbegreber i praksis: det kliniske arbejdes filosofi og videnskabsteori. København: Munksgaard.

Jonas H (1985). Technik, Medizin und Ethik. Frankfurt a.M: Insel Verlag.

Jonsen AR (1988). What Does Life Support Support? In: Winslade W (ed.). Personal Choices and Public Commitments: Perspectives on the Humanities. Galveston, TX: Insitute for the Medical Humanities.

Jonsen AR (1990). The New Medicine and the Old Ethics. Cambridge MA: Harward University Press.

Kant I (1798). Anthropolgie. In Handschriftliger Nachlass. Werke. Akademie Ausgabe, 15: 964.

Kendell RE (1975). The Nature of Disease and Diagnosis. In: The Role of Diagnosis in Psychiatry. Oxford : Blackwell Scientific Publications: 2-26.

Khushf G (1995). Expanding the Horizon of Reflection on Health and Disease. Journal of

Medicine and Philosophy; 20: 461-473.

King L (1954). What is a Disease? Philosophy of Science; 21: 193-203.

Kleinman A (1988). The Illness Narratives: Suffering, Healing, and the Human Condition. New York: Basic Books.

Koenig BA (1988). The Technological Imperative in Medical Practice: the Social Creation of a "Routine" Treatment. In Lock M, Godon DR (eds.). Biomedicine Examined. Dordrecht: Kluwer Academic Publishers: 465-96.

LaCombe MA (1995). Art and the Science of Medicine. Am J Med, 99(4): 427-31.

Le Fanu J (1999). The Rise and Fall of Modern Medicine. London: Little Brown.

Leder D (1995). Health and Disease - The Experience of Health and Illness. In Reich WT (ed.) (1995) Encyclopedia of Bioethics. New York: MacMillan: 1106-13.

Lenihan J (1984). Descartes versus Hippocrates - a Conflict Resolved? The British Journal of Radiology; 57: 861-865.

Lipowski ZJ (1979). Physical Illness, the Individual and the Coping Process. Psychiatry in Medicine; 1(2): 91-102.

Lupton D. (1994), Medicine as Culture: Illness, Disease and the Body in Western Societies. London: Sage.

MacIntyre A (1984). After Virtue: a Study in Moral Theory. Notre Dame: University of Notre Dame Press.

Mackie JL (1974). The Cement of the Universe. A Study of Causation. London: Oxford University Press.

Margolis J (1976). The Concept of Disease. Journal of Medicine and Philosophy; 1: 238-55.

McDermott W, Rogers D (1983). Technology's Consort. American Journal of Medicine 74: 353-8.

Mitcham C (1994). Thinking through Technology. The Path between Engineering and Philosophy. Chicago: The University of Chicago Press.

Mitcham C (1995). Philosophy of Technology. In Reich WT (ed.) (1995) Encyclopedia of Bioethics. New York: MacMillan: 2477-84.

Morris DB (2000). How to Speak Postmodern: Medicine, Illness, and Cultural Change. Hastings Center Report 30; 6: 7-16.

Moss RW (1991). The Cancer Industry: The Classic Exposé on the Cancer Establishment. New York: Paragon House.

Mumford L (1934). Technics and Civilization. New York: Harcourt Brace.

Mumford L (1967). Technics and Human Development. Vol.1 of The Myth of the Machine. New York: Harcourt Brace Jovanovich.

Mumford L (1970). The Pentagon of Power. Vol 2 of The Myth of the Machine. New York: Harcourt Brace Jovanovich.

Nordenfelt L (1986). Health and Disease: two Philosophical Perspectives. J Epidemiol Community Health, 40(4):281-4.

Nordenfelt L (1987). On the Nature of Health. Dordrecht: Kluwer Academic Publishers.

Nordenfelt L (1988). [Health Care with its Various Ethical Dimensions Demands Training of the Intellect, Feelings and Attitudes]. Lakartidningen, 85(40):3277-8.

Nordenfelt L (1989). [The Concept of Functional Disabilities is not Independent of Evaluation]. Läkartidningen, 86(28-29):2516-7.

Nordenfelt L (1993a). On the Relevance and Importance of the Notion of Disease. Theoretical Medicine; 14; 15-26.

Nordenfelt L (1993b). On the Disease, Illness and Sickness Distinction: A Commentary on Andrew Twadle's System of Concepts. In Twaddle A, Nordenfelt L. Disease, Illness and Sickness: Three Central Concepts in the Theory of Health. Linköping: Studies on Health and Society, 18: 19-36.

Nordenfelt L (1993c). Concepts of Health and their Consequences for Health Care. Theor Med, 14(4): 277-85.

Nordenfelt L (1993d). On the Relation Between Biological and Social Theories of Health: a Commentary on Fulford's Praxis Makes Perfect. Theor Med, 14(4):321-4.

Nordenfelt L (1996). The Goals and Limits of Medicine. Stockholm: Almqvist & Wiksell.

Nordenfelt L (1997). The Importance of a Disability/Handicap Distinction. J Med Philos, 22(6):607-22.

Nordenfelt L, Larsen Ø (1986). Hälsa, sjukdom, dödsorsak: studier i begreppens teori och historia. Malmö: Liber.

Nordenfelt L, Lindahl BIB (eds.) (1984). Health, Disease and Causal Explanations in Medicine. Boston: Reidel.

Nordin I (2001). Expert and non-Expert Knowledge in Medical Practice. Medicine, Health Care and Philosophy; 3, 297-304.

Nussbaum M (1994). The Therapy of Desire: Theory and Practice in Hellenistic Ethics. Princeton, N.J.: Princeton University Press.

Nørreklit L (1973). Concepts: Their Nature and Significance for Metaphysics and Epistemology. Odense: Odense University Press.

Oesterlen F (1852). Medizinische Logik. Tübingen: Verlag der H.Lauppæschen Buchandlung. English translation by G. Whitely 1855/1958. London: Printed for the Sydenham Society.

Parsons T (1958). Definitions of Health and Ilness in the Light of American Values and Social Structure. In Jaco EG (ed.). Patients, physicians and illness: sourcebook in behavioral science and medicine. New York: Free Press: 107-27.

Pasveer B (1989). Knowledge of Shadows: the Introduction of X-ray Images in Medicine. Sociology of Health & Illness; 11: 360-81.

Paul N (1998). Incurable Suffering from the "Hiatus theoreticus"? Some Epistemological Problems in Modern Medicine and the Clinical Relevance of Philosophy of Medicine. Theoretical Medicine and Bioethics; 19: 229-48.

Payer L (1992). Disease-Mongers. How Doctors, Drug Companies, and Insurers Are Making You Feel Sick. New York: John Wiley & Sons.

Pedersen T, Dyrlund Pedersen B, Moller AM (2001). Puls Oxymetry for Perioperative Monitoring. (Cochrane Review). In: The Cochrane Library; Issue 3. Oxford: Update Software.

Pellegrino ED (1979a). Toward a Reconstruction of Medical Morality: the Primacy of the Act of Profession and the Fact of Illness. Journal of Medicine and Philosophy; 4: 32-56.

Pellegrino ED (1979b). Medicine, Science, Art: an Old Controversy Revisited. Man Med, 4(1): 43-52.

Pellegrino ED, Thomasma DC (1981). A Philosophical Basis of Medical Practice. New York and Oxford: Oxford University Press.

Pellegrino ED, Thomasma DC (1993). The Virtues in Medical Practice. Oxford: Osford University Press.

Porter R (1997). The Greatest Benefit to Mankind. A Medical History of Humanity from Antiquity to the Present. London: Harper Collins Publishers.

Press.

Rather LJ (1958). Zur Philosophie der Begriffs "Krankheit". Deutsche Medizinische Wochenschrift; 83: 2012-8.

Redlich FC (1976). Editorial Reflections on the Concepts of Health and Disease. J Med Philosophy; 1: 269-80.

Reise W (1953). The Conception of Disease: Its History, Its Versions and Its Nature. New York: Philosophical Library.

Reiser SJ (1977). Therapeutic Choice and Moral Doubt in a Technological Age. In: Knowles JH (ed.). Doing Better and Feeling Worse. New York: Norton & Co: 47-56.

Reiser SJ (1978). Medicine and the Reign of Technology. New York: Cambridge University Press.

Reznek L. The Nature of Disease. New York: Routledge & Keagen Paul, 1987.

Ridderikhoff J (1994). The Artificial and Elusive Demarcation Between Health and Disease. Health Care Analysis; 2: 339-342.

Riese W (1953). The Conception of Disease, its History, its Versions, and its Nature. New York: Philosophical Library.

Romanyshyn RD (1989). Technology as Symptom and Dream. London: Routledge.

Rosenberg CE (1982). The History of Disease: Now and in the Future. Henry E Sigerist Suppl Bull Hist Med;(6):32-6.

Rosenberg CE (1992). Framing Disease: Illness, Society, and History. In: Rosenberg CE, Golden J (eds.). Framing Disease: Studies in Cultural History. New Brunswick NJ: Rutgers University Press: xiii-xxvi.

Ross A (1979). Sygdomsbegrepet. Bibliotek for læger; 171: 111-29.

Rothman DJ. Beginnings Count: the Technological Imperative in American Health Care. New York : Oxford University Press, 1997.

Rothschuh K (1972). Der Krankheitsbegriff. (Was ist Krankheit?). Hippokrates; 43: 3-17.

Ryle G (1949). The Concept of Mind. London: Hutchinson.

Räikkä J (1996). The Social Concept of Disease. Theoretical Medicine 17(4): 353-61

Sade RM (1995). A Theory of Health and Disease: The Objectivist-Subjectivist Dichotomy. Journal of Medicine and Philosophy 20: 513-25.

Sadegh-Zadeh K (1977). Krankheitsbegriffe und nosologische Systeme. Metamed; 1: 4-41.

Scadding JG (1967). Diagnosis: The Clinician and the Computer. Lancet; 2: 877-82.

Schaffner KF (1993). Functional Analysis and Teleological Explanations. In: Discovery and Explanation in Biology and Medicine. Chicago: University of Chicago Press: 362-410.

Schrader-Frechette K, Westra L, (Eds) (1997). Technology and Values. Oxford: Rowman &

Littlefield.

Sedgwick P (1973). Illness – Mental and Otherwise. The Hastings Studies Center Studies I; 3: 19-40. Insitute of Society Ethics and Life Sciences, Hastings-on-Hudson, New York.

Smith MR, Marx L (1994). Does Technology Drive History?: the Dilemma of Technological Determinism. Cambridge, Mass.: MIT Press.

Solbakk JH (1992). Medizin als Idealexemplar einer allgemeinen Wissenschaftstheorie: Ein historisches Beispiel. In: Deppert W, Kliemt H, Lohff B, Schaefer (eds.). Wissenschaftstheorien in der Medizin. Berlin: Walter de Gruyter: 115-35.

Solbakk JH (1993) Forms and Functions of Medical Knowledge in Plato: Interpretations and Research-historiography. Thesis. Oslo: University of Oslo.

Solbakk JH (1995). Medisin som møtested og markedsplass. Oslo: Forum.

Sontag S. Illness as Metaphor. New York: Farrar, Strays and Giroux, 1978.

Stempsey WE (1999). Disease and Diagnosis: Value-dependant Realism. Dordrecht: Kluwer.

Sundström P (1987). Icons of Disease: a Philosophical Inquiry into the Semantics, Phenomenology and Ontology of the Clinical Conceptions of Disease. Linköping: Linköping University. 1987.

Sørensen AC, Dalgård C (1999). Sundhed mellem biologi og kultur: en bog om nye sundhedsbegreber. København: Gyldendal Uddannelse.

Tatum, JS (1997). The Political Construction of Technology: a Call for Constructive Technology Assessment. In K. Schrader-Frechette and L. Westra, *Technology and values*. New York: Rowman & Littlefield Publishers, pp.

Taylor FK (1979). The Concepts of Illness, Disease and Morbus. Cambridge: Cambridge University Press.

Tegern G (1994). Frisk och sjuk: Vardagliga förestellningar om hälsan och dess motsatser. Dissertation. Linköping: The institute of Tema Research, Department of Health and Society.

Temkin O (1977). The Scientific Approach to Disease: Specific Entity and Individual Sickness. In: The Double Face of Janus. Baltimore: Johns Hopkins University Press: 441-55.

Thomas L (1977). On the Science and Technology of Medicine. In Knowles JH (ed.) Doing Better and Feeling Worse: Health in the United states. New York: W.W. Norton: 35-46.

Toombs SK (1990). The Temporality of Illness: Four Levels of Experience. Theor Med; 11(3): 227-41.

Toon PD (1981). Defining "Disease" - Classification must be Distingueshed from Evaluation. J Med Ethics; 7: 197-201.

Toulmin S (1982). How Medicine Saved the Life of Ethics. Perspectives in Biology and Medicine 1982; 25: 741.

Tranøy KE (1972). ‘Ought’ Implies ‘Can’: A Bridge from Fact to Norm? Part I. Ratio; 14: 116-30.

Tranøy KE (1975). ‘Ought’ Implies ‘Can’: A Bridge from Fact to Norm? Part II. Ratio; 17: 147-75.

Tranøy KE (1994). Should Responsibility for Health Promotion be the Responsibility of the Health Service? In Lis PE, Nikku N. Health Promotion and Prevention. FRN Report; 4: 100-4.

Tranøy KE (1995a). Om helsebegreper og helsetjeneste: en meditasjon. I Klockars K, Österman B. Begrepp om hälsa: filosofiska och etiska perspektiv på livskvalitet, hälsa och vård.

Stockholm: Liber Utbildning: 127-139.

Tranøy KE (1995b). Grunnleggende etiske prinsipper i helsetjenesten. I Liss P-E, Petersson B. Helsosamma tankar. Nora: Nya Doxa: 145-54.

Tranøy, KE. (1967) Asymmetries in Ethics. Inquiry; 10: 351-372.

Troels-Lund T (1900). Sundhedsbegreber i Norden i det 16 aarhundrede. København: Schubotheske forlag.

Tymstra T (1989). The Imperative Character of Medical Technology and the Meaning of "Anticipated Decision Regret". Int J of Technology Assessment in Health Care; 5: 207-13.

Veatch RM (1976). Value-Freedom in Science and Technology: a Study of the Importance of the Religious, Ethical, and other Socio-Cultural Factors in Selected Medical Decisions Regarding Birth Control. (Harvard dissertations in religion; no. 8). Missoula, Mont.: Published by Scholars Press for Harvard theological review.

Virchow RLK (1958). Disease, Life, and Man: Selected Essays. Translated by Rather LJ. Stanford Ca: Stanford University Press.

von Engelhardt D (1995). Health and Disease - History of the Concepts. In Reich WT (ed.) Encyclopedia of Bioethics. New York: MacMillan; vol.2: 1085-92.

Vos R (1991). Drugs Looking for Diseases: Innovative Drug Research and the Development of the Beta Blockers and Calcium Antagonists. Dortrecht: Kluwer Academic Pbulishers.

Wartofsky MW (1975). Organs, Organisms, and Disease: Human Ontology and Medical Practice. In Engelhardt HT, Spicker SF. Evaluation and Explanation in the Biomedical Sciences. Dordrecht: Reidel: 67-83.

WielandW (1993). The Concept of the Art of Medicine. In: Delkeskamp-Hayes C, Cutter MAG. Science, Technology, and the Art of Medicine: European-American Dialogues. Dordrecht: Kluwer Academic: 165-81.

Winner L (1977). Autonomous Technology. Cambridge Ma: MIT Press.

Wolf S, Berle BB (eds.) (1981). The Technological Imperative in Medicine. London and New York: Plenum Press.

Wright GHv (1971). Explanation and Understanding. Ithaca, N.Y.: Cornell University Press.

Wright GHv (1993). Myten om framsteget : tankar 1987-1992 : med en intellektuell självbiografi. Stockholm: Bonnier.

Wright L (1973). Functions. Philosophical Review; 82: 139-68.

Wright L (1976). Teleological Explanations. Berkley: University of California Press.

Wulff HR (1994). The Disease Concept and the Medical View of Man. In: Querido A, Mandema E (ed.). The Discipline of Medicine. Amsterdam: Elsevier Science, 1994: 11-19.

Wulff HR (2000). The Concept of Disease: from Newton back to Aristotle. Lancet 2000; 354: SIV50.

Wulff HR, Gøtzche PC (1976, 1981). Rational Diagnosis and Treatment: An Introduction to Clinical Decision-Making. Oxford: Blackwell Scientific Publications.

Wulff HR, Pedersen SA, Rosenberg R (1986). Philosophy of Medicine. An Introduction. Oxford: Blackwell Scientific.

Young A (1982). The Anthropologies of Illness and Sickness. Ann. Rev. Anthropology; 11: 257-85.

Young A (1995). Health and Disease - Anthropological Perspectives. In Reich WT (ed.) (1995)

Encyclopedia of Bioethics. New York: MacMillan: 1097-1101.
Zajicek G (1995). Normative Medicine. Medical Hypotheses; 45: 331-334.

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Hofmann B. Technological Medicine and the Autonomy of Man. European Journal of Medicine, Health Care and Philosophy2002; 5: 157-67.

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Hofmann B. Medicine as Téchne - a Perspective from Antiquity. Journal of Medicine and Philosophy. In press.

Papers

Paper 1

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BJØRN HOFMANN

COMPLEXITY OF THE CONCEPT OF DISEASE AS SHOWN THROUGH RIVAL THEORETICAL FRAMEWORKS

ABSTRACT. The concept of disease has been the subject of a vast, vivid and versatile debate. Categories such as "realist", "nominalist", "ontologist", "physiologist", "normativist" and "descriptivist" have been applied to classify disease concepts. These categories refer to underlying theoretical frameworks of the debate. The objective of this review is to analyse these frameworks. It is argued that the categories applied in the debate refer to profound philosophical issues, and that the complexity of the debate reflects the complexity of the concept itself: disease is a complex concept, and does not easily lend itself to definition.

INTRODUCTION

In a review of the debate on the concept of disease it may seem reasonable first to ask: Why does a concept of disease matter? Why do scholars find it urgent to give a strict, consistent and coherent definition of *disease*? The common answer to these questions is that *disease* is a central notion to modern health care, it effects society and is important to the process of discovering and identifying disease entities [1]. We need a concept of disease in order to decide who is entitled to treatment and to economic rights, who is to be exempted from social duties and who is morally accountable, and to decide what is the subject matter of medical science [2]. Furthermore, a strictly, consistently and coherently defined concept of disease could help the health care system face its basic economical, social, epistemological and ethical challenges, and could clarify the goal and limit of medicine.

In order to meet these requirements extensive attempts to define the concept of disease have been made, and the literature has become extensive. The disease concept has been categorised in a variety of ways, and some examples of such categories are given in Table I.

The table illustrates the comprehensiveness and the complexity of the literature. Categories like "naturalist", "nominalist", "ontologist" etc. point to the underlying theoretical frameworks of the debate. The objective of this article is to analyse the literature on the concept of disease on the background of these frameworks. It will be argued that the categories

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TABLE I

Concepts applied to categorise the concepts of disease

Categories		Reference
Realist	Nominalist	King [3]; Rather [4]; Cohen [5]; Scadding [6]; Rothshuh [7]; Kennedy [8]; Gillon [9]; Nordenfelt [10]; Sundström [11]; Albert, Munson & Resnik [1]; Stempsey [12]
Realist	Anti-realist	Engelhardt [13]
Realist	Constructivist	Stempsey [12]
Essentialist	Nominalist	Campbell et al. [14]; Jensen [15, 16]
Universalist	Particularist	Sundström [11]
Deduktiv	Empiristisch	Jaspers [17]
Ideal concept of disease	Practical concept of disease	Jensen [15, 16]; Nordenfelt [10]
Natural kind semantics Real essence	Descriptive semantics Nominal essence	Reznek [18]
Analytic	Holistic	Nordenfelt [10]
Positivist	Holistic	Sundström [11]
Reductionist	Relativist	Sade [19]
Reductionist	Subjectivist	Gillon [9]
Reductionist	Life-world conceptions	Sundström [11]
Naturalist	Normativist	Reznek [18]; Räikkä [20]; Kovács [21]; van der Steen [22]
Non-normativsm	Normativism	Boorse [23]; Caplan [24]; Bechtel [25]

TABLE I

Continued

Categories			Reference
Neutralist	Normativist		Goosens [26]
Objectivist	Normativist		Brown [27]
Objectivist (Normative)	Subjectivist (Normative)		Lennox [28]; Sade [19]; Kovács [21]
Objectivism (setting goals: biol. needs)	Subjectivism (setting goals)		Edwards [29]
Biological	Social		Fulford [30]
Scientific, value free	Evaluative		Gillon [9]
Descriptive	Evaluative		Engelhardt [31]; Fulford [32]; Fedoryka [33]
Descriptive	Normative		von Engelhardt [34]; Fedoryka [33]
Value free	Value-laden		Margolis [35]; Boorse [36], Turner [37]; Räikkä [20]; Fulford [30]
Value free	Value-loaded		Sedgwick [38]
Descriptivist	Non-descriptivist		Fulford [32]
Descriptivist	Value-realist	Normativist	Fedoryka [33]; Stempsey [12]
Descriptive	Explanatory/predictive		Hempel [39]
Medical disease	Social disease		Räikkä [20]; Nordenfelt [40]
Ontological Entity concept Platonic Cnidian	Biographical/historical Deviation from the normal Hippocratic (founders) Coan (temples)		Cohen [5]

TABLE I

Continued

Categories		Reference
Rationalist Naturalist	Empirical (phil.) Conventional (phil.)	
Ontological	Attributive (nominalist)	Taylor [41]
Ontological	Modern (aetiological/taxonomic)	Taylor [42]
Ontological	Physiological, biographical,	Virchow [43]; Rather [4]; Temkin [44], Rothshuh [7]; Hudson [41]; Bechtel [25]; Juengst [42]; Fagot-Largeault [45]; Engelhardt and Wildes [48]; Canguilhem [49]; Stempsey [12]
Ontological	Holistic	Aronowitz [50]
Ontologist	Etiologist	Copeland [51]
Ontologist	Physiologist, functionalist	Nordenfelt [10]; Sundström [11]
Ontologist	Ecologist	Callahan and Parens [52]
Structuralists	Functionalists	Callahan and Parens [52]
Essentialistic/static	Dynamic	Jensen [15]
Positivist view	Entity view	Jensen and Jensen [53]
Denotative (term)	Attributive (term)	Frabrega [54]
Casualism	Conditionalism	von Engelhardt [34]
Causal	Operational	Juengst [46]
Humoralpathologie	Solidarpathologie	Rothschuh [55]
Spatial	Temporal	Toombs [56]
Taxonomic realism	Taxonomic scepticism	Reznek [18]

TABLE I

Continued

Categories						Reference
Taxonomical/nosological	Anatomical	Physiological				Bernard [57]
Disease identity	Disease status					Reznek [18]
Disease theories	Disease Ascriptions					Kopleman [58]
Logical	Conventional					Birch [59]
Defining characteristics	Disease description	Diagnostic criteria				Scadding [6]
Environmental	Reduction of repro-duction and survival	Maladaptation				Fabrega [60]
Descriptive	Explanatory	Evaluative	Social			Engelhardt [31]
Xenochtonous	Autochtonous					Copeland [51]
Rel.	Biomed.	Psycho-somatic	Humanistic	Existential	Trans-personal	Tamm [61]
Clinical-pathological concept of disease	Pathological concept of disease	Treatment-based concept of disease	Research-based concept of disease			Redlich [62]
Metaphysical	Philosophical (speculative)	Naturalistic	Psychosomatic, anthropologic, sociocultural			Rothschuh [55]
Physical	Psychosmoatic	Psychological/ mental				Redlich [62]
Physiological	Psychological	Social				Engelhardt and Wildes [48]
Physiological	Morphological	Psychological				Rather [4]

TABLE I

Continued

Categories						Reference
Level of individual experience: Phenomenology of sickness	Level of social values and institutions: Sociology of the sick role	Macro-societal level: Political economy of health-care syst.				Turner [37]
Nominalism	Relativism	Idealism	Realism	Socio-cultural	Statistical	Albert, Munson and Resnik [1]
Psychogenic	Hereditery	Parasitic	Social	Climatological		Ackerknecht [63]
Medical	Sociaocultural					Albert, Munson and Resnik [1]
Objectivistic Bioilogical	Subjectivistic Humanistic					Wulff [64]
Medical	Non-medical					Engelhardt and Wildes [48]
Demonologic	Mechanistic					Engel [65]
Irritability (Reitz) *sthenic*	Reaction (Reaktion) *Asthenic*					Brown [66]; Broussais [67]; Hufeland [68]
Biological	Phenomenological	Behavioural				Fabrega [54]
Professional: Disease Biological	Personal: Illness Phenomenological	Social: Sickness Behavioural				Bentham [69]; King [3]; Parsons [70, 71]; Twaddle [72]; Rothschuh [7]; Frabrega [54, 60]; Marinker [73]; Redlich [62]; Birch [59]; Jenner [74]; Eisenberg [75]; Whitbeck [76]; Young [77]; Taylor [42]; Hudson [45]; Twaddle [78]; Nordenfelt [79]; Sedgwick [38]; Engelhardt and Wildes [48]; von Engelhardt [31]
Moral	Charismatic	Sapential				Redlich [62]

applied in the debate (Table I) refer to profound philosophical issues, and that the complexity of the debate reflects the complexity of the concept itself: *disease* is a complex concept. More precisely, the complexity of issues in the disease-debate stems from the complexity of the concept's extension.

Hence, I will not try to give a review of the comprehensive variety of definitions of disease. Rather than being a review article of definitions, it is a review of the theoretical frameworks for such definitions. Thus, the objective is to investigate what the categories presented in Table I can tell us about the concept of disease.

IS THE DEBATE CONFUSED?

Before I start to analyse some of the philosophical issues referred to by the categories of Table I, allow me to take a brief look at some of the categories.

The categories of Table I appear to be applied in quite different ways. E.g. the term "naturalism" is applied to denote both semantical realism [4], the "descriptivist" position in meta-ethics [30] and the stance claiming that disease can be described in the language of natural science. Similarly, the term "objectivist" is applied to describe the "descriptivist" position (in metaethics) as well as being applied to denote that the normative aspect of the concept of disease is "objective" or intersubjective.[1]

Furthermore, the "ontologist" position appears to refer to quite different issues. E.g. Engelhardt differentiates between weak and strong versions of ontological concepts of disease [13]. The strong version corresponds to the issue of whether a disease is a thing. The weak version concerns the "ontological" status of the "disease type" according to which disease is a "logical entity" [13, pp. 129–30]. Here Engelhardt appears to be concerned with the "ontological" status of the concept, which is a semantical issue. Hence Engelhardt equals the positions of the "ontologist" with that of the "conceptual realist" [48, p. 1102].

A prevalent category to be recognised in the disease debate is "nominalism". The term appears to have a variety of connotations. In the debate "nominalism" refers to the position denying that instances have anything in common other than being called "disease". It is applied to maintain that instances of disease have a common property that is socially defined. "Nominalism" is also summarised by the statement: "A disease is whatever physicians *say* is a disease" [1, p. 153]. Additionally, "nominalism" has been applied to emphasise that disease is value-laden and is contrasted to

"descriptivism". Hence, "nominalism" is a category applied for a variety of purposes and positions.

A wide range of the categories refers to the question of whether the concept of disease is normative or evaluative. It appears to be quite unclear, however, what "norms" and "values" mean. It is not explicit what kind of norms or values are the issue. Esthetical, economic, methodological and moral norms and values seem relevant to the concept of disease.[2] So do classificatory norms.[3]

Furthermore, the various disease concepts do not always have the same extension. Sometimes the concept refers to theories of disease, while in other instances the ascription of disease is the issue, and sometimes they are intermingled [20]. Correspondingly, a wide variety of terms is applied in the debate, e.g. such as "concept of disease", "disease concepts", "disease entities", "disease identity", "disease status", "disease condition", "disease category", "disease event", "disease process". The relationship between them is not always clear, which seems to complicate the discussion.

Where then does this leave us? Does it mean that the categories are inconsistent and incoherent? Do the many categories that are applied to discuss the concept of disease only result from conceptual or philosophical confusion? So far we can only say that the debate is complex. It applies a variety of categories (Table I) that are not exclusive and exhaustive. However, as will be argued in the following, the categories refer to basic philosophical issues.

One such basic issue where there is reasonable agreement among scholars is expressed in the crucial question: does the concept of disease exist? Most commentators appear to believe it does. This does not, however, mean that they are conceptual realists. The modern discussion on the existence of the concept of disease is not concerned with the (ontological) status of universals, as were the medieval scholars. The issue of the concept's existence appears to be semantic: do instances of disease have anything in common other than being called "disease"? Although most scholars would agree that "disease" is a general term in our language, there is a disagreement about what makes it a general term.

DO INSTANCES OF DISEASE HAVE ANYTHING IN COMMON?

Categories such as "disease ascriptions", "class membership", "class extension", "denotative" and "nominalist", have been applied to characterise positions that claim that there is nothing common to instances called

"disease" other than that they are called "disease". That is, there are no common properties that qualify for something to be named "disease".

The background for this issue is that the practical and changing character of medicine and its language frustrates the efforts to define disease [27]. Disease is given by a variety of attributes: "the involuntary occurrence of pain, suffering and illness, gross physical dysfunction, disfigurement or progressive debility, statistically abnormal structures or processes, the discovery of causal agents of such conditions, the development of techniques for changing undesirable or unwanted conditions, or the disruption of social roles" [27, p. 326]. This rises the question: Does *disease* exist, or are there only sick persons? [44].[4] This challenge has resulted in a conception where disease is nothing general, but the aggregate of all the prevailing disease entities. The concept of disease is given by its extension.[5] Frabrega calls this way of defining the term "denotative" [54, p. 584], and Kraüpl Taylor discusses it under the term "class membership" and "class extension" [41]. The position is also frequently referred to as "nominalism".[6]

Accordingly, there is no need to describe the criteria for disease or to give an abstract definition of the concept of disease [12, 15, 16, 80, 81]. Physicians will identify and treat disease entities and do not need a general concept. In fact, the attempt to define disease will fail, because disease entities do not actually have anything in common other than being called "disease".

The question of whether *disease* is given by its extension or by some property, is an issue of semantics, in particular in the logic of classes, and it touches upon the problem of reference in the philosophy of language.

WHAT MAKES SOMETHING CALLED "DISEASE"?

Many commentators claim, however, that the disease entities do have something in common which makes them termed "disease". For them it has become urgent to define what this common character might be. Categories such as "class intension" and "attributive" [6, 18, 54] have been applied to argue that instances called "disease" have something in common other than that they are called "disease". There appears to be an extensive debate on what these common properties of disease might be.

Let me for the sake of convenience divide the positions in two, according to prevailing categories applied in the debate, claiming that the concept of disease has a "real essence" or a "nominal essence".

The Real Essence of Disease

Categories like "essentialist", "objectivist", "naturalist", "realist" and "taxonomic realist" are prevalent in the debate on the concept of disease. They are widely applied to designate the position where the term "disease" is applied and classified according to common phenomena in nature. Reznek calls this position "natural kind semantics" [18], according to which diseases are grouped together on the basis of sharing a real essence. There are certain characteristics of distinct events that naturally group them together (natural kinds).

Correspondingly, in a variety of ways the category "naturalism" has been applied to denote the position where the question "is this disease?" can be answered by investigating nature. That is, what disease is can be settled by methods of natural science.

The Nominal Essence of Disease

Others, however, reject that what makes something a member of the class labelled "disease" is something natural or real. There is something common to instances called "disease", but that it is not given by nature. Categories such as "social", "subjectivist", "autonochous", "attributive" and "descriptive", together with "nominalism" have been applied to denote such positions.

The rejection of a real essence of *disease* is partly motivated by events in the history of medicine. The definitions of disease seem to have varied with the prevailing explanatory models of medicine. Medicine has studied disease in terms of disturbance of bodily homeostasis (Hippocrates, Galenus), morphological changes in the internal organs (Morgagni), tissues (Bichat) or cells (Virchow), the irritation of the organs and their reaction (Brown), the invasion of the body of an external contagion (Koch) and genetic alterations. Whereas ancient medicine defined disease as the disturbance of humoral homeostasis, medicine of the third millennium seeks to define disease in the language of microscopic or radiographic morphology, biochemistry and molecular biology. Diseases are given in terms of signs, symptoms, abnormal findings, complaints and social circumstance (ICD-10, Vol. II: 2).[7]

Claude Bernard in his *An Introduction to the Study of Experimental Medicine* states that "neither physiologists nor physicians need imagine it their task to seek the cause of life or the essence of disease. That would be entirely wasting one's time in pursuing a phantom. The words, life, death, health, disease, have no objective reality" [57, p. 67]. Correspondingly, Lester King in a frequently cited passage he claims that "Disease is the aggregate of those conditions which, judged by the prevailing culture,

are deemed painful, or disabling, and which, at the same time, deviate from either the statistical norm or from some idealized status" [3, p. 197]. Hence, diseases are invented and not discovered.[8]

What the categories above appear to have in common is that they reject that instances called "disease" are grouped together according to phenomena in nature. Conversely, they seem to claim that what the instances share is that they fit a given description. Something is classified as "disease" if it satisfies certain "classification criteria", "attributes", "expression of properties" or "defining characteristics" [10]. This has been called "descriptive semantics" [18].[9,10]

What is common to the categories and positions discussed in this section, is that they address the question 'what makes something called "disease"?' This appears to be a semantic issue, and touches upon the debate on meaning and reference in the philosophy of language. The point here is not to enter discussions on such issues, but only to emphasise that the categories applied in the debate on the concept of disease refer to basic subjects in semantics.

DOES "DISEASE" REFER TO A THING?

Related to the semantical question of whether there is something real making a condition classified as "disease", we encounter a widely discussed issue of the nature of the instances of disease. In particular, is a disease a thing?[11] Because, if it is a thing that can be observed and delimited from other related things, it could be classified according to its natural kind.

Categories such as "ontological", "Platonic", "Cnidian", "realist", "rationalist", "pro-ontological" and "naturalistic" have been applied to denote the position conceiving of a disease as a thing. According to most varieties of this position, diseases are independent self-sufficient entities running a regular course of their own and having a separate natural history [5]. They are not invented, but discovered. "... classes, or groups, or families [of diseases], cannot be created, arbitrarily, and at will, by our own skill and ingenuity. ... We must take ... individual diseases ... as they exist in nature" (Bartlett 1844 here cited from [3, p. 199]). "Disease is very old and nothing about it has changed. It is we who change as we learn to recognize what was formerly imperceptible" (Jean-Martin Charcot, 1892 – here cited from [84, p. 2271]).

Although the "ontological" view of disease might be a prevalent lay conception [14, p. 760], few contemporary commentators appear to defend it. The reason why it still is referred to and debated seems to be because it

serves as a contrast to alternative conceptions. What then, is a disease, if it is not a thing?

DISEASE AS DEVIATION?

Contrary to the "ontological" position, concepts of disease have been categorised as "physiological", "biographical", "historical", Hippocratic", "Coan", "nominalist", "empirical" and "conventional".

According to what is best known as the "physiological" position, disease is deviation from the normal homeostasis [4, 5, 7, 10]. It is a process in time, and not a stationary picture [85]. Contrary to being a thing, disease is an imbalance and an alteration. Disease conceived of as a deviation from a norm has also been termed "idealism" and "normative" [1].

The question of whether disease is a deviation from a norm can be conceived of as a relational issue. However, it can also be a semantical subject. The deviation from a norm can be understood as a descriptive criteria (nominal essence) of disease. It does not always come clear from the discussion whether the "physiologist" in question actually addresses a relational or a semantical issue. Furthermore, the category "physiological concept of disease" is frequently contrasted with the "ontological concept of disease", which addresses an ontological issue.

Moreover, the category "physiological concept of disease" is also applied to denote that disease is something that occurs in particular persons, and that is not a general matter. Disease is typical to the peculiar nature of each individual [10, 13, 44, 86]. This aspect addresses the issue of whether *disease* is only the assemblage of individual instances of disease, and not a concept with given properties.

Hence, the "ontologist/physiologist-debate" appears to be complex, addressing a wide range of philosophical issues (ontological, relational and semantical). There appear to be historical reasons why these categories are part of the same debate. In the tradition of medicine, there seems to have been a basic (ontological) discussion of whether disease was a matter of solids or of humours. The character of the debate on humours changed its focus of attention to the issue of (physiological) homeostasis and balance. However, the debate on "the physiological concept of disease" at is later was called, was still related to and contrasted with what has come to be termed the "ontological concept of disease".

IS DISEASE AN EVALUATIVE CONCEPT?

Another crucial question has been how the concept of disease is related to norms and values. Is *disease* an evaluative concept? This issue can be recognised in the dichotomy between categories such as "descriptivist", "objectivist", "reductionist", "non-normativist" and "naturalist" positions on the one hand, and "normativist", "non-descriptivist", "subjectivist" and "relativist" positions on the other hand. On the one hand it has been claimed that the concept of disease is a value-neutral concept. On the other hand it has been claimed that the concept of disease is essentially connected with human interests, what is valued and desired. It is "normative" [18, 19, 21, 27], "evaluative" [31, 32], "non-descriptivist" [32] and "value-laden" [30, 35]. This question about *the normative status of the concept of disease* leans on the general philosophical debate on norms and values.

Christopher Boorse has forcefully and skilfully claimed that the concept of disease is a theoretical and value-neutral concept [36]. It can be studied and described by science. However, the main argument against Boorse's stance is that his definition of disease is inherently normative [30].[12] His critics maintain that any definition of disease has to be normative. The concept of disease is not given by a scientific value-neutral description of phenomena in nature. It is established according to human needs, values and norms. Hence it is invented and not discovered [35, 48].[13]

> The concept of disease acts not only to describe and explain, but also to enjoin to action . . . It is a normative concept; it says what ought not to be. As such, the concept incorporates criteria of evaluation, designating certain states of affairs as desirable and others as not so. It delineates and establishes social roles such as being sick or being a physician. [13, p. 127]

Within the framework of a normative or evaluative concept of disease it becomes important to reveal *whose* values and norms are constitutive. Here a distinction has been made between "subjectivist" and "objectivist" concepts of disease [19, 21, 28, 29]. The distinction is applied to discuss whether the normative concept of disease is given by "subjective norms" or by "objective norms" – whether it is defined by the individual patient or whether it is valid for all members of a normative community.

Another distinction within the normative account of the concept of disease is between the descriptivist and non-descriptivist positions [30]. The descriptivist position acknowledges the normative and evaluative aspects of the concept of disease. It claims, however, that the normative or evaluative aspects follow from descriptive matters. Fulford tries to give

a descriptivist account of Boorse's definition of disease, but concludes in favour of the non-descriptivist position [30].

The point here is not to enter the meta-ethical debate between "descriptivism" and "non-descriptivism" or between "subjectivism" and "objectivism", but only to indicate the theoretical framework of the categories. Evaluative and normative aspects have been of great importance for the debate on the concept of disease.

WITH WHAT PERSPECTIVE DO WE CONCEIVE OF SOMETHING AS DISEASE?

Another version of the question "What is *disease*?" can be phrased: is "disease" a matter of subjective experience, of objective signs, of therapeutic or of social concern? "Disease" has been defined with respect to the suffering of the individual [80], physical lesions [87], "therapeutic concern" [41][14] or according to the ability to realise goals [10, 76, 88].

Jeremy Bentham, in his considerations on health and disease, paid attention both to the subjective and objective (localisable) aspect of human ailment [69, p. VI, 7]. Claude Bernard differentiated between the taxonomical/nosological, anatomical and physiological aspects of disease [57]. King's definition of disease above quoted addresses both the subjective aspects of pain and disability and the cultural context. Scadding's 1967 definition of disease takes into account demographic and biological as well as evaluative aspects [6].

These perspectives are also reflected in studies of the concept of disease from different points of reference: anthropological, sociological, phenomenological, historical and philosophical. These discussions emphasise the diversity and complexity of the concept of disease. So in defining this concept, it has become crucial to identify its perspective.

Additionally it has been important to delimit "disease" from other concepts of human ailment.[15] How does "disease" relate to "malady", "defects", "disability", "handicap", "deformity", "disfigurement", "infirmity", "impairment", "dysfunction", "dystrophy", "abnormality", "debility", "derangement", "malignancy", "morbidity", "suffering", "pain", "weakness", "incompetence", "illness" and "sickness", "symptom" and "syndrome"?[16]

By now, some distinctions have become commonplace both in the philosophy and the sociology of medicine, as well as in medical anthropology: the distinction between "disease", "illness" and "sickness". "Disease", "illness" and "sickness" denote the medical, the personal and the social aspects of human ailment respectively. The origin of the triad

can be traced back to Parsons and Twaddle, and has seen a variety of applications [7, 42, 48, 54, 70–73, 75, 77–79].

The perspective of the concept of disease and its delimitation from other concepts of health care are epistemological issues concerning how we recognise human ailment.

HOW CAN WE EXPLAIN DISEASE?

Related to this discussion, there has been a debate on theories and models of disease. Rothschuh has differentiated between "metaphysical", "philosophical" (speculative), "naturalistic" and "psychosomatic/anthropologic/sociocultural" models [55]. Copeland distinguishes between "xenochthonous" and "autochtonous" models. "Xenochthonous" models address external causes, whereas "autochtonous" models focus on internal causes [51]. Ackerknecht identifies several causal explanations of disease: "psychogenic", "hereditary", "parasitic", "climatological", as well as explanations of poverty and wealth [63].

Engelhardt maintains that different languages are applied in the discussion of disease [31]. He refers to "descriptive", "explanatory", "evaluative" and "social" languages. Others have referred to "religious", "biomedical", "psychosomatic", "humanistic", "existential" and "transpersonal" models of disease [61].

Models of disease have an explanatory function and reflect the different exegetic perspectives on disease. Furthermore, they are sensitive to the emergence of new methods and techniques [53, p. 107]. Besides, models are applied according to their utility; doing good is more important than finding the truth. The requirements of coherence and consistency are less crucial in the case of models than in the case of concepts. Hence, models of disease are more dynamic and pragmatic than concepts of disease.

This is not the proper place to enter the interesting debate on the issue of disease models. The point here is that this is an epistemological topic concerning how we get to know disease. The models have a pragmatic end: to be able to act and help, and both in theory and practice they influence the concept of disease. Therefore, the discussion on disease models has been relevant for and part of the debate on the concept of disease.

BASIC ISSUES OF THE DEBATE ON THE CONCEPT OF DISEASE

So far it has been argued that the debate on the concept of disease applies a variety of categories referring to profound philosophical issues. The key question "What is *disease*?" has been phrased in a number of ways reflecting these issues. In summary, these are:

1. *Do instances of disease have anything in common?* Terms such as "disease ascriptions", "class membership", "class extension", "denotative" and "nominalist" reflect basic issues in semantics.
2. *What makes something called "disease"?* Categories such as "class intension", "attributive", "essentialist", "objectivist", "naturalist", "realist", "taxonomic realist", "social", "subjectivist", "autonochous", "descriptive" as well as "nominalist" are applied to discuss this semantical issue.
3. *Does "disease" refer to a thing?* Categories such as "ontological", "Platonic", "Cnidian", "realist", "rationalist", "pro-ontological" and "naturalistic" have addressed this ontological question.
4. *Is disease a deviation from normal?* Contrary to the "ontological" position, concepts of disease have been categorised as "physiological", "biographical", "historical", "Hippocratic", "Coan", "nominalist", "idealist", "normativist", "empirical" and "conventional". This appears to be a complex issue touching upon relational and semantical aspects.
5. *Is disease an evaluative concept?* This question is addressed by categories such as "descriptivist", "objectivist", "reductionist", "non-normativist" and "naturalist" positions on the one hand, and "normativist", "non-descriptivist", "subjectivist" and "relativist".
6. *Within what perspective is something conceived of as disease?* The debate on concepts such as "malady", "defects", "disability", "handicap", "deformity", "disfigurement", "infirmity", "impairment", "dysfunction", "dystrophy", "abnormality", "debility", "derangement", "malignancy", "morbidity", "suffering", "pain", "weakness", "incompetence", "illness" and "sickness", "symptom" and "syndrome" try to clarify and delimit the concept of disease. This appears to be an epistemological issue.
7. *How can we explain disease?* A variety of models, such as "metaphysical", "philosophical", "naturalistic", "psychosomatic/anthropologic/sociocultural", "xenochthonous", "autochtonous", "religious", "biomedical", "psychosomatic", "humanistic", "existential" and "trans-

personal" models, have been applied to address this epistemological and practical issue.

These are by no means the only issues of the debate on the concept of disease or the only way to structure them. However, they seem to be sufficient to illustrate the point that the categories applied in the debate on the concept of disease refer to main distinctions in philosophy: they rest on semantical, ontological, ethical and epistemological issues. Hence, the complexity of categories refers to profound philosophical questions that are not easily answered.

Before analysing the results of this observation, it is necessary to broaden this perspective. The complexity of the literature is not only due to the variety of theoretical frameworks and profound philosophical topics, but also because there appear to be a diversity of relations between these frameworks and topics.

COMPLEXITY OF THEORETICAL FRAMEWORKS

Within the main lines of the discussion indicated above, there seems to be a variety of constellations. E.g. there appears to be a relation between the semantical and the normative status of the concept of disease. Positions subscribing to "nominal essence" tend to be evaluative [6]. Commentators claiming that *disease* has a "real essence", are assumed to be value-free and descriptive. However, this does not have to be so.

Combinations of seemingly antagonistic positions appear to be viable. Concepts of disease can be both "descriptive" and "normative". King's definition of disease from 1954 refers both to a descriptive deviation from a statistical standard and a normative judgement by the prevailing culture of what is painful and disabling [3, 27, p. 318]. Accordingly, Scadding's definition of disease from 1967 is both described by some "specified common characteristic" and is subject to evaluative judgements of "abnormal phenomena" that place an organism at a "biological disadvantage" [6, 14]. Additionally, Reznek claims that the *disease status* is "normative" and invented, whereas the *disease identity* can be discovered [18].[17] Hence, the concept of disease is both normative and non-normative, depending on the issue.

Furthermore, it has been argued that the borders between non-evaluative and evaluative matters are not as clear-cut as some commentators seem to claim. Non-evaluative matters influence evaluative ones. Wulff has argued that a biological or empirical conception of disease contributes to a paternalistic medical practice, because the patient's role is

reduced [64]. Hence, medical activity dominated by description and theory promote value judgements of a certain kind. Others have claimed that the fact-value distinction is obscure, that non-evaluative definitions of disease are inherently evaluative, and conversely: that evaluative definitions are factual [30]. In particular, Boorse's definition of disease has been subject to such a critique. It has been maintained the evaluative matter of normality is inherent in the matter of "natural functioning".

Moreover, there is a wide range of constellations of categories in the debate. The distinction between "ontological" and "physiological" is related to the distinctions between "realist" and "nominalist", and between "rationalist" and "empirical" [5, 44]. However, this is not necessarily so. Boorse's concept of disease is characterised as being both "physiologist" and "naturalist" [25].

Additionally, there are no clear borders between the concept of disease and disease models. The models discussed by Tamm are the same as those that in other contexts are discussed as concepts [61]. Engelhardt conceives the concept of disease as explanatory models. "The concept of disease thus comes to identify disease models, supporting the search for unnoticed causal factors and expressions of disease" [48, p. 1103]. Hence, there are close relations between the concept and models of disease.

Accordingly, the concept of disease does not have to be either "objective" or "subjective", but can be both [91, p. 211; 76, p. 615]. It can be both value-dependant and realist [12]. Taylor has argued that there is a close relation between the ontological status of disease and its semantic characteristic. Various "ontological" concepts of disease can be analysed in the framework of modern logic of classes [41].[18]

Additionally, there are different perspectives to human ailment (e.g. personal, professional or social). It is sometimes unclear which perspective is referred to in the discussion. E.g. the terms "illness" and "disease" are sometimes interchanged, and "illnesses" are sometimes classified as diseases. Additionally, the taxonomic attributes are highly diverse.[19] They make it difficult to find a unified concept of disease [6, p. 877; 65, p. 512].

Moreover, there seems to be a difference in the concept of disease between lay persons and professionals [14]. Some insist that "disease" is a theoretical concept [36], others maintain that it is a practical concept [15] and others that it is both [10]. However, if it really is possible to give a strict, rigorous and consistent definition of disease, why is the taxonomy completely independent of such definitions? Classification of disease seems to be ruled by pragmatic more than by conceptual aspects. Due to such difficulties it has been argued that it is difficult to give a rigorous and consistent definition of "disease" [16, 18]. Others go one step

further and argue that a concept of disease is irrelevant for the purpose of medical practice [21].

Hence, the categories of Table I are not applied as strict and distinct disciplines, but interrelate in different ways. This illustrates that the theoretical frameworks underlying the debate on the concept of disease are neither rigorous nor strict, but emphasise the complexity of the debate.

CONCLUDING REMARKS

I have argued here that the debate on the concept of disease is complex, and that this complexity can be recognised in the theoretical frameworks of the debate. The profound philosophical issues underlying the debate illustrate the complexity of the concept. That is, the complexity of the concept is displayed by the complexity of the categories of the debate.

There is something outstanding to the concept of disease generating logical, ontological, epistemological and normative challenges. The concept appears to be irreducible to a particular perspective or a monistic conception. Even if we could answer the question of the ontological status of instances of disease, its classificatory and normative issues would not be resolved. Correspondingly, if we cleared the evaluative status of disease, the ontological, semantical and epistemological issues would still be open. These issues seem not to be inter-reducible.

However, is this only a theoretical complexity? People are actually treated in the health care system without there being any reflections of this kind. Are the challenges only of an abstract kind? The complexity in the theoretical frameworks appears to be more than a mere academic issue, and it is reflected in medical practice. Whether pregnancy, excellence, infertility, whiplash, or a general feeling of incompetence are cases of disease are practical issues, and even the status of homosexuality as a disease has been a topic in clinical practice until recently.

Furthermore, the classification of disease entities is a great challenge to modern medicine. A strict and consistent concept of disease, be it theoretical or practical, should result in a strict and consistent taxonomy, which obviously is not the case. Disease entities are classified according to symptoms, syndromes, physical signs, paraclinical signs, abnormalities of morphology, physiological aberrations, genetic abnormalities, ultrastructural abnormalities, etiological agents and according to eponymal origin.

Hence, the theoretical complexity discussed in this study corresponds to a practical complexity, and as far as the conceptual debate on disease is concerned, the concept should give practical guidance and pave the way to

a tidier practice. In this respect it has certainly failed. The reason for this is reflected in the complexity of the theoretical frameworks.

My aim has not been to argue that the profound issues revealed in this study are final and absolute for the debate on the concept of disease. A conceptual debate of human disease may follow other lines of thought. The presentation has been *one* attempt to structure the categories of the debate. However, I would argue that any investigation of these categories has to take into account the theoretical complexity. The profound philosophical distinctions of the debate show that the concept of disease involves fundamentally different issues. *Disease* is basically an issue that is so complex that it appears extremely difficult to encompass it by a single monistic theory.

There appears to be something special about the concept of disease compared to other concepts. Take for example the concept car: Cars certainly have social implications and affinity to questions of "the good life", but it does not pose corresponding challenges to classification, as does the concept of disease. Accordingly, the semantical, ontological, evaluative and epistemological status of *car* is not subject to controversies as is *disease*. Even though there are debates about the evaluative consequences of large-scale motorism, there are few disagreements on the evaluative status of cars as such. The car concept appears to be conceived of in a rather uniform manner independent of whether it is in a personal, professional or social context. A car is easily differentiated from other vehicles, and we do not depend (epistemically) on complex models of "car", although cars certainly are complex objects.

Does this mean, then, that it is impossible to give a definition of disease? This question has not been the issue in this study. However, it has become clear that if it is possible to give a definition of disease, the definition of disease has to take into account the diversity and complexity that the concept involves. A simple definition of the concept of disease cannot be obtained. This concurs with Aristotle's much quoted phrase that no more precision can be expected than the subject matter allows (*Nicomachean Ethics* 1094b11). Disease is a complex concept, that is, it has a complex extension, and does not lend itself to a simple definition.

NOTES

[1] Additionally, the concepts are ambiguous. E.g. the term "realism" has been contrasted to "idealism", "scepticism", "pragmatism", "instrumentalism", "relativism" in addition to "nominalism". Hence, it is not always quite clear whether the discussion is on an ontological, epistemological, logical or practical level.

[2] Engelhardt seems to be an exception. He discusses both esthetical and ethical matters within the framework of disease as a "normative" concept [11]. He also identifies values associated with human bodily and mental excellence [44, p. 1104]. See also Aronowitz [50].

[3] One reason for the lack of explicit conception of norms and values might of course be the general philosophical difficulties at this point.

[4] This refers to Armand Trousseau frequently cited statement "Il n'y a pas de maladies. Il n'y a que des malades."

[5] Taylor argues that this was the predominant conception in pre-scientific and Virchowian medicine [41].

[6] E.g. Jensen contends that 'disease' is not an "ideal concept". There is no definable use of the concept of disease in language. It varies with praxis and has to be studied in praxis [15, 16, 10, p. 175]. This "practical" and "strong" version of "nominalism" implies that the concept of disease cannot be applied to demarcate treatment, at least not in a strong version of nominalism. We cannot apply a concept determined by practical use to determine practice. Proponents of weaker versions of nominalism maintain that concepts, although defined by practice, being idealised simplifications, can be guiding to action [10].

[7] Copeland gives a more comprehensive list of the classification terms: symptoms, clusters of symptoms (syndromes), physical signs, abnormalities of morphology, physiological aberrations, biochemical defects, genetic abnormalities, ultrastructural abnormalities, etiological agents and diseases having eponymal origin [51, p. 530].

[8] Disease is a human construction given by social criteria and not by discoveries in nature. This is further exemplified by the following citation from Kendell: "To our generation it is self-evident that diseases, tuberculosis as well as schizophrenia, are nothing but man made abstractions, inventions justified only by their convenience and liable at any time to be adjusted and discarded. Our present outlook is so whole-heartedly empirical that we find it difficult to credit how an earlier generation could have talked of diseases being "discovered" like so many golden sovereigns on a beach, or have imagined that there were a finite number of them waiting to be identified. Yet although we know these things perfectly well, we have still not rid ourselves of all the old Platonic assumptions. Claims are still made even now that this or that syndrome is a "disease entity", in spite of the fact that the word entity, defined in the Oxford dictionary as a "thing that has real existence", is meaningless outside its original Platonic context" [82, pp. 21–22].

[9] Within the framework of descriptive semantics Reznek identifies two different theories of meaning. According to these, disease entities might be grouped together by family resemblance (Wittgenstein) or by expression of properties (Frege, Russel). Taylor also argues in terms of descriptive theory. He contends that modern disease entities are given as attributes of the class intension [41, 42].

[10] Hempel has suggested that the concept of disease should be given by "operational definitions" [39]. The term "operational definition" was originally coined by Bridgman [83] and denotes a test operation that functions as a classification criterion. However, it does not have to be an operation in a strict sense, it might be an "observation" [39] or semantic [80, p. 26]. The point is that it provides clear cut rules of application.

[11] Diseases or disease entities are here conceived of as instances of *disease*.

[12] Boorse runs into serious difficulties: Where do we set the limits of normality? Do we not have to have a preconception of what disease is in order to select a statistical reference group? What about people who do not have reproduction as a *telos* of life?

[13] The details of how the concept of disease is constituted by values and norms, however, are seldom discussed. The emphasis of the "normative", "evaluative" or "value-laden"

aspects of the concept of disease seems to be to make clear that it is *not* a descriptive concept.

[14] Taylor defines disease by what needs medical attention. Such a definition of theconcept of disease is practical and nominalistic. It cannot be applied to demarcate the need for treatment, as it would become circular: demarcating therapy on behalf of a definition based on "therapeutic concern".

[15] For the purpose of this study, "ailment" is applied as a common term to denote phenomena that represent or tend to result in human suffering. Culver and Gert have applied "malady" [89] and Taylor has used "morbus" [41].

[16] Other interesting and challenging distinctions are between "disease" and "immorality", "dissidence" and "delinquency". The concept of disease differentiates medical treatment from other human practices such as blaming the immoral, convicting felons, exorcising demons, although, this differentiation has not always been clear. Furthermore, the difference between disease and crime has not been clear [90]. The same goes for the relation between social and political attitudes and disease. The hospitalisation of soviet dissidents is only one example of this.

[17] *Disease status* denotes the question of whether a event is a disease or not. *Disease identity* is a matter of whether one event is the same disease or a different disease from another event. Diseases are identical if they share the same explanatory nature.

[18] Taylor claims that Virchowian disease entities are members in a "class extension", whereas Sydenham's theory of disease focused on the "class entity". Modern disease entities are attributes given by "class intension" [41, p. 278].

[19] The classification criteria for a disease might be symptoms, clusters of symptoms (syndromes), physical signs, morphological abnormalities, physiological aberrations, biochemical defects, genetic abnormalities, ultrastructural abnormalities, etiological agents, and having eponymeal origin [51]. Furthermore, they might be specific deficiencies, organ or system involvement, or descriptions of abnormalities [65, p. 512], or measurable functional disorders [6, p. 878].

REFERENCES

1. Albert DA, Munson R, Resnik MD. *Reasoning in Medicine: An Introduction to Clinical Inference*. Baltimore: Johns Hopkins University Press, 1988.
2. Nordenfelt L. Concepts of health and their consequences for health care. *Theor Med* 1993; 14(4): 277–285.
3. King L. What is a Disease? *Philosophy of Science* 1954; 21: 193–203.
4. Rather LJ. Zur Philosophie der Begriffs "Krankheit". *Deutsche Medizinische Wochenschrift* 1958; 83: 2012–2018.
5. Cohen H. The evolution of the concept of disease. In Lush B, ed. *Concepts of Medicine: A Collection of Essays on Aspects of Medicine*. Oxford: Pergamon Press, 1961.
6. Scadding JG. *Sarcoidosis*. London: Eyre & Spottiswoode, 1967.
7. Rothschuh K. Der Krankheitsbegriff (Was ist Krankheit?). *Hippokrates* 1972; 43: 3–17.
8. Kennedy I. *The Unmasking of Medicine*. London: Granada, 1983.
9. Gillon R. On sickness and on health. *Brit Med J* 1986; 292: 318–320.
10. Nordenfelt L. *On the Nature of Health*. Dordrecht: Kluwer Academic Publishers, 1987.

11. Sundström P. *Icons of Disease: A Philosophical Inquiry into the Semantics, Phenomenology and Ontology of the Clinical Conceptions of Disease*. Linköping: Linköping University, 1987.
12. Stempsey WE. *Disease and Diagnosis: Value-Dependant Realism*. Dordrecht: Kluwer, 1999.
13. Engelhardt HT. The concepts of health and disease. In Engelhardt HT, Spicker SF, eds. *Evaluation and Explanation in the Biomedical Sciences*. Dordrecht: Reidel, 1975, pp. 125–141.
14. Campbell EJ, Scadding JG, Roberts RS. The concept of disease. *Brit Med J* 1979; 2: 757–762.
15. Jensen UJ. *Sygdomsbegreber i praksis: det kliniske arbejdes filosofi og videnskabsteori*. København: Munksgaard, 1983.
16. Jensen UJ. A critique of essentialism in medicine. In: Nordenfelt L, Lindahl BIB, eds. *Health, Disease and Causal Explanations in Medicine*. Boston: Reidel, 1984, pp. 63–73.
17. Jaspers K. Die Begriffe Gesundheit und Krankheit. In *Allgemeine Psychopathologie*. Berlin: Springer-Verlag, 1913, pp. 651–711.
18. Reznek L. *The Nature of Disease*. New York: Routledge & Keagen Paul, 1987.
19. Sade RM. A theory of health and disease: The objectivist-subjectivist dichotomy. *Journal of Medicine and Philosophy* 1995; 20: 513–525.
20. Räikkä J. The social concept of disease. *Theoretical Medicine* 1996; 17(4): 353–361
21. Kovács J. The concept of health and disease. *Medicine, Health Care and Philosophy* 1998; 1: 31–39.
22. Steen, WJvd, Thung PJ. Concepts of health and disease. In *Phases of Medicine: A Philosophical Study*. Dordrecht: Kluwer Academic Publishers, 1988, pp. 80–117.
23. Boorse C. On the distincion between disease and illness. *Philosophy and Public Affairs* 1975; 5: 49–68.
24. Caplan AL. The concepts of health and disease. In Veatch RM, ed. *Medical Ethics*. Boston: Jones and Bartlett Publishers, 1989, pp. 51–63.
25. Bechtel W. In the defense of a naturalistic concept of health. In Humber JM, Almeder RF, eds. *Biomedical Ethics Reviews – 1985*. Clifton, New Jersey, 1985, pp. 131–170.
26. Goosens W. Values in health and medicine. *Philosophy of Science* 1980; 47: 100–115.
27. Brown WM. On defining "disease". *Journal of Medicine and Philosophy* 1985; 10(4): 311–328.
28. Lennox J. Health as an objective value. *Journal of Medicine and Philosophy* 1995; 20: 499–511.
29. Edwards SD. Nordenfelt's theory of disability. *Theoretical Medicine* 1998; 19(1): 89.
30. Fulford KWM. Praxis makes perfect: Illness as a bridge between biological concepts of disease and social conceptions of health. *Theoretical Medicine* 1993; 14: 305–320.
31. Engelhardt HT. *Disease, Malady, and Informed Consent*. Dordrecht: D. Reidel Publishing Co, 1986.
32. Fulford KWM. *Moral Theory and Medical Practice*. Cambridge: Cambridge University Press, 1989.
33. Fedoryka K. Health as a normative concept: Towards a new conceptual framework. *Journal of Medicine and Philosophy* 1997; 22: 134–160.
34. von Engelhardt D. Health and disease – history of the concepts. In Reich WT, ed. *Encyclopedia of Bioethics*. New York: MacMillan, 1995, pp. 1085–1092.
35. Margolis J. The concept of disease. *Journal of Medicine and Philosophy* 1976; 1: 238–255.

36. Boorse C. Health as a theoretical concept. *Philosophy of Science* 1977; 44: 542–573.
37. Turner BS. *Medical Power and Social Knowledge*. London: Sage, 1987.
38. Sedgwick P. Illness – mental and otherwise. *Hastings Centre Studies* 1973; 1: 19–40.
39. Hempel CG. Introduction to problems of taxonomy. In Zublin J, ed. *Field Studies in the Mental Disorders*. New York: Grune and Stratton, 1961, pp. 3–22.
40. Nordenfelt L. On the relation between biological and social theories of health: A commentary on Fulford's praxis makes perfect. *Theoretical Medicine* 1993, 14(4): 321–324.
41. Taylor FK. Disease concepts and the logic of classes. *Br J Med Psychol* 1981; 54(3): 277–286.
42. Taylor FK. A logical analysis of disease concepts. *Comprehensive Psychiatry* 1983; 24: 35–48.
43. Virchow R. Über die Standpunkte in der wissenschaftlichen Medizin. *Virch Arch exp Path Pharmak* 1847; 1.
44. Temkin O. The scientific approach to disease: Specific entity and individual sickness. In Crombie AC, ed. *Scientific Change: Historical Studies in the Intellectual, Social and Technical Conditions for Scientific Discovery and Technical Invention from Antiquity to the Present*. New York: Basic Books, 1963, pp. 629–647.
45. Hudson RP. *Disease and Its Control*. London: Greenwood Press, 1983.
46. Juengst ET. Causation and the conceptual scheme of medical knowledge. In Delkeskamp-Hayes C, Cutter MAG, eds. *Science, Technology, and the Art of Medicine: European-American Dialogues*. Dordrecht: Kluwer Academic, 1993, pp. 127–152.
47. Fagot-Largeault A. On medicine's scientificity – did medicine's accession to scientific "positivity" in the course of the nineteenth century require giving up causal (etiological) explanation? In Delkeskamp-Hayes C, Cutter MAG, eds. *Science, Technology, and the Art of Medicine*, 1993, pp. 105–126.
48. Engelhardt HT, Wildes KW. Health and disease – philosophical perspectives. In Reich WT, ed. *Encyclopedia of Bioethics*. New York: MacMillan, 1995, pp. 1101–1106.
49. Canguilhem G. *The Normal and the Pathological*. New York: Zone Books, 1991.
50. Aronowitz RA. *Making Sense of illness: Science, Society, and Disease*. Cambridge, U.K.: Cambridge University Press, 1998.
51. Copeland DD. Concepts of disease and diagnosis. *Persp Biol Med* 1977; 20: 528–538.
52. Callahan D, Parens E. The ends of medicine: Shaping new goals. *Bulletin of the New York Academy of Medicine* 1995; 72(1).
53. Jensen AO, Jensen HS. *Medicinsk videnskabsteori*. Copenhagen: Christian Eilers Forlag, 1976.
54. Fabrega H. Concepts of disease: Logical features and social implications. *Perspectives in Biology and Medicine* 1972; 22: 583–616.
55. Rothschuh KE. *Was ist Krankheit? Erscheinung, Erklärung, Sinngebung*. Darmstadt: Wissenschaftliche Buchgesellschaft, 1975.
56. Toombs SK. The temporality of illness: four levels of experience. *Theoretical Medicine* 1990; 11(3): 227–241.
57. Bernard C. *An Introduction to the Study of Experimental Medicine*. New York: Dover, 1927.
58. Kopelman L. On disease: theories of disease and the ascription of disease. In Engelhardt HT, Spicker SF, eds. *Evaluation and Explanation in the Biomedical Sciences*. Dordrecht: Reidel, 1975, pp. 143–150.

59. Birch J. A misconception concerning the menaing of a "disease". *British Journal of Medical Psychology* 1979, 52: 367–375.
60. Fabrega H. Scientific usefulness of illness. *Perspectives in Biology and Medicine* 1979; 22: 545–558.
61. Tamm ME. Models of health and disease. *British Journal of Medical Psychology* 1993; 66: 213–228.
62. Redlich FC. Editorial reflections on the concepts of health and disease. *Journal of Medicine and Philosophy* 1976; 1: 269–280.
63. Ackerknecht EH. Causes and pseudocauses in the history of diseases. In Stevenson LG, ed. *A Celebration of Medical History*. Baltimore: The Johns Hopkins University Press, 1982: 19–36.
64. Wulff HR, Gøtzche PC. *Rationel klinik*. København: Munksgaard, 1997.
65. Engel GL. A unified concept of health and disease. *Perspectives in Biology and Medicine* 1960; 3(4): 459–485.
66. Brown J. *Elementa medicinæ*, 1803.
67. Broussais FJV. *Examen des Doctrines Medicales et des Systemes de Nosologie*. Paris: Mequignon-Marvis, 1821, Vol. 2, p. 646.
68. Hufeland CW. *Ideen über Pathogenie und Einfluss der Lebenskraft auf Entstehung und Form der Krankheiten*. Jena: In der Academischen Buchhandlung, 1795.
69. Bentham J. *An Introduction to the Principles of Morals and Legislation*. Oxford: Carlendon Press, 1879. In paperback: London: Methuen, 1982.
70. Parsons T. *The Social System*. London: Routledge & Kegan Paul, 1951.
71. Parsons T. Definitions of health and illness in the light of American values and social structure. In Jaco EG, ed. *Patients, Physicians and Illness: Sourcebook in Behavioral Science and Medicine*. New York: Free Press, 1958.
72. Twaddle A. *Influence and Illness: Definitions and Definers of Illness Behavior among Older Males in Providence, Rhode Island*. Ph.D. Thesis, Brown University, 1968.
73. Marinker JH. Why make people patients? *Journal of Medical Ethics* 1975; 1: 81–84.
74. Jenner E. *An Inquiry into the Causes and Effects of Variolae Vaccine, a Disease Discovered in Some of the Western Counties of England, Particularly Gloucestershire and Known by the Name of Cowpox*. London: Sampson Low, 1798.
75. Eisenberg L, Kleinman A. *The Relevance of Social Science for Medicine*. Dordrecht: Reidel, 1981.
76. Whitbeck C. A theory of health. In Caplan AL, Engelhardt HT, McCartney JJ, eds. *Concepts of Health and Disease: Interdisciplinary perspectives*. Reading, MA: Addison-Wesley, 1981.
77. Young A. The anthropologies of illness and sickness. *Ann Rev Anthropology* 1982; 11: 257–285.
78. Twaddle A. Disease, illness and sickness revisited. In Twaddle A, Nordenfelt L, eds. *Disease, Illness and Sickness: Three Central Concepts in the Theory of Health*. Linköping: Studies on Health and Society, 1994, 18, pp. 1–18.
79. Nordenfelt L. On the disease, illness and sickness distinction: A commentary on Andrew Twadle's system of concepts. In Twaddle A, Nordenfelt L, eds. *Disease, Illness and Sickness: Three Central Concepts in the Theory of Health*. Linköping: Studies on Health and Society, 1994, Vol. 18, pp. 19–36.
80. Kendell R. The concept of disease. *British Journal of Psychiatry* 1976; 128: 508–509.
81. Hesslow G. Do we need a concept of disease. *Theoretical Medicine* 1993; 14: 1–14.
82. Kendell RE. *The Role of Diagnosis in Psychiatry*. Oxford: Blackwell Scientific Publications, 1975.

83. Bridgman PW. *The Logic of Modern Physics*. New York: Macmillan, 1927.
84. Feinstein AR. ICD, POR, and DRG. Unsolved scientific problems in the nosology of clinical medicine. *Arch Intern Med* 1988 (Oct) 148; 10: 2269–2274.
85. Temkin O. Greek medicine as science and art. *Isis* 1953; XLIV: 213–225.
86. Burns CR. Diseases versus healths: Some legacies in the philosophies of modern medical science. In Engelhardt HT, Spicker SF, eds. *Evaluation and Explanation in the Biomedical Sciences*. Dordrecht: Reidel, 1975, pp. 29–47.
87. Szasz T. The myth of mental illness. *American Psychologist* 1960; 15: 113–118.
88. Pörn I. An equilibrium model of health. In Nordenfelt L, Lindahl BIB, eds. *Health, Disease, and Causal Explanations in Medicine*. Dordrecht: Reidel, 1984.
89. Clouser KD, Culver CM, Gert B. Malady. In Almeder RF, Humber JM, eds. *What is a Disease?* Totowa, NJ: Humana Press, 1997, pp. 173–217.
90. Flew A. *Crime or Disease?* New York: Barnes and Noble, 1973.
91. Whitbeck C. Four basic concepts of medical science. *PSA* 1978; 1: 210–222.

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On the triad *disease, illness, and sickness*

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Abstract

The point of departure for this article is a review of the discussion between Twaddle and Nordenfelt on the concepts of disease, illness, and sickness, and the objective is to investigate the fruitfulness of these concepts. It is argued that disease, illness, and sickness represent different perspectives on human ailment and that they can be applied to analyse both epistemic and normative challenges to modern medicine. In particular the analysis reveals epistemic and normative differences between the concepts. Furthermore, the article demonstrates, against Nordenfelt's claim, that the concepts of disease, illness, and sickness can exist without a general theory of health. Additionally, the complexity of different perspectives to human ailment also explains why it is so difficult to give strict definitions of basic concepts within modern health care.

Key words: disease, illness, sickness, epistemic and normative challenges

Introduction

The triad of *disease*, *illness*, and *sickness* has been applied to denote medical, personal, and social aspects of human ailment[1]. The distinction between illness and disease has been noted in theoretical medicine since the 1950's (Parsons 1951; 1958; 1964; Feinstein 1967). Andrew Twaddle first applied the full triad in his doctoral dissertation defended in 1967 (Twaddle 1968;

[1] "Ailment" here denotes negative bodily occurence and is applied as a common term to refer to "disease", "illness", "sickness", "injury", "defect", "disability", "handicap" and "impairment".

Twaddle 1994a, p. 22). The distinction between *disease*, *illness*, and *sickness* has become commonplace in medical sociology, medical anthropology, and philosophy of medicine.[2]

In recent years, the triad has been elaborated and more strictly defined (Sachs 1988; Twaddle 1994a; 1994b), but also fundamentally challenged (Nordenfelt 1994). Lennart Nordenfelt has argued that the triad[3] is fruitful only within the context of a general theory of health (Nordenfelt 1987; 1994).

The point of departure for this article is the discussion between Twaddle and Nordenfelt of the triad (Twaddle 1994a; 1994b; Nordenfelt 1994). Its objective is to investigate whether the triad of *disease*, *illness*, and *sickness* remains fruitful, despite the critique. This will be done by addressing the following questions:

1. What is the triad's explanative power? In particular, how can it be applied to analyse *a)* controversial cases and *b)* epistemic and normative challenges to modern medicine?
2. What is the relation among the concepts of the triad? In particular, is there a primacy of any of the concepts?
3. Can the concepts of the triad be upheld only within the framework of a general theory of *health*, as Nordenfelt claims?
4. Can the triad shed light on why it appears to be so difficult to define basic concepts within modern health care?

To address these questions, I will apply a provisional definition of the triad and confront it with difficult cases discussed in the literature.[4]

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[2] See for example: (Bentham 1892; King 1954; Parsons 1951; 1958; Twaddle 1968; Susser 1971; Rothschuh 1972; Frabrega 1972; 1974; 1979; Marinker 1975; Howels 1976; Redlich 1976; Birch 1979; Jenner 1979; Eisenberg & Klienman 1981; Whitbeck 1981; Young 1982; Taylor 1983; Hudson 1983; Twaddle 1993; Nordenfelt 1997/8; Sedgwick 1973; Engelhardt 1995; von Engelhardt 1995)

[3] Nordenfelt applies the term *trichotomy* to describe the relation between disease, illness and sickness. This seems to have some unfortunate consequences. *Trichotomy*, means parted in three disjoint parts. However, as argued by Twaddle, and defended in this article, the concepts of disease, illness and sickness are not exclusive or disjoint. On the contrary, the paradigm case of modern medicine is a member of all these categories. The term *trichotomy*, thus, misses the point that the concepts of *disease*, *illness* and *sickness* are not exclusively definable, but have conjunctive areas. Therefore, the term *trichotomy* is omitted and replaced with the term *triad*.

[4] As Nordenfelt's and Twaddle's discussion is restricted to somatic phenomena, so too is this article. The discussion could be expanded to encompass mental phenomena, however that would demand a separate article. Correspondlingly, the article is concerned with the paradigms of the modern western medical tradition when it refers to the medical profession.

Definitions of disease, illness, and sickness

As Nordenfelt in particular criticises the definitions of the concepts *disease*, *illness*, and *sickness* presented by Andrew Twaddle (Twaddle 1973, 1979, 1994a), I will take these definitions as a point of departure and cite them at some length.

According to Twaddle, *disease* is defined in the following way: "Disease is a health problem that consists of a physiological malfunction that results in an actual or potential reduction in physical capacities and/or a reduced life expectancy" (Twaddle 1994a, p. 8). Ontologically, *disease* is an organic phenomenon (physiological events) independent of subjective experience and social conventions. Epistemically, it is measurable by objective means (Twaddle 1994a, p. 9).

Illness, on the other hand, is defined as follows: "Illness is a subjectively interpreted undesirable state of health. It consists of subjective feeling states (e.g. pain, weakness), perceptions of the adequacy of their bodily functioning, and/or feelings of competence" (Twaddle 1994a, p. 10). Ontologically *illness*, then, is the subjective feeling state of the individual often referred to as symptoms. Epistemically this can only be directly observed by the subject and indirectly accessed through the individual's reports.

Sickness is defined in the following way: "Sickness is a social identity. It is the poor health or the health problem(s) of an individual defined by others with reference to the social activity of that individual" (Twaddle 1994a, p. 11). *Sickness*, thus, is a social phenomenon constituting a new set of rights and duties. Ontologically Twaddle conceives of *sickness* as "an event located in society … defined by participation in the social system" (Ibid). Epistemically *sickness* is accessed by "measuring levels of performance with reference to expected social activities when these levels fail to meet social standards ..." (Ibid).

Furthermore, Twaddle outlines the temporal relationship between *disease*, *illness*, and *sickness*. The paradigm case is when a *disease* leads to *illness, which* then results in *sickness*. Moreover, he gives a relational analysis of the triad in the form of partly overlapping spheres (figure 1)[5].

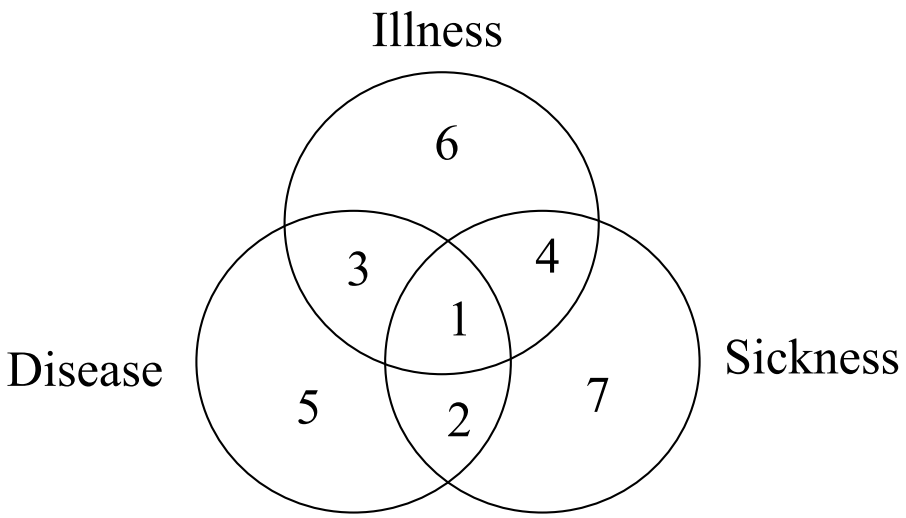

Figure 1 Visual outline of Twaddle's model of the triad

This relation between the concepts of the triad will be applied in the following analysis.

Deficiencies in Twaddle's triad

The conclusion of Nordenfelt's critical analysis of Twaddle's triad is that it is inadequate to define and describe the condition of "un-health". Only in the framework of a general theory of health based on a concept of disability can the triad be fruitful (Nordenfelt 1987, pp. 105-117; 1994, p. 22, 35). Nordenfelt's critique of Twaddle's triad can be grouped in three areas of concern, *disease*, *illness*, and *sickness* respectively.

Nordenfelt argues that the definition of *disease* excludes central phenomena in modern health care from being a disease. Injuries, impairments, and defects reduce human capacities, but are not

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[5] This figure is essentially identical to Twaddle's (Twaddle 1994a, p. 15). The layout and numbering is changed here

clearly included by the definition. According to Nordenfelt, the integration of these categories into the definition of disease has to be based on a concept of health. Furthermore, Nordenfelt pays attention to the meaning of the claim that disease is a "reduction in physical capacities". He appreciates that Twaddle does not refer to a statistical abnormality, but he questions whether the "reduction in physical capacities" is particularly related to the individual. "Does Twaddle mean that any reduction would do, or does he require that the reduction should be of some importance for the individual in question?" (Nordenfelt 1994, p. 24).

Furthermore, Nordenfelt's dissatisfaction with Twaddle's concept of *illness* contains three aspects. Firstly together with Wittgenstein and Ryle, he questions whether the subject has any exclusive empirical access to a private mental world. According to Nordenfelt *illness* is not a hidden private sensation but a perceptible disability. Secondly, the concept of *illness*, as defined, is highly diverse. It includes anxiety, pain, itching, lack or loss of competence, and a general feeling of depression (lack of optimism). According to Nordenfelt the definition does not provide any means of differentiating between these phenomena, as does a health-based concept of *illness*. Thirdly, the definition of *illness* as an undesirable state of feelings interpreted as undesirable by the individual, presupposes that the person is conscious. This is not so in many cases of medical treatment and care today. Furthermore, to be able to interpret a state as undesirable implies that the person already possesses the notion of a health problem. Nordenfelt therefore concludes: "Twaddle has not attempted to give a sharp characterisation of the notion of illness. He has not excluded those undesirable mental states which are obviously not instances of illness." (Nordenfelt 1994, p. 27).

In the case of *sickness*, Nordenfelt resents the idea that the status of being sick should be due to a change in activity of the person. There does not have to be any altered activity prior to categorising a person as *sick*. "The standard case seems to me to be the contrary. There is no particular activity at all, except the seeking of health-care, that could give any clue to the diagnosis concerning the patient." (Nordenfelt 1994, p. 29). In particular, the paradigm case of assignment of sickness is sick leave, which does not presuppose any such change in social activity on the part of the patient.

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according to the argumentation and structure of this article.

According to Nordenfelt these difficulties show that the triad cannot be upheld without a general theory of health. His critique of Twaddle, and Twaddle's answer (Twaddle 1994b) can give the impression that their theories are far apart. Instead of referring to the detailed discussion between Nordenfelt and Twaddle I will, for the purposes of this study, only point out some of the similarities between the two.

Twaddle and Nordenfelt revisited

Even though Twaddle and Nordenfelt may have quite different approaches to the conceptual challenges in health care, they seem to have several things in common.

Firstly, Twaddle's triad of *disease*, *illness*, and *sickness* is related to World Health Organisation's (WHO) definition of health as "a state of complete physical, psychological and social well being". The terms of the triad refer to the spheres of *physical*, *psychological*, and *social* well-being respectively (Twaddle 1994a, p. 5). Nordenfelt's *welfare* theory of health is also closely related to this definition. He sees health as the primary concept, and as being "not merely the absence of disease or infirmity" (WHO). Furthermore, the "ability to realise vital goals" is related to the well-being (Nordenfelt 1987, p. 36). According to Nordenfelt, health is the ability to realise goals which are necessary and together sufficient for minimal happiness (Nordenfelt 1987, p. 90). At the same time "happiness is the most important variant of welfare" (Nordenfelt 1987, p. 184). Hence, both Twaddle and Nordenfelt relate the basic concepts in health care to welfare.

Secondly, Twaddle's definitions of *disease*, *illness*, and *sickness* are based on the notion of *health*. "Disease is a *health problem*", "illness is a subjectively interpreted undesirable *state of health*", and sickness is "*poor health* or *health problem(s)* as defined by others" (Twaddle 1994a, pp. 8-11, my emphasis). Thus, the definition of the triad is based on a concept of health (Twaddle 1974; Twaddle 1994b, p. 51), although it is different from and not as elaborate as Nordenfelt's[6].

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[6] Furthermore, it seems worth noting that Nordenfelt actually has only two arguments that support the need for a general theory of health in order to make sense of the triad. Firstly, he argues that the distinction between disease, defects and injuries can only be made with reference to such a theory. Secondly, Nordenfelt believes that to be able to make sense of the definition of disease as "a physiological malfunction that results in an actual or potential reduction in physical capacities and/or reduced life expectancy" one needs a general theory of health (Nordenfelt 1994, p. 24). However, he does not give any clear arguments for this claim. Twaddle therefore can still claim that cases of defects

Thirdly, Twaddle's primary concept is *sickness*. *Disease* and *illness* are mainly of interest in so far as they result in *sickness*. Similarly, Nordenfelt's primary concept of "un-health" is *disability*. *Disease*, *defects*, and *injuries* are conditions that may lead to *disability*, and are of interest only in so far as they do. This certainly allows comparison between the two, and as Twaddle himself notes: "... Nordenfelt seems to be bringing his concept of disability very close to my concept of sickness." (Twaddle 1994b, p. 50). Nordenfelt's "non-capacity of performing a set of activities given standard circumstances" (Nordenfelt 1994, p. 29) is close to Twaddle's definition of *sickness* being an inability to perform expected social activities (Twaddle 1994a, p. 11). This is confirmed by Twaddle's concept of health as taking into account the "individual's capacities for task or role performance" (Twaddle 1974, p. 31). Thus, there is a close relationship between Nordenfelt's concept of ability and Twaddle's concept of capacity and between Nordenfelt's concept of disability and Twaddle's concept of sickness. Furthermore, as will be discussed later in this article, the concepts of *sickness* and *disability* both have epistemic and normative aspects.

Thus, despite differences e.g. in interpretations of *defects*, *injuries*, and *impairments* or theories of health, there are basic similarities in their perspectives. Does this imply that it is possible to reconcile Nordenfelt's and Twaddle's concepts of the triad? Is it possible on the basis of their discussion to give strict and consistent definitions of the concepts of *disease*, *illness*, and *sickness*? Although Nordenfelt's and Twaddle's conceptions might not be so different after all, and it may be tempting to tinker with the definitions so as to render them less objectionable, this article will not pursue such a course. There has been a comprehensive debate on the basic concepts of health care from a variety of perspectives; realist or nominalist (King 1954; Cohen 1961; Rather 1958; Scadding 1967; Rothschuh 1972; Kennedy 1981; Gillon 1986; Sundström 1987), analytic or holistic (Nordenfelt 1987), naturalist or normativist (Reznek 1987, Räikkä 1997, Kovács 1998), objectivist or subjectivist (Lennox 1995; Sade 1995, Kovács 1998), ontological or physiological (Rather 1958; Temkin 1963, Hudson 1983) theoretical or practical (Boorse 1977; Jensen 1984; Brown 1985; Hesslow 1993) or value-laden or value free (Margolis 1976; Boorse 1975, Turner 1987; Fulford 1993). Hence, the concepts of *disease*, *illness*, and *sickness* are widely recognised in the literature, but they are subject to substantial controversy.

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and injuries are part of diseases, and that his definition holds within his concept of disease. The argument of this article however, is that this is possible without any elaborated theory of health.

However, the objective of this article is to investigate the fruitfulness of the triad without entering this extensive and complex debate. Therefore, only a coarse and tentative definition of the triad, *disease*, *illness*, and *sickness* will be given in order to investigate its explanatory abilities.

Disease, *illness*, and *sickness* as different perspectives

The concepts of *disease*, *illness*,, and *sickness* emphasise different perspectives on important aspects of human life. The concepts of *disease*, *illness*, and *sickness* reflect professional, personal, and social perspectives and concern biological, phenomenological, and behavioural phenomena respectively. This has become widely accepted in the literature and in practice. Furthermore, *disease*, *illness*, and *sickness* are negative notions reflecting negative occurrences in human life.

Moreover, they call for action. *Disease* calls for actions by the medical profession towards identifying and treating the occurrence and caring for the person. *Illness* changes the actions of the individual, making him or her communicate their personal perspective of the negative occurrence to others, e.g. call for help. *Sickness* calls for a determination of the social status of the sick person; deciding who is entitled to treatment and economic rights and who is to be exempted from social duties.

Thus, for the purpose of this study the triad will be defined as follows:

> *Disease* is negative bodily occurrences as conceived of by the medical profession.
>
> *Illness* is negative bodily occurrences as conceived of by the person himself.
>
> Correspondingly, *sickness* is negative bodily occurrences as conceived of by the society and/or its institutions.

Occurrence here means process, state or event.[7]

These are not as strict definitions of the concepts as one could wish. However, the main point here is not to enter the vast, vivid and versatile debate on the definition of the concepts, but to

[7] Negative bodily occurrences appear to be the focus of attention of the person, the medical profession and of society, even though the concepts of *disease*, *illness* and *sickness* may vary with time and social context. Despite the variability of the concepts of *disease*, *illness* and *sickness*, they represent persistent perspectives on human ailment.

investigate their fruitfulness. Furthermore, strict definitions of the concepts might even leave out important explanatory aspects and restrict the their fruitfulness.

The triad in practice: comprising controversial cases

How then can such coarse conceptions of *disease*, *illness*, and *sickness* be of any value? In the discussion on the basic concepts of health care practical cases have been applied to evaluate the definitions of the concepts. "Descriptive" or "naturalist" theories have been accused of making pregnancy, excellence, and homosexuality into diseases. On the other hand, "normativist" or "nominalist" theories are charged with making ageing and general dissatisfaction diseases.[8] In the following I will try to analyse the triad with respect to such controversial cases to investigate the fruitfulness of the perspectivistic distinction between *disease*, *illness*, and *sickness*.

The paradigm case in health care is when a person feels *ill*, and the medical profession is able to detect *disease*, and society attributes to him the status *sick*. *Illness* explains the person's situation to himself, *disease* permits medical attention, and *sickness* frees him from ordinary duties of work and gives him the right to economic assistance (area 1 in Figure 1). Examples of such conditions are numerous. There appears to be agreement in conditions labelled myocardial infarction, tuberculosis and renal failure. Here negative bodily occurrences as conceived of by the individual correspond with negative bodily occurrences recognised by the medical profession and by relevant social institutions.

Thus, cases of *disease*, *illness*, and *sickness* are paradigms of health care. There are, however, several other conditions deviating from this ideal, that is conditions which are members of two of the spheres of the triad.

There are instances conceived of as *disease* and *sickness*, but not *illness* (2), for example conditions where certain signs or markers are recognised by the medical profession before the patient experiences any illness, and where society entitles the person to treatment and economic

[8] Nordenfelt tries to avoid this by excluding from illness emotions which are direct reactions to external events (Nordenfelt 1987, pp. 114-7). This seems difficult in practice. How are we to know what is caused by external events? Furthermore, what is the difference between the grief experienced when loosing (the sensation in) a leg and that of loosing a close relatives?

support. Various forms of screening and predictive testing belong to this group. The professionals are confident that they are dealing with *disease*, social institutions assign the *sick role*, but the person in question is not *ill*. The same situation can be recognised when patients are unconscious or have impairments recognised by the medical profession and society, but not by the person in question.

Correspondingly, there are cases of *disease* and *illness*, but not *sickness* (3). Examples are common cold, tooth decay, ageing, and seasickness.[9] The medical profession is able to recognise these conditions as negative bodily occurrences and the person in question certainly experiences them as such, but they normally do not qualify for *sickness*.

Furthermore, there are instances of *illness* and *sickness*, but not *disease* (4). Fibromyalgia, low back pain, whiplash, and chronic fatigue syndrome are examples of conditions where the person certainly feels ill and society entitles the person to have the status *sick*, but where the medical profession cannot correlate any negative bodily occurrences. Correspondingly, pregnancy is commonly not conceived of as *disease* by the medical profession, although it might be experienced by many women as *illness* and accepted by society as a reason for *sickness*.[10]

Another group of cases covers conditions where only one of the concepts of the triad is applicable. Asymptomatic instances of hyperglycaemia, hypertension (low or moderate), and lactose intolerance (in areas where they do not drink milk) are examples of *disease*, but neither *illness* nor *sickness* (5). The medical profession conceives of these as negative bodily occurrences, but the person does not experience them as such and they do not normally qualify for *sickness*.

Correspondingly, instances of *illness*, but neither *disease* nor *sickness* (6) represent cases that are perceived as negative bodily occurrences by the person, but are not recognised as such by the

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[9] It might rightly be argued that seasickness is a *sickness* if one is a member of a boat crew. However, within many boat crews seasickness does not qualify for sick leave. Rather it is stigmatising, questioning ones identity as a member of the boat crew.

[10] It is interesting to note that because it is conceived of as both *illness* and *sickness* it is made the subject of the health care system, even though it is not recognised by the medical profession as a *disease*.

medical profession or by society. General feeling of dissatisfaction, unpleasantness or incompetence, anxiety or melancholia might be examples of this.

The last group concerning only one of the triad's concepts are cases of *sickness*, but neither *disease* nor *illness* (7). Delinquency, dissidence, homosexuality, skin colour, and masturbation may count as examples of cases where social institutions have entitled people to have the *sick role*, but where the person has not felt ill and the medical profession has not recognised any negative bodily occurrences.[11]

Thus, the triad appears to be able to integrate controversial cases discussed in the literature. The claim here is not that these are the only examples that exist, nor that they cannot or will not be interpreted differently, but only that the concepts of *disease*, *illness*, and *sickness* represent a framework to conceive of controversial cases.

Additionally, the triad allows for an analysis of some of the controversies of the debate. Firstly, some of the epistemic and normative challenges in medicine will be investigated on the basis of the triad.

Epistemic and normative consequences

Several interesting observations, both epistemic and normative, follow from this analysis. Situations incorporating *disease*, *illness*, and *sickness* are neither epistemically nor normatively challenging. The person experiences a negative bodily occurrence making him request help, the medical profession recognises certain signs and knows what can be done, and society and its institutions entitle him to treatment, economic support and freedom from certain obligations (work).

However, situations belonging to only one of the spheres (5, 6, and 7) represent challenges. Conditions classified by the medical profession as *disease*, where the patient does not however feel any *illness*, and society does not find any reason to change his or her social status (5), have

[11] The examples of *sickness*, but not *illness* or *disease* are mainly historical examples, as we like to believe that today's society is free of such repressive actions. In Norway, however, the government tries to make the medical profession perform tests (genetic and x-ray) on asylum seekers, to investigate whether they have the sickness of "lying about their identity".

resulted in epistemic as well as normative challenges. How can we know that people with asymptomatic disease will actually develop symptoms and become ill? Should people with low or moderate hypertension be subject to extensive treatment? Should sickle cell anaemia be treated in areas with malaria? Can it be right to treat polydactylism and obesity if it does not annoy the person? Here we encounter ethical issues such as patient autonomy, paternalism, and informed consent.[12]

Accordingly, situations where a person is suffering (*illness*), yet no *disease* has been found, and where there is no change in his or her social status (6) represent an epistemic as well as a normative challenge. Epistemically it is a challenge to the medical profession to find a cause for the suffering. Normatively it is a challenge to know what to do in such situations. A general feeling of dissatisfaction does not normally qualify the person for medical care or economic support. On the other hand medical intervention has been initiated in such cases and has been criticised for being medicalising. Trying to handle all cases of illness is also a matter of resources, and hence a question of prioritisation.

Correspondingly, cases of *sickness* with neither *disease* nor *illness* (7) are challenging and might be dangerous. Skin colour, drapetomania (a disease that made slaves run away), homosexuality, and political dissidence are crude examples. There appears to be no knowledge of negative bodily occurrences correlating to these cases. Accordingly, the norms that have been applied to entitle a person to be *sick* in these cases have been questioned.

Thus, cases where only one of the attributes of the triad is valid call for special attention. Furthermore, cases joining two of the spheres of the triad *may* be epistemically and normatively challenging as well. Cases of *disease* and *illness*, but not *sickness* (3) are subject to pressure from professionals and interest groups for support. There may be several reasons why the status of *sickness* is not given even though the case is both *disease* and *illness*. There can be a lack of resources, the situation may be common or equally distributed in a population or there might be no cure available. Myopia and tooth decay are examples of cases that are not conceived of as

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[12] If the medical profession is the only one identifying negative bodily occurrences, their sensitivity to the interests of the person and society, will determine whether they act paternalistic or violate patient autonomy. Additionally, one can question how well a person without illness understands information about diseases that he or she cannot experience. Is there a real informed consent?

sickness in many countries, but are acknowledged as *disease* by the medical profession, and certainly experienced negatively by persons having these conditions. The epistemic challenge is to find effective and efficient cures, whereas the normative challenges are found in questions of rationing and what to do in cases where persons are not able to pay for health care services themselves.

Accordingly, cases of *illness* and *sickness*, but not *disease* (4) put pressure on medical research to find mechanisms and causes of personally experienced and economically supported occurrences. Fibromyalgia, whiplash, and low back pain have been applied as examples. The aetiology of and treatment for these conditions are not commonly agreed upon. They have, however, in various countries been accepted as *sickness* and persons certainly claim to experience them as *illness*. There is pressure on the medical establishment to see these conditions as *disease* as well. There is an epistemic challenge to establish aetiology and a normative challenge to find a treatment: such conditions ought to be treated. It is certainly a challenge to the medical profession to know what to do in cases that they do not recognise as *disease*.

Lastly, cases of *disease* and *sickness* without *illness* (2) represent profound challenges. Epistemically we are challenged by the question of how the particular patient relates to general knowledge and how certain we can be that persons actually will become ill when they have positive tests and are left untreated (Fischer & Welch 1999). Normatively we are faced with a series of questions: How are we to handle the results from predictive testing? Are there limits to the treatment of asymptomatic diseases? How are we to break bad news? The discussion on genetic testing, hypercholesterolaemia, and hypertension illustrates some of these normative challenges (Le Fanu 1999). How far can we go in treatment of cases where the patient is not *ill*? How is patient autonomy preserved? Who is to determine the trade-off between the risks and the benefit of such treatment? These conditions represent some of the aspects most intensively discussed in modern medical ethics, and pose questions of patient autonomy, paternalism, and medicalisation.

Hence, cases which belong to only two of the spheres represent epistemic and normative challenges as well. This further demonstrates that the concepts of *disease*, *illness*, and *sickness*

represent a fruitful framework for analysing some of the pressing epistemic and normative problems of modern medicine.

Differences between the spheres

Furthermore, from the discussion above it can be argued that cases which belong to only one of the spheres of the triad may be more challenging than cases which belong to two. We appear to be more challenged by medical treatment of incompetence, dissatisfaction, homosexuality, dissidence, and low or moderate hyperglycaemia than we are by the treatment of asymptomatic breast cancer, common colds, and seasickness.

Cases are stronger and less controversial where two of the agents agree and the cases are recognised as both *disease* and *sickness* (2), *disease* and *illness* (3), or *illness* and *sickness* (4), than if they are only recognised by one of the agents as *disease* (5), *illness* (6), or *sickness* (7). Persons, professionals or social institutions appear to have a weaker case if it belongs to only one sphere. The pressure on medicine to accept an occurrence as *disease* is strong when it is recognised both as *illness* and *sickness*. Correspondingly, there is pressure on society to provide necessary resources and to ascribe *sickness* when occurrences are recognised both as *disease* and *illness*.

In cases of only *illness*, the ill person has to convince both the medical profession and social institutions about his or her situation. Correspondingly, social institutions have to convince both the medical profession and the person in cases of *sickness* only, and both society and the person have to be persuaded in cases of *disease* only. Hence, cases of only *disease*, *illness* or *sickness* appear to be difficult cases.

Thus, there are normative and epistemic differences between the areas (1-7) where membership of only one sphere is more normatively challenging than membership of two. The normative differences between the areas are investigated in further detail in the following section.

The primacy of *illness*

One interesting observation resulting from the analysis of the triad of *disease*, *illness*, and *sickness* is the difference in challenges between these conjunctive areas. Area (2) seems to cause more challenges than areas (3) and (4). Conditions like fibromyalgia, whiplash, and low back pain

(4) seem mainly to challenge the medical profession (in lack of knowledge and treatment). Cases of the common cold, tooth decay, warts, and lung and throat irritations due to cigarette smoking (3) primarily challenge the resources of the society in question. A predominant proportion of medical ethics cases seems to concern cases of *disease* and *sickness* but not *illness* (2). To treat persons when they do not know that they need help appears to represent a major challenge to modern health care. Issues of patient autonomy, paternalism, and medicalisation belong to this area.

Accordingly, we appear to be more willing to accept cases of only *illness* (6) than only *disease* (5) or only *sickness* (7). For example it seems easier for us to accept giving people treatment and care in cases where there are no medical indications in terms of *disease* (6) than to treat people against their knowledge or will (5,7). The first case is a matter of limited medical knowledge and recourses. However, treatment in cases of only *disease* (5) or only *sickness* (6) raises more profound issues, such as patient autonomy, paternalism, and medicalisation, and appears to be more challenging.

Hence, the most challenging cases appear to be those of *disease* and *sickness* (2), *disease* (5), and *sickness* (6). What does this tell us? Common to these cases is that they lack *illness*. This must means that the most profound challenges that are related to the triad of *disease*, *illness*, and *sickness* are to be found in cases without *illness*. That is, there appears to be an epistemic and normative primacy of the concept of illness. This accords well with a substantial critique of modern medicine directed at its ignorance of the subjective experience of the individual patient, i.e. *illness*.[13] It also agrees with modern medicine's challenge of the epistemic-normative foundation of medicine evident from antiquity until today: the primacy of the individual person who is ill.[14]

However, what consequences does such a primacy for *illness* have for health care? Does it result in an overall subjective approach? Does it make any kind of ailment a case to be treated by the

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[13] See e.g. (Illich 1975; Knowles 1977; Reiser 1978; Pellegrino & Thomasma 1981; 1993; Jonas 1985; Beauchamp & Childress 1989; Gadamer 1993; Delkeskamp-Hayes & Cutter 1993).

[14] Furthermore, it concurs with the practical taxonomy of medicine where there is an extensive class of symptomatic diseases. Although the aetiology is unknown and there are no clinical or paraclinical signs, they are classified and handled by the medical profession as diseases.

health care system? This does not seem to be the case. Within the framework of the triad, *disease* and *sickness* limit the situations of *illness* to be handled by the health care system. The triad provides a framework to acknowledge people's *illness*. At the same time as it reveals the restriction of the medical profession to identify *disease* in all instances of *illness*. Correspondingly, it articulates society's abridged ability to ascribe *sickness* to all cases of *illness*.

Illness, then, without *disease* and/or *sickness* is challenging and must be "handled with care". The very existence of *illness* can be taken seriously and examined cautiously both by the medical profession and by the appropriate social institutions. It does not, however, automatically qualify for help from the health care system. This will be determined by whether negative bodily occurrence can be identified by the medical profession (*disease*) and by relevant social institutions (*sickness*).

It is worth noting that within a system based on the concept of *health*, as suggested by Nordenfelt, one has to rely on special restrictions, for example statistical normality, or external events (Nordenfelt 1987, p. 114-7). Otherwise all cases of *illness* become eligible for treatment by the health care system, e.g. incompetence and general dissatisfaction. Nordenfelt tries to restrict the concept of *illness* from within the concept itself, and does this by making qualifications that are external to the person experiencing illness. This appears to be problematic. The triad, on the other hand, acknowledges illness as the negative bodily occurrences as conceived of by the person in question, and restricts the cases that are to be subject to medical treatment by *disease*, and the instances that are to gain economic support by *sickness*. This suggests that the triad is more robust with regard to the threat of "subjectivism" (Lennox 1995; Sade 1995; Kovács 1998; Edwards 1998) than a health based system.

This invites scrutiny of Nordenfelt's main claim that the triad is not fruitful other than within a general concept of health.

The triad and the concept of health - or: why we do not need a concept of health in order to treat disease

The tentative account of the triad given above is dependent only on the professional, personal, and social conception of negative bodily occurrences and not on a positive concept or theory of

health. The triad of *disease*, *illness*, and *sickness* has been shown to serve a practical purpose integrating "controversial cases" and to present a framework for analysing epistemic and normative challenges to medicine. Furthermore, it has revealed normative differences between the spheres, and in particular a primacy of the concept of *illness*. Hence, the triad has been shown to be fruitful without a concept of health.

This coincides with Tranøy's argument that we are more ready to define negative notions such as *illness* and *disease* than *health* (Tranøy 1967, p. 355). Tranøy relates this to a general asymmetry in ethics. There is a higher "moral weight" attached to negative notions than to positive ones. There is an asymmetry between concepts such as *good* and *bad*, *health* and *disease*, or *life* and *death* (Tranøy 1967, p. 351). This also agrees with Hans Georg Gadamer's general emphasis of negative critique (Gadamer 1960). In particular it is in accordance with his characteristic of the hiddenness or enigma of health, *die Verborgenheit der Gesundheit* (Gadamer 1993). Gadamer argues that *health*, as the aim of medicine, is not a definable concept. Ailment (Krankheit), however, is. Furthermore, he acknowledges the professional, personal,, and social aspects of human ailment, as well as their normative aspects (Gadamer 1987, p. 258).[15]

This is not the proper place to enter into a detailed discussion on asymmetries in ethics. Suffice it here to note that the triad has been applied without a general theory of health, and that it has been fruitful to analyse important epistemic and normative challenges to modern medicine. Hence, we do not need a concept of health in order to handle people's negative bodily occurrences. To further illustrate the triad's fruitfulness, let me turn to the last question raised at the outset of this article: how can the triad explain the difficulties of defining the basic concepts of health care?

Difficulties of definition

Conditions such as pregnancy, excellence, ageing, fibromyalgia, homosexuality,, and a general feeling of dissatisfaction or incompetence have challenged explicit definitions of basic concepts

[15] "Das Ziel [der Medizin], die Gesundheit, ist nicht ein von der Arztkunst her klar definierbarer Zustand. Denn Krankheit ist ein sozialer Tatbestand, sie ist auch ein psychologisch-moralisher Tatbestand, weit mehr als ein von den Naturwissenschaften aus bestimmbares Faktum." (Gadamer 1987, p. 258). "[t]he goal of health is not a condition that is clearly deniable from within the medical art. For illness is a social state of affairs, much more than a fact that is determinable from within the natural sciences." (Gadamer 1996, p. 20).

of health care. Biostatistical definitions have been profoundly challenged with conditions such as pregnancy, excellence, and homosexuality, because they represent deviance from statistical "normality". Welfare-based definitions (well-being, happiness, goal-realisation, action failure) are challenged with the conditions of dissatisfaction and incompetence, because they tend to relativise the concepts.

To be able to handle all these difficulties many have tried to refine definitions of basic concepts of health care. However, as it has been argued here, there appear to be distinct perspectives to occurrences conceived of as human ailment. To embrace all these perspectives in one single concept appears to be difficult.

Furthermore, some of the definitions of basic concepts in modern health care appear to be monistic. Although there is a variety of basic concepts in health care, such as *health*, *disease*, *illness*, and *sickness*, one single concept is the basic concept from which the other concepts are developed. E.g. Nordenfelt derives concepts like *disease* and *illness* from his concept of *health*. Again, a monistic approach appears to face the same challenges of taking into account the different perspectives; as trying to cover them all with one concept.

However, the difficulties of defining the basic concepts are not only due to the described complexity of perspectives but also to the relation between them. *Disease*, *illness*, and *sickness* are not static concepts, they influence each other and the borders between them are blurred. This influence can be described in three different ways.

Interrelating concepts

Firstly, the spheres of *disease*, *illness*, and *sickness* are not independent of each other. The attribute of social status (*sickness*) is influenced by distinctions made, processes described and entities applied in the medical profession. *Infertility,* traditionally not ascribed to the *sick role*, qualifies for economic support in many countries because it has become treatable as a *disease*.

Accordingly, the experience of *illness* is affected by medical knowledge in the same manner. The personal experience of ailment is influenced by the medical terminology, e.g. a soccer-player might state that he has some pain in his *meniscus* or a patient can feel his "large intestines a bit bound" (Nessa & Malterud 1998). Conversely, the experience of *illness* influences the activities of the medical profession. Research into lower back pain and whiplash was initiated by peoples'

suffering and need for help. The status of pregnancy and childbirth as *illness* and *sickness* has made the medical establishment hospitalise pregnant women as if they were suffering from diseases.[16]

Correspondingly, the sphere concerned with *disease* is influenced by the social status of *sickness*. The search for a causal explanation for fibromyalgia is supported by its status as *illness* and *sickness*. On the other hand, cases of the common cold are not usually classified as *sickness*, therefore the viruses which are the etiologic agents are normally not traced, even though this is technologically possible (Copeland 1977, p. 530). Furthermore, the social sphere governs medical education and research to a wide extent. The social and psychological influences on the concept of disease are clearly reflected in the influential biopsychosocial model of disease (Engel 1977).

Secondly, the class membership of the spheres may vary with time. As Twaddle has pointed out, a person may be a member of none, one or more spheres at the same time (Twaddle 1994a, pp. 13-16). However, the membership may be complex and change with time, e.g. both the medical professionals and ill people are members of society, and thus all influence the sphere of *sickness*. In particular, in some countries the physician is the representative of society and manages both *disease* and *sickness* at the same time[17]. Furthermore, all members of society, whether medical professionals or not, may become *ill*.

Thirdly, a practical-historical observation may be added. The concepts of disease change with time and depend on praxis. This influences medical taxonomy. Diseases are defined according to abnormalities of morphology, physiological aberrations, biochemical defects, genetic abnormalities, ultrastuctural abnormalities, and etiologic agents (Copeland 1977, p. 530). Hence, it has been difficult to provide a consistent medical taxonomy. There is no unified nosology

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[16] Furthermore, if the differentiation between disease entities are of no influence on the *illness* of patients they are in practice abandoned, e.g. the histopathological distinction between meningothelial type I and type II meningiomas is seldom made. Both tumours share the same prognosis and treatment (Copeland 1977, p. 535-6).

[17] This is particularly so in the Scandinavian health care system, where physicians administer sick leave, making them directly involved in the sphere of *sickness*, in addition to that of *disease*.

(Ibid), and the taxonomy seems to be more influenced by prognostic and therapeutic capacity than by formal definitions (Scadding 1967).[18]

Thus, the distinctions between *disease*, *illness*, and *sickness* are not clear-cut. Twaddle's ideal relation of *disease* leading to *illness* subsequently resulting in *sickness* appears too simplistic, and Nordenfelt's conception of them as disjoint (as a trichotomy) seems to be difficult to defend. As argued, the concepts are not disjoint, but the borders between them are blurred, and the concepts influence each other. *Disease*, *illness*, and *sickness* are interdependent concepts.

However, the concepts of the triad are concerned with the same matter: human ailment in terms of negative bodily occurrences, but the extensions of *disease*, *illness*, and *sickness* relate to different perspectives. This might be why it appears to be difficult to give one assembling definition of all negative bodily occurrences, or why it is so difficult to define them by each other.[19] Thus, the interrelated but still different perspectives represent an inherent difficulty to providing strictly consistent definitions, and this may be the reason why the definitions of basic concepts such as *disease*, *illness*, and *sickness* have become controversial in the philosophy of medicine. However, although they appear to influence each other and they vary with time, the personal, professional, and social perspectives appear to persist.

Concluding remarks

The point of departure for this article was a review of the debate between Twaddle and Nordenfelt on the triad *disease*, *illness*, and *sickness*. It acknowledged Nordenfelt's critique of Twaddle's definitions, but instead of tinkering with these definitions in order to render them less objectionable, a coarse and tentative account of the triad was given. This account acknowledged the different perspectives on human ailment: professional, personal, and social.

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[18] Additionally, at a given point in history, there is not always agreement what is *disease* and what is *sickness* within the medical profession and the social institutions respectively.

[19] Tranøy has pointed out that some of the basic concepts of health care, such as *health* and *disease* belong to different categories and thus are not definable by each other. Although they are interdependent, they are not interdefinable (Tranøy 1995a; 1995b).

The objective has been to investigate whether the triad, *disease*, *illness*, and *sickness* still can be fruitful, and in particular, to investigate its explanative power. Some conclusions can been drawn from this analysis:

Firstly, the triad of *disease*, *illness*, and *sickness* is able to address controversies over basic concepts in health care. It is thus a suitable conceptual framework for analysing and facing controversial cases. In particular, the triad represents a framework for addressing the normative as well as the epistemic challenges in medicine. It enables us to identify and analyse normative matters such as autonomy, paternalism, rationing,, and medicalisation in terms of conflicting perspectives.

Secondly, the analysis also reveals epistemic and normative differences between the concepts, in particular a primacy of *illness*. This is in accordance with a common account in the philosophy of medicine. It does not, however, imply that all cases of *illness* are to be treated by the health care system. The other spheres of the triad, *disease* and *sickness* protect society from medicalisation of the life world. Any kind of *illness* is not the concern of medicine, and happiness is not its goal.

Thirdly, the triad of *disease*, *illness*, and *sickness* can be fruitful without a general concept of health. We do not need a concept of health to respond to human ailment, in particular we do not need a concept of health to treat disease. This agrees with the philosophical account that ailment is more easy to conceive of than health, due to the general primacy of negative normative notions over positive ones.

Fourthly, it has been argued that the triad clarifies why it is so difficult to render strict and consistent definitions of concepts such as *disease*, *illness*, and *sickness*. These concepts are not mutually exclusive, but are interdependent. They represent different perspectives on human ailment, and are thus difficult to unite in a strict and consistent definition.

Another commonplace but significant conclusion can be added: since it has been argued that the triad of *disease*, *illness*, and *sickness* is fruitful without a conceptual framework of health, the term “health care” appears to be a paradox. A consequence of this analysis is that it seems to be both difficult and unnecessary to define the concepts of *disease*, *illness*, and *sickness* in the term of *health*. Thus, a system or institution intended to handle cases of human ailment does not properly fall under the term “*health* care”, thus “health care” is a contradictory term used to

describe the eradication of disease (defects and injuries).[20] To avoid the paradox of "health care" and include the structure of the triad it might be more proper to differentiate between the terms *disease treatment system*, *illness care system*, and *sickness rights system*. Instead of trying to save the term "health care" by elaborating a system of "health enhancement" (Nordenfelt 1998), the ailment-based triad restricts the duties and rights in a medical system. There is a fundamental difference between a "health care system" based on negative notions of human ailment such as *disease*, *illness*, and *sickness* and a system based on the concept of *health*.

A clearer differentiation of what is called "health care" appears to be fruitful. The concepts of the triad exhibit profound perspectives to human ailment. The medical profession provides a perspective that is different from that of the patient and from that of social institutions. It is because *disease* is distinct from both *illness* and *sickness* that the medical profession is able to help. This means, however, that *illness* or *sickness* cannot be reduced to *disease*. That is, there are limits to what the medical profession can be expected to do and what it should do. Correspondingly, the other concepts of the triad represent distinct subject matters with characteristic limitations. Hence, the concepts of the triad display profound limitations that are easily neglected in the "health care" system.

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[20] Even Nordenfelt's health-based concept seems to suffer from this paradox. In his analysis of general health enhancement, he returns to defining medical care in terms of disease and injuries. Medical care aims at "eradicating diseases and injuries by cure or at reducing the negative consequences of diseases and injuries for the person who has been stricken" (Nordenfelt 1998, p. 75). If health really had primacy in relation to *disease*, *illness* and *sickness* (including defects and injuries) then a system of health enhancement should not need to be based on "medical care" dealing with ailment. Furthermore, a definition of medical *care* should not need to be based on the *treatment of disease*.

References

Beachamp T.L., & Childress J.F. (1989). *Principles of Biomedicla Ethics*. New York: Oxford University Press.

Boorse, C. (1975). On the Distincion Between Disease and Illness. *Philosophy and Public Affairs*, *5*, 49-68.

Boorse, C. (1977). Health as a Theoretical Concept. *Philosophy of science, 44*, 542-573.

Brown, W.M. (1985). On Defining 'Disease'. *Journal of Medicine and Philosophy, 10*, 311-28.

Cohen, H. (1961). The evolution of the concept of disease. In B. Lush (ed). *Concepts of Medicine: a collection of essays on aspects of medicine*. Oxford: Pergamon Press.

Copeland, D.D. (1977). Concepts of Disease and Diagnosis. *Persp Biol Med, 20*, 528-38.

Delkeskamp-Hayes, C., & Cutter, M.A.G. (1993). *Science, technology, and the art of medicine: European-American dialogues*. Dordrecht: Kluwer Academic.

Eisenberg, L., & Kleinman, A. (1981). *The Relevance of Social Science for Medicine*. Dortrecht: Reidel.

Engel, G.L. (1977). The need for a new medical model: A challenge for biomedicine. *Science 196*, 129-36.

Engelhardt, H.T. (1975). The concepts of health and disease. In H.T. Engehlardt and S.F. Spicker. *Evaluation and explanation in the biomedical sciences* (pp. 125-41). Dordrecht: Reidel.

Feinstein, A.R. (1967). *Clinical Judgement*. Baltimore: The Williams and Wilkins Company.

Fischer, E.S., & Welch, H.G. (1999). Avoiding the Unintended Consequences of Growth in Medical Care. *JAMA, 281*, 446-53.

Fulford, K.W.M. (1993). Praxis makes perfect: Illness as a bridge between biological concepts of disease and social conceptions of health. *Theoretical Medicine, 14*, 305-20.

Gadamer, H.G. (1960). *Wahrheit und Methode: Grundzüge einer philosophischen Hermeneutik*. Tübringen: Mohr.

Gadamer, H.G. (1987). *Gesammelte Werke*. Tübringen: Mhor, Vol.4.

Gadamer, H.G. (1993). *Über die Verborgenheit der Gesundheit*. Frankfurt aM: Suhrkamp. English translation: Gadamer, H.G. (1996). *The Enigma of Health: The Art of Healing in a Scientific Age*. Stanford, California: Stanford University Press.

Gillon, R. (1986). On sickness and on helath. *Brit Med J, 292*, 318-20.

Hesslow, G. (1993). Do we need a concept of disease. *Theoretical Medicine, 14*, 1-14.

Hudson, R.P. (1983). *Disease and Its Control*. London: Greenwood Press.

Illich, I. (1975). *Medical Nemesis: The Expropriation of Health*. Calder and Boyars, London.

Jensen, U.J. (1984). A critique of essentialism in medicine. In: L. Nordenfelt and B.I.B Lindahl (eds.). *Health, disease and causal explanations in medicine* (pp. 63-73). Boston: Reidel.

Jonas, H. (1985). *Technik, Medizin und Ethik*. Frankfurt a.M: Insel Verlag.

Kennedy, I. (1983). *The Unmasking of Medicine*. London: Granada.

King, L. (1954). What is a Disease? *Philosophy of Science, 21*, 193-203.

Knowles, J.H. (ed) 1977. *Doing better and feeling worse*. New York: Norton & Co.

Kovács, J. (1998). The concept of health and disease. *Medicine, Health Care and Philosophy, 1*, 31-9.

Le Fanu, J. (1999). *The rise and fall of modern medicine*. London: Little Brown.

Lennox, J. (1995). Health as an objective value. *Journal of Medicine and Philosophy, 20*, 499-511.

Margolis, J. (1976). The concept of disease. *Journal of Medicine and Philosophy, 1*, 238-55.

Marinker, J.H. (1975). Why Make People Patients? *Journal of Medical Ethics, 1*, 81-4.

Nessa, J., & Malterud, K. (1998). Feeling your large intestines a bit bound: clinical interaction – talk and gaze. *Scand J Prim Health Care, 16*, 211-5.

Nordenfelt, L. (1987). *On the Nature of Health*. Dortrecht: Kluwer.

Nordenfelt, L. (1994). On the Disease, Illness and Sickness Distinction: A Commentary on Andrew Twadle's System of Concepts. In A. Twaddle and L. Nordenfelt. *Disease, Illness and Sickness: Three Central Concepts in the Theory of Health* (pp. 19-36). Linköping: Studies on Health and Society, 18.

Parsons, T. (1951). *The Social System*. London : Routledge & Kegan Paul.

Parsons, T. (1958). Definitions of Health and Ilness in the Light of American Values and Social Structure. In E.G. Jaco (ed.). *Patients, physicians and illness : sourcebook in behavioral science and medicine*. New York: Free Press.

Parsons, T. (1964). *Social Structure and Personality*. New York: Free Press.

Pellegrino, E.D., & Thomasma, D.C. (1981). *A Philosophical Basis of Medical Practice*. New York and Oxford: Oxford University Press.

Pellegrino, E.D., & Thomasma, D.C. (1993). *The virtues in medical practice*. Oxford: Osford University press.

Pörn, I. (1993). Health and Adaptedness, *Theoetical Medicine, 14*, 295-303.

Rather, L.J. (1958). Zur Philosophie der Begriffs "Krankheit". *Deutsche Medizinische Wochenschrift*, 83, 2012-8.

Reiser, S.J. (1978). *Medicine and the Reign of Technology*. New York: Cambridge University Press.

Reznek, L. (1987). *The nature of disease*. New York: Routledge & Keagen Paul.

Rothschuh, K. (1972). Der Krankheitsbegriff. (Was ist Krankheit?). *Hippokrates, 43*, 3-17.

Ryle, G. (1949). *The concept of mind*. London: Hutchinson.

Räikkä, J. (1996). The social concept of disease. *Theoretical Medicine* 17(4), 353-61

Sachs, L. (1988). *Medicinsk Antropologi*. Stockholm: Liber.

Sade, R.M. (1995). A Theory of Health and Disease: The Objectivist-Subjectivist Dichotomy. *Journal of Medicine and Philosophy, 20*, 513-25.

Scadding JG (1967). *Sarcoidosis*. London: Eyre & Spottiswoode

Sundström, P. (1987). *Icons of Disease: a philosophical inquiry into the semantics, phenomenology and ontology of the clinical conceptions of disease*. Linköping: Linköping University. 1987.

Temkin, O. (1963). The Scientific Approach to Disease: Specific Entity and Individual Sickness. In A.C. Crombie (ed.). *Scientific Change: Historical Studies in the Intellectual, Social and Technical Conditions for Scientific Discovery and Technical Invention from Antiquity to the Present* (pp. 629-47). New York: Basic Books.

Tranøy, K.E. (1995b). Grunnleggende etiske prinsipper i helsetjenesten. In P.E. Liss and B. Petersson. *Helsosamma tankar* (pp. 145-54). Nora: Nya Doxa.

Tranøy, K.E. (1995a). Om helsebegreper og helsetjeneste: en meditasjon. In K. Klockars and B. Österman. *Begrepp om hälsa: filosofiska och etiska perspektiv på livskvalitet, hälsa och vård* (pp. 127-139). Stockholm: Liber Utbildning.

Tranøy, K.E. (1967). Asymmetries in ethics. *Inquiry, 10*, 351-372.

Turner, B.S. (1987). *Medical Power and Social Knowledge*. London: Sage Publications.

Twaddle, A. (1968). *Influence and illness: definitions and definers of illness behavior among older males in Providence, Rhode Island*. Thesis (Ph. D.)--Brown University.

Twaddle, A. (1994a). Disease, illness and sickness revisited. In A. Twaddle and L. Nordenfelt. *Disease, Illness and Sickness: Three Central Concepts in the Theory of Health* (pp. 1-18). Linköping: Studies on Health and Society, 18.

Twaddle, A. (1994b). Disease, Illness, Sickness and Health: A Response to Nordenfelt. In A. Twaddle and L. Nordenfelt. *Disease, Illness and Sickness: Three Central Concepts in the Theory of Health* (pp. 37-53). Linköping: Studies on Health and Society, 18.

Twaddle, A.C. (1973). Illness and Deviance. *Social Science and Medicine, 7*, 751-62.

Twaddle, A.C. (1974). The Concept of Health Status. *Social Science and Medicine, 8*, 29-38.

Twaddle, A.C. (1979). *Sickness behavior and the sick role*. Boston: Hall.

Twaddle A.C. (1981). *Sickness behavior and the sick role*. Cambridge, MA: Schenkman.

Wittgenstein, L. (1953). *Philosophical Investigations*. Oxford: Blackwell.

Yong, A. (1982). The Anthropologies of Illness and Sickness. *Annual Revue of Anthropology, 11*, 257-85.

Paper 3

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The technological invention of disease

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Abstract

Technology has come to play a profound role in medicine since the middle of the 19th century, and many scholars have analysed the role of technology in medicine. Parallel to this development there has been a comprehensive debate on the concept of disease. This article combines these fields and investigates the influence of technology on the concept of disease. With reference to the literature it tries to elaborate an explicit account of the constitutive role of technology in relation to the concept of disease. It will be argued that technology constitutes the concept of disease in three profound ways. Firstly, technology provides the physiological, biochemical, and biomolecular entities that are applied in defining diseases. Secondly, it establishes the way we try to gain knowledge of disease and the way we recognise disease in practice. Technology constitutes the signs, markers and end points that define disease entities and it strongly influences the explanatory models of disease as well as medical taxonomy. Thirdly, technology establishes how we act towards disease: thorough diagnosis and treatment technology establishes the actions that constitute the concept of disease. Altogether, this constitutive technological influence on the concept of disease is considered as a technological invention of disease.

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Keywords: Technology; concept of disease

Introduction

There has been a diverse and complex debate on the concept of disease. It has been debated whether "disease" is a theoretical or a practical concept.[1–5] Furthermore, the logical, the ontological and the normative status of the concept of disease have been widely discussed.

Parallel to the debate on the concept of disease, there has been a debate on the role of technology in medicine. There is unanimity that technology plays an important role in the development of medical theory as well as clinical practice. Technology has become the driving force of medical development. It has changed medical knowledge as well as its practice. The discovery of bacteria, the development of penicillin, and the elaboration of the diagnostic and therapeutic armamentarium—electrocardiographs (ECG), x-rays, magnetic resonance imaging (MRI), endoscopy and genetic and pharmaceutical products—have all played an evolutionary role in medicine over the last two centuries.

Although both the concept of disease and the role of technology in medicine are central issues in the philosophy of medicine, only a few scholars have extensively addressed the question of how technology influences the concept of disease. The objective of this article is to elaborate, from the existing literature, an explicit account of the constitutive role of technology in relation to the concept of disease.

There might be many ways in which technology influences health care in general and the concept of disease in particular. Firstly, according to a common account, technology has eradicated many diseases, reduced the prevalence of others and improved the health of the human race. Technology has great potential for reducing disability and avoidable death, improving the quality of life and prolonging lives of good quality.[6] That is, technology alters the occurrence of disease. Secondly, it has been argued that technological development alters the physical and social environment of humanity, creating new diseases. Life in modern urban societies causes man to develop new diseases.[7] Thirdly, modern medicine has become dependent on and altered by the technical armamentarium it applies. It has changed the content and configuration of its knowledge. Both in theory and in practice, technology appears constitutive of medical activity and its basic concepts.

Only one of these three perspectives will be addressed in this study. The perspective of technology eradicating disease is an epidemiological matter and will not be pursued here. The second one, analysing how technology changes the human environment and thereby the distribution and definition of diseases, is an indirect perspective. Even though there might be a plausible explanation of how technology has influenced the human environment, this does not necessarily explain the emergence of new diseases. This matter will therefore not be pursued any further. The third perspective, however, represents the strongest claim. If it can be argued that technology provides the basic phenomena which define disease and does indeed generate and form medical knowledge and action, there has to be an essential relation between technology and the concept of disease. The objective of this review is to investigate such a possibility. This will be done with reference to the literature on the concept of disease and on technology in medicine.

An opening remark on technology

Before we enter the detailed discussion on how technology constitutes the concept of disease, it is important to be clear what is meant by *technology*. A plausible definition of technology might be that it is

the complex of devices, methods and organisations applied in human purposive activity. Both in terms of devices, methods and organisation, technology today is integrated in modern medicine. A defibrillator (heart starter) is not just a box with wires, electrodes and electronic components (*device*). It is a defibrillator because it is a methods of medical resuscitation applied in an *organisation* of health care. This definition of technology stresses the significance of technology for different levels of health care, and accordingly the term "technological medicine"emphasises the constitutive role of technology in modern medicine.

Let us then start with the role of technology in establishing the entities that are applied in defining disease.

I. The technological constitution of the entities defining disease

Technology provides the entities and events that are applied in defining diseases both in diagnostics and in treatment, in clinical practice and in research. The pathological morphology, chemical substances, biochemical agents and biomolecular sequences studied in research, detected in diagnosis and manipulated in therapy are grounded in technology. "It is the x-rays, the laboratory studies, the pathology reports ... which are taken to constitute the central phenomenon [*sic*] of disease."[8] Technology provides the basic entities for defining disease. Light microscopy establishes basic structures, such as the cell, whereas stains and cultures constitute viral and bacterial agents, and electron microscopy defines a range of diseases.

The QRS-complex, the echodoppler image and its corresponding indices, the scintigram and angiogram, establish a wide range of cardiac diseases which are generated by technology such as the electrocardiograph, ultrasound machine, gamma camera and x-ray modality. Entities such as *Helicobacter pylori*, urea, cholesterol, and deoxyribonucleic acid (DNA) are basic to the definitions of diseases such as peptic ulcer, renal insufficiency, cholesterolaemia, and Huntington's disease.

Evans argues that technology constitutes the aetiological agents that define disease. For example, the technology which cultivates and identifies bacterial culture has led to the discovery of most bacteria causing diseases: The development of fluorescent antibodies resulted in the discovery of *M pneumoniae*, and the aetiology of infectious mononucleosis. Furthermore, the growth of human B and T lymphocytes in suspension cultures led to the discovery of several important groups of viruses.[9] In this manner, technology constituted a number of disease entities.

Correspondingly, the phenomena constituting epilepsy were in antiquity conceived as being humoral and spiritual (the sacred disease). Through technology, for example, electroencephalography and chemical analysers, the constitutive phenomena of epilepsy have come to be the electrical activity of the brain and the paroxysmal function of cerebral nerve cells.

Furthermore, we do not perceive entities such as *Helicobacter pylori* and DNA directly, but rather, they are provided by technology. We have no access to the time-delays (T1 and T2) constituting the magnetic resonance image except through the MRI machine. The ECG providing the signs of various cardiac diseases does not exist independently of the electrocardiograph. They are constituted by the armamentarium itself.

Hence, the basic phenomena and entities applied to define many central diseases are provided by technology. Technology, however, also influences the way we detect, identify and interpret these phenomena. That is, technology strongly influences the content and formation of medical knowledge.This will be investigated in the following section.

II. The technological knowledge of disease

Technology constitutes medical knowledge in several ways: It establishes the signs, markers and end points that define the disease entities. Furthermore, technology strongly influences the explanatory models of disease and the way medical knowledge is organised (its taxonomy).

Signs[10]

Modern medicine relies on paraclinical signs for defining and detecting disease.[11] For example blood pressure and venous plasma glucose concentration define diseases such as hypo-, and hypertension and diabetes. A variety of cardiac conditions are defined by specific ECG patterns, ultrasound Doppler flow and tissue stress measurements, and radiographic morphology. Paraclinical signs that define disease might be abnormalities of morphology, physiological aberrations, biochemical defects, genetic abnormalities, ultrastuctural abnormalities and aetiological agents.[12]

Such paraclinical signs are detected with chemical analysers, x-ray-modalities, ultrasonic devices, haemodynamic monitors, computed tomography (CT)-, MRI-, and PET-scanners. Furthermore, they are manipulated by dialysis machines, lasers, diathermy, anaesthiological devices and drugs of various kinds. In this manner technology founds the paraclinical signs that define disease. One important reason for the constitutive role of these paraclinical signs is that they can be reproduced. "The electrocardiograph began to serve as the objective graphic method for establishing firmly and convincingly the clinical diagnosis of coronary heart disease."[13]

Technology renders the signs of disease reliable.

However, not only paraclinical signs are established by technology. Clinical signs earlier investigated by manual means are now tested by technology. "And we are even happier when these pathognomonic signs or specific tests are revealed by the exact instruments of a clinical laboratory, by x-rays or by the whole gamut of electrical recording

machines."[14] The perception of blood colour in a wound has been substituted by oxygenation measures, for example, pO_2 and SaO_2.

Moreover, technology is not restricted to founding the clinical and paraclinical signs of disease. Technology is also applied to detect symptoms and syndromes.[15] The importance of technology in the generation and formation of knowledge in medicine has led to the application of technological tests in the detection of symptomatic diseases and syndromes as well. In fact technology has become the gold standard for assessing and evaluating such conditions. Lung infarction is an example. Here pulmonary angio and lung scintigraphy have been applied as a standard for diagnosing this symptomatic disease.[16]

Furthermore, the set of technological tests is constitutive of how physicians conceive the symptoms of the patient. Chest pain of a certain kind immediately implies an ECG with a focus on the ST-segment. In medical practice the symptoms are transformed into paraclinical signs and tests. Symptoms gain significance only as projections of signs. Technology directs their significance and the way they are interpreted and acted upon.

Hence, technology influences the conception of symptoms in two ways. Firstly, technology is developed to detect symptoms. Secondly, the subjective experience of the patient is projected onto paraclinical signs and tests.

Markers and risk factors of disease

In many cases the signs that define diseases are not accessible. However, various markers are applied to detect and identify them. For instance, changes in DNA are markers or risk factors for Alzheimer's disease (chromosome 1, 14, 19 and 21).[17] For such diseases neither signs nor symptoms are detectable early in the development of the disease. Genetic markers, however, might indicate a disposition to them. Such markers are applied to identify and distinguish disease entities. As with paraclinical signs, disease markers are provided and founded by technology. Advances in technology facilitate the identification of new markers that will be treated as disease.[18]

Thus, the technological constituted signs and markers are basic to the demarcation of disease. They define disease entities and are applied to recognise disease in the particular case, and as such provide a technological semiology of disease.

Technological end points

The signs and markers of disease also represent the measure of what is to be altered in order to make the patient healthy again. The general belief in the existence of basic phenomena such as cells, calcium and potassium concentrations, or signs such as ST-segment displacement and markers like trisomy 21, causes physicians to try to influence and manipulate them. They become end points of medical treatment. The end point of the treatment of hypertension and cholestorelaemia is the blood pressure and the level of cholesterol in the blood. The aim of genetic engineering is to repair or exchange defective DNA sequences, for example in persons showing markers of Huntington's disease. Hence, technology defines the signs and markers to be detected, studied and manipulated in medicine and thereby it also constitutes the end points of medicine.[19]

Technological explanation of disease

It has been argued that there are important conceptual ties between different forms of causal thinking and particular views of what diseases are.[9 20–22] Throughout history disease has been explained within different causal frameworks. Disease has been conceived as an imbalance of the humours (Hippocrates, Galenus), as a disturbance of the morphological structure of the elements of the body, such as its organs (Morgagni), tissues (Bichat) or cells (Virchow), and as an error in the base pair sequence in deoxyribonucleic acid (DNA). "Forms of explanation influence how a disease is conceptualised through the conceptual schemes the explanations presuppose."[23] Hence, the *explanatory language* of medicine is constitutive of the concept of disease.[24–25] In addition, as argued, this language is today formed by technology, and it is technology which constitutes its expressions, measures and aims. In other words, the causality of disease is limited by its frame of reference[26] which is in turn technological methodology.[27] The explanatory models of disease and its causality are constituted by technology.[9]

Moreover, technology has not only constituted the models of disease. It has influenced the models of humanity itself.[28–29] The application of technology in medicine, successfully detecting, identifying and treating disease, has made it a model for human physiology:

"From the 19th century onward there has been a succession of more sophisticated models, all based on the latest fashionable technologies. The ear, originally a harp (according to Helmholtz) became a telephone and is now known to be an advanced stereophonic hi-fi system. The brain, viewed by Descartes as a hydraulic network, has since been recognised as a telephone exchange, a computer and, more recently, a holographic data storage system. The eye was once a telescope, then a simple camera and is now known to be a very elaborate camera, with the original zoom lens and through-the-lens exposure meter, producing instant three-dimensional pictures in colour on re-usable film."[30]

Technology is not only constitutive of the models of health and disease. It provides also for their metaphors. Furthermore, with the application of artificial organs such as pacemakers, cochlear implants and advanced limb prosthesis, technology becomes a part of humanity's physical existence, that is, there is a fusion of human being and technology.[31] Hence, technology constitutes the explanatory models of disease and its symbolism, in

addition to establishing the signs and markers that define diseases.

Technological taxonomy

Furthermore, the organisation of medical knowledge is influenced by technological innovation. Progress in science and technology changes the classification of disease. This is explicitly stated in the introduction to the *International Classification of Disease*.[32] Since the time when technology began to impact on medicine, the number of disease entities has increased coherently with technological development which, whilst typically gauged by qualitative judgments, is generally believed to follow an exponential curve.[33]

The influence of technology on medical taxonomy has been commented on in various ways. Jensen claims that classification does not result from the nature of disease, but from the apparatus of treatment.[34] Wulff correspondingly argues that the development of treatment strongly influences the classification of disease.[35] As will be argued later, technology is constitutive of medical treatment. Hence, a medical taxonomy founded on existing treatment must be influenced by technology.

According to Feinstein the classification of diseases seems to follow three main organising principles.[36] Firstly, diseases are classified according to clinical manifestations. Secondly, they are classified according to entities causing these manifestations. Thirdly, diseases are classified according to patterns and events following the clinical manifestations. The main argument so far is that the manifestations, the causal entities and the resulting patterns and events are constituted, detected and identified by technology. It follows from this that the organisation of medical knowledge is also established by technology.

The influence of technology on the classification of disease appears in several ways. Firstly, technology creates new disease entities. Secondly, it changes existing disease entities. Thirdly, technology differentiates existing disease entities.

NEW DISEASE ENTITIES

There are numerous examples of new disease entities generated by technological innovations. To cover even a fraction of them is beyond the scope of this study. Some examples will be discussed to illustrate the point. It has been argued that the invention of the sphygmomanometer established hypertensio arterialis.[37] Correspondingly, the electrocardiograph revolutionised the analysis of heart diseases, resulting in several new disease entities. For example, the clinical entity atrial fibrillation was established by the ECG.[38–39]

The case of electrocardiography can be applied to illustrate another important aspect of the technological generation of new disease entities. It also constituted conditions such as silent ischaemia. The electrocardiograph revealed that many patients had similar changes of their ECG when undergoing stress-testing as patients with angina, and that such changes predicted an increased risk of heart disease. In this way the technological method established disease without the patient feeling ill. Hence, it was the technological test that defined and detected disease and that initiated medical activity and not the subjective experience of the patient.

In this way technology has replaced the traditional meaning of disease, for example, bodily pain (*dolor corporis*), suspension of joy (*intermissio voluptatum*), and fear of death (*metus mortis*).[40] Disease has become independent of the subjective experience of the person, and technology has endorsed a new range of disease entities: asymptomatic diseases.[41] The development of molecular biology is a clear example of this. A great number of new disease entities are based on genetic abnormalities. A variety of genetic tests can detect diseases where the person tested does not feel ill.

How technology has made medicine less dependent on the subjective experience of the patient will be discussed in further detail later. Here it has been argued that technology constitutes the classification of new disease entities and a wide range of them are asymptomatic diseases.

TECHNOLOGICAL CHANGE OF DISEASE ENTITIES

When development in technology changes the phenomena that are applied to define disease and the explanatory models of medicine, this correspondingly affects the classification of disease entities.[42–43] "[T]he concepts used in a given field of scientific inquiry will change with the systematic advances made in that field: the formation of concepts will go hand in hand with the formulation of laws and, eventually, of theories."[44] Hence, disease entities alter with the advances of technology. They develop according to "the gradual adoption of characteristics derived from more precise fields of inquiry" and the "new definition tends gradually to displace the old".[45] A "more precise field of inquiry" refers to the technological approach to medicine, for example the introduction of the electrocardiograph, resulting in people "beginning to die of myocardial infarction rather than indigestion".[46]

Disease terms such as "epilepsy" and "dropsy" have been applied in medicine since ancient times. Their meaning and extension, however, have changed. The name "dropsy" was replaced by "Bright's disease", which was then exchanged for "nephritis", and lately, has become "end stage renal disease" (ESRD).[47]

Changes in conceptual framework, for example the prevailing entities, theories and tests, result in alteration of disease entities. For example diabetes has been conceived of as a condition caused by excessive salt (Paracelsus), excessive food, sex or alcohol (Amatus Lusitanus), as a disturbance of the nervous system (Cullen), as a disturbance of the nutrition of the liver (Bernard), atrophy of the pancreas (1788–1910), and hydropic degeneration of the islets of Lagerhans (Opie).[48] Today diabetes is considered to be the result of infectious agents. Similarly, infectious diseases were earlier classified

according to their respective organs. Today they are classified separately. The technological detection of viral and bacterial specimens establishes the category: infectious diseases.

Hence, technological development in medicine changes the definitions and taxonomy of disease entities.[12 32 49]

DIFFERENTIATION OF DISEASE ENTITIES

A third way in which technology has contributed to the development of disease entities is through the differentiation of existing entities. What was once reckoned to be one disease entity has, through the development of technology, evolved into a multitude of different diseases, for example what was once called acute respiratory disease developed into many different infectious and chronic diseases entities. The only way both to differentiate and properly detect the various entities was by the use of proper laboratory technology.[50] Diseases, previously diagnosed in only a vague manner, have now been rendered less ambiguous by technological means and can thus be clearly differentiated.

For example, angiography, echodoppler and tissue-velocity-imaging have resulted in an extended classification of myocardial infarction. The application of the tank respirator in the 1950s established the differentiation between intercostal and bulbar polio.[51] In the case of intercostal polio the treatment with a respirator had an effect, but not in the case of bulbar polio.

So, technology has altered medical taxonomy: It has constituted new disease entities and changed and differentiated existing entities.

From subjective symptoms to objective signs

Technology has thus become constitutive in defining, classifying and identifying disease entities. It has been argued that technology makes diagnosis and treatment objective and reliable. It facilitates direct access to the disease. "Ophthalmoscope, bronchoscope, etc allow him [the physician] a direct view of the conditions of many parts."[52] This, however, has reduced the epistemological importance of the individual person for the concept of disease; it has reduced the importance of the subjective experience of the patient.

Before the eighteenth century medicine was based on the patient's narrative of the symptoms. In addition to this subjective portrait of the illness, the physician observed the patient's appearance and behaviour as well as any signs of disease. During the eighteenth and nineteenth centuries medical instrumentation enabled and extended the physical examination of patients which made the physician less dependent on subjective narration.[53]

"In the nineteenth century, a separation between the subjective history of the patient and the objective examination by the physician became noticeable. The objective signs of percussion and auscultation were the early core of examination; temperature curves and the result of the ever increasing tests and special examinations, followed. Thus the case history has come to incorporate all the data obtained through the scientific progress of medicine."[50]

With the stethoscope the physician could "listen to the disease directly". Measuring blood pressure gave an "objective account" of the internal conditions in the patient. The introduction of machines such as the ECG, x-ray, and chemical laboratory analysers during the nineteenth and twentieth centuries further enhanced the objectivity of medicine.[54] "Experimental medicine enables the physician to interpret his findings so as to translate the language of symptoms and tests into the language of physiological processes. Here then is a scientific approach to individual sickness."[55] Furthermore, the doctor had to ignore the obvious symptoms and signs. "Fever and joint pain were the symptoms that frequently brought patients to doctors. Yet, it was just these obvious complaints that physicians were asked to ignore in favour of potential dangers, often unperceived by the patient, that had to be detected through new technological devices."[56]

In addition to removing the errors introduced by subjective patients, technology also reduced the risk of error in physicians' judgments. Technology freed medicine from the subjective, individual and emotional, which confused the conception of "the real objective disease". "Twentieth-century technology with all its progress had tended to push the human dilemmas of illness out of the doctor's thoughts, and replace them with laboratory facts derived from tests on the patient's body."[57] Whereas the physician earlier was dependent on narration and clinical signs, he has nowadays come to rely on pathogenetic and aetiological signs.[58] Technology has guided medicine from basing its knowledge on symptoms to basing it on clinical signs, and from them to paraclinical signs and markers.

There has been "a detachment from the suffering of [the] patient".[59] This detachment is made explicit in the technological concept of disease. The capacities of technological medicine have replaced the individual patient as the epistemological basis of the disease concept. This has urged critics to maintain that medicine has become a "stranger medicine"[60] and that technology has altered the patient's experience of being ill, for example that the x-ray image becomes part of the patient's illness.[61]

The technological gaze on disease

One way to epitomise how technology has influenced the content and formation of medical knowledge, is through the notion *technological gaze*. As argued, technology constitutes the signs, markers and end points that define disease entities, it strongly influences the explanatory models of disease and the way that medical knowledge is organised, ie medical taxonomy. Hence, technology provides medicine with a new and radically different semiology.[62]

Technology constitutes the categories of the medical gaze. It translates the physiological events into "the language of machines".[63] "Innovations transform the perceptual experiences ... of those who use them."[64] Medical technology creates what the physician, the technician or the researcher sees. And they see what they are looking for: *disease*. "The technology mediates between the seer and the seen and what is seen becomes largely constituted by technology. This is why practices change with the development of new technologies."[65] As argued, technology even transfers subjective symptoms into the realm of paraclinical signs.

The way we perceive diseases, name them and talk about them is dependent on technology. Technology has become constitutive of the medical gaze and added to medical language. "The technical elucidation of somatic disease pictures has steadily added to and refined our vocabulary of disease entities."[66] "Roentgenology, endoscopy, biopsy, and unprecedented surgical operations became available, allowing clinicians to observe specific representations of morbid anatomy during life. With these new techniques of observation, the clinician could now classify evidence directly."[43] Hence, the medical gaze and the way we talk about this medical perception have altered with technological development. The change in medical gaze can be recognised in medical language. "[T]he question of chest pain has been changed to the question of coronary heart disease, which is changed to the question of coronary artery disease ... . [C]hanging the question is a result of available technology."[67]

Before the nineteenth century dropsy was characterised and recognised by symptoms such as diminished urine and swollen legs. During the 1840s, patients with the same symptoms came to have Bright's disease. The technique of detecting albuminuria had, together with the recognition of different textures of autopsied kidneys, established a new disease entity. Furthermore, the application of the light microscope and cryoscopy during the 1850s established the disease entity (glomerulo-) nephritis. In the 1970s the development of the dialysis machine and the method of transplantation established end stage renal disease (ESRD) as a disease entity.[47]

Each new technology represented a new perspective and a new language which were distinctively different from the perspective and the language of the patients. Technology changed the physician's perception and made disease the physician's property, but at the same time removed him or her from it. "The nephrologist has ... lost touch literally with the diseased kidney itself ... [he] now sees kidneys only microscopically, a biopsied bit at a time, or views shadowy reniform images on an ultrasound screen."[68] Or in other words, there is an electronic narration of disease.[69]

This technological gaze in medicine has been criticised because it fits the illness of the patient to the skills of technology. As H Spiro, a Yale professor in medicine, remarked:

"The worst problems come when the doctor fits the patients to his skills, something which is true for all professions. A woman comes to a gastroenterologist and gets a sigmoidoscopy, a barium enema and a high fibre diet. Going to a gynecologist, she runs the risk of laparoscopy and of losing her uterus if she continues to complain. ... I know that the minute I see the x-rays of the patient, before looking at the patient or before working on him, I will fit the patient's story into whatever the x-rays or other images are showing me."[20]

Altogether, medical knowledge is constituted by technology: technology constitutes the signs, markers and end points that are applied to define disease entities, it strongly influence the explanatory models of disease and the way that medical knowledge is organised. Hence, there is a *technological gaze* in medicine.

III. The practical formation of the disease concept

In addition to this essential role of technology in the formation of medical knowledge and the constitutive role of technology to the (physiological, biochemical, biomolecular and morphological) entities that are applied to define disease, there is a pragmatic influence on the conception of disease. The concept of disease is defined by its use,[70] and the use of the term "disease" is constituted by the application of histopathological and chemical analysers, CT, MRI and PET scanners, and ECG, electroencephalographs (EEGs) and electromyographs (EMGs). Hence, technology does not only constitute the concept of disease by its subject matter and by medical knowledge, but also through medical practice. This practical formation of the disease concept will be investigated in the following sections.

The technological constitution of medical action

Conceptualising disease is motivated by the purpose of medicine: to help the patient.[3 5] The concept of disease is formed by the physician's capacity for action. This seems to create an obligation: "Choosing to call a set of phenomena a disease involves a commitment to medical interaction."[71] The need for medical intervention causes certain conditions to be perceived and classified as disease.[72–73] The perspectives of the medical gaze and the concepts of medical language have an aim: medical action.

DIAGNOSIS

Blume has pointed out the special importance of technology for diagnosis: "Through a variety of processes, physicians have been led to attach more and more significance to the evidence provided by machines. This is nowhere more evident than in the field of diagnostics."[74] The diagnostic methods give access to the signs and markers that define the disease entities. They provide the means to recognise

the entities in clinical practice. The diagnostic methods of modern medicine are founded by technology, which ties the concept of disease even closer to technology.

In this way, technology comes to constitute an *operational definition* of disease where the concept of disease is defined with reference to a particular operational test.[44 75] "Disease" is a term that applies to all those cases where a given technological test yields a specific outcome. Diabetes mellitus is defined as a fasting glucose concentration of the blood plasma above a given level. Hence the practical identification of disease is given by the technological test.

Furthermore, it has been argued that the practical ability to detect phenomena in the human body has changed the meaning of these phenomena. Detectable phenomena, such as the electrical activity of the heart disclosed by ECG, gained importance by their correlation to various pathologies. The electrocardiogram "transformed the meaning of the heart's electrical activity".[76] Although this electrical activity was already known to a certain extent at the end of the 19th century, it had no pathological significance. With the development of the electrocardiograph the electrical activity of the heart gained significance and constituted disease entities. Correspondingly, disease entities that earlier were detected using one technological method alter diagnosis with the emergence of new technology. Congenital heart disease was earlier detected by angiography, but is now diagnosed by ultrasound Doppler and tissue stress measurements. A change in diagnostic method has altered the conception of the disease.

It might be argued that there are a vast number of disease entities where there are no technological tests. Hence, technology cannot be constitutive of the definition and diagnosis of the disease entities. Even new disease entities, for example whiplash and fibromyalgia have no corresponding technological tests. These examples, as with other symptomatic diseases, do not, however, weaken the argument for the technological diagnosis of disease. On the contrary, these cases are controversial in medical literature. They are considered as borderline cases and classified as syndromes. Non-technological disease entities are low-status diseases[77] precisely because they are not technologically testable and treatable.[78]

Treatment

In practice the fundamental role of technology in relation to the concept of disease is not limited to diagnosis. There is also a therapeutic constitution of disease. It has been claimed that a technological treatment of disease is the result of a technological conception of disease. A mechanically or technologically structured concept of disease requires a mechanically or technologically structured therapy.[79 80]

However, the relationship between technology and treatment might also be conceived in a reverse mode: technological treatability itself constitutes disease. It has been argued that it is not the concept of disease that decides whether something is treated or not, it is the treatability that makes something a disease.[5] " ... it is not really the presence of a disease that is crucial, but the fact that some medical intervention may be beneficial and that it is within the physician's power to help the patient."[80] "There is little to be gained from labelling [something as disease] if not much can be done once the label has been arrived at."[81] Taylor recognises how therapeutic concern constitutes the concept of disease.[82] Disease is what causes "medical concern for him [the patient] by experienced doctors".[83 84]

The success of technological medicine has made technology the criterion for the demarcation of treatment.[85] The methods of technological medicine determine what is treatable and thereby set a precedent for what is to be treated. That is, medical technology has become the measure of what is to be treated and what is not to be treated, and hence, what is diseased and what is not. Therapeutically the technologies of corrective surgery, regulating blood pressure and artificial fertilisation have caused health care to treat these conditions as diseases: hypoplastic left heart syndrome, hypertension and infertility.[86] Decisions and prognosis have come to be based on technology.[87–88] Furthermore, the possibilities of dialysis and transplantation of kidneys established ESRD as a disease entity.[47]

However, treatability has not only changed the concept of disease by establishing new disease entities. It has also altered existing entities. The ability to detect and treat disease at an early stage has changed the symptoms that patients normally experience and the signs that the doctors relate to the disease. As pointed out earlier, with some diseases the patient never experiences any symptoms at all. Hence, technological treatment alters the course of the disease (perceived by physicians) and the way patients experience it. In this manner technology itself introduces new signs and symptoms that come to constitute the disease. Whereas patients with nephritis earlier experienced diminished urine, swollen legs, nausea and headache, a patient with ESRD is subject to complications of dialysis treatment, such as dialysis-introduced cramps, clotting and infection of catheters and shunts, chronic anaemia, renal bone disease and aluminium toxicity.[89]

Thus, technological treatment influences the concept of disease in a variety of ways. Mitcham elegantly summarises the influence of technology on the basic concepts of medicine:

"Medicine is increasingly defined by the type and character of its instruments (from stethoscope to high-tech imaging devices) and the construction of special human-artefact interactions (synthetic drugs, prosthetic devices). Indeed, the physician-patient relationship, medical knowledge, and the concept of health are all affected by technological change."[90]

Whether technological treatment is a result of a technological conception of disease or technological treatability strongly influences the concept of disease, the conclusion is the same: technological treatment is basic to the concept of disease. In the former case, the technological concept of disease is established by the pragmatic concern for diagnosis. One applies a technological concept of disease in order to be able to detect the phenomena of disease. In the latter the concept of disease is founded by treatability. However, both diagnosis and treatment are established by technology.

The technological influence of diagnosis and treatment can also be recognised in the way medicine is organised. Disease taxonomy affects the centralisation and specialisation of medicine.[91–92] This is displayed by the emergence of diagnostic departments, for instance in radiology, nuclear medicine and neurophysiology, and in centres for single technologies such as ultrasound and genetics. Correspondingly, there are therapeutic departments such as chemotherapy, anaesthesiology and dialysis. Hence, there is a technological organisation of diagnosis and treatment of disease.

It has been argued that disease is defined by the methodology of medicine, and that this is constituted by technology. Technology has become the *definiens* of disease. Because of this constitutive role in medical action, technology has become the paradigm method in medicine. This has influenced the status of disease, which will now be investigated.

The technological status of disease entities

In practice, technology has become the general method in medicine. Disease can now be measured using objective instruments,[93] and technology has become the norm for detecting, identifying and treating disease. The success of technology has extended the general belief in technological medicine, enhanced its status and strengthened its paradigmatic position. Technology has become the criterion for the demarcation of what is "real medicine" and what are "true diseases". "'High-tech', hospital-based medicine has been perceived as the acme of medical practice, as against less 'scientific' areas such as primary care … and psychiatry."[94]

In this way technology has not only influenced the concept of disease, but also the status of the disease entities.[77] Acute high-tech diseases, for example myocardial infarction, enjoy a higher status than chronic low-tech diseases in the same way that heart and brain surgery gain a higher position than geriatrics. Malaria, tuberculosis, and cancer are conceived as clear cases of disease, whereas colour blindness, senility, and depression are vague cases.[95] In addition, as already noted, whiplash, and fibromyalgia are low-status diseases because they are not technologically detectable or treatable. Thus, there is a technological influence on the status of the disease entities.[96]

Sensitivity, treatment threshold and the technological expansion of disease

Technology has not only influenced the concept of disease by expanding medical knowledge, as discussed earlier. In practice technology has also expanded the conditions qualifying as disease entities. It has increased the sensitivity to the paraclinical signs and markers.

"The instruments of physics and chemistry, rapidly increasing in sensitivity and complexity, were during the ensuing decades turned to the study of disease. Normal values were determined and deviations from the normal recognized. Hyperchlorhydria and hypochlorhydria, hypertension and hypotension, polycythæmia and anæmia were now capable of recognition and quantitative assessment."[97]

This methodological increase in sensitivity seems to be rich in its consequences. It expands the range of conditions qualifying as disease. An example from Copeland can illustrate this point. "As the technical capability of quantifying the nutritional state increases, our power to distinguish mild or borderline cases of hyper- or hypovitaminosis A also increases. The range of normal or healthful levels thus varies according to the level at which we wish to detect deviations from the mean."[98] Thus, technology increases the sensitivity and enables lower limits of disease. In this manner the technological improvement of medical methods increase the prevalence of disease, ie *technology generates disease*.

The increase in sensitivity combined with improvements in therapeutic capacity leads to a lowered treatment threshold. This results in an apparent improvement in patient outcome,[99] and has made technological methods appear highly successful.[100] This subsequently enhances the constitutive role of technology in defining, in recognising and in treating disease.

Concluding remarks: the technological invention of disease

All in all it has been argued that technology is constitutive of the concept of disease. Firstly, technology provides the physiological, biochemical, biomolecular and morphological entities that are applied in defining diseases. Secondly, it constitutes the formation of medical knowledge. Technology constitutes the signs, markers and end points that define disease entities and it strongly influences the explanatory models of disease and medical taxonomy. Thirdly, technology establishes how we act towards disease: through diagnosis and treatment technology establishes the actions that constitute disease. Furthermore, the practical capability of technology increases the sensitivity and lowers the treatment threshold, resulting in an increased occurrence of disease.

Hence, medical technology has become the measure of all things; a kind of *ars mensura*. It has become the *technê metriké* of the modern age,[101] the measure of what is good and bad, what is to be

treated and not, and hence, what is diseased and what is not. This can be entitled *the technological invention of disease*. What, then, are the consequences of such a "technological concept of disease"?

If the concept of disease is constituted by technology this must be of relevance to the vast, vivid and versatile debate on the concept of disease. The fundamental role of technology will be essential to the debate on the epistemological, ontological and logical status of the concept of disease. Furthermore, it will be of great importance to the debate about the value-ladenness of the concept of disease.

Moreover, the analysis illustrates the importance of paying attention to technology in the general discussion of medicine. Technology, constituting the basic concepts of medicine, its knowledge and its actions, has become essential to the understanding of crucial challenges of modern medicine such as medicalisation, somatisation, paternalism, and patient autonomy. For example, it has been argued that a mechanical conception of disease contributes to paternalistic medical practice due to the reduced role of the patient.[102] Although these issues are beyond the scope of this article the investigation has made it clear that such challenges are related to the role of technology in medicine.

Furthermore, it is worth noting that the analysis does not presuppose a particular conception of technology. The argument that technology is constitutive to the concept of disease does not depend on a determinist view of medical technology,[6 11 20 88 103–104] a phenomenological position,[65] a social constructivist stance[47 56 105–107] or on the value-neutral dictum.[108]

The consequences of such a technological concept of disease will depend on the position one takes to technology. The point here has been to argue that within any of these positions technology is constitutive for the concept of disease: Technology has become the measure of disease.

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References and notes

1 Boorse C. On the distinction between disease and illness. *Philosophy and Public Affairs* 1975;**5**:49-68.
2 Boorse C. Health as a theoretical concept. *Philosophy of science* 1977;**44**:542-73.
3 Jensen UJ. A critique of essentialism in medicine. In: Nordenfelt L, Lindahl BIB, eds. *Health, disease and causal explanations in medicine.* Boston: Reidel, 1984: 63-73.
4 Brown WM. On defining "disease". *Journal of Medicine and Philosophy* 1985;**4**:311-28.
5 Hesslow G. Do we need a concept of disease. *Theoretical Medicine* 1993;**14**:1-14.
6 Jennett B. Medical technology, social and health care issues. In: Gillon R, ed. *Principles of health care ethics.* New York: John Wiley & Sons, 1994: 872.
7 Fabrega H. Scientific usefulness of illness. *Perspectives in Biology and Medicine* 1979;**22**:557.
8 Toombs SK. The temporality of illness: four levels of experience. *Theoretical Medicine* 1990;**3**:227.
9 Evans AS. Causation and disease: effect of technology on postulates of causation. *The Yale Journal of Biology and Medicine* 1991;**64**:513-28.
10 A commonplace definition of *sign* in medicine is that it is an objective piece of evidence of disease, ie such evidence as is perceptible to the examining physician, and which is opposed to the subjective sensations of the patient. A *paraclinical sign* is objective evidence of disease provided by instrumentation. Wulff HR, Gøtzche PC. *Rationel klinik*. København: Munksgaard, 1997. The term "indicator" is used widely as synonymous with "sign", and "pathognomic indicators/signs" have been applied as clinical signs. Cohen H. The evolution of the concept of disease. In: Lush B ed. *Concepts of medicine: a collection of essays on aspects of medicine*. Oxford: Pergamon Press, 1961. Fabrega H. Concepts of disease: logical features and social implications. *Perspectives in Biology and Medicine* 1972;**22**: 583-616 .
11 Cassell EJ. The sorcerer's broom. Medicine's rampant technology. *Hastings Center Report* 1993;**6**:32-9.
12 Copeland DD. Concepts of disease and diagnosis. *Perspectives in Biology and Medicine* 1977;**20**:530.
13 Burch GE. Developments in clinical electrocardiography since Einthoven. *American Heart Journal* 1961;**61**:324.
14 See reference 10: Cohen H: 163.
15 See reference 10: Wulff HR, Gøtzche PC: 110.
16 See reference 10: Wulff HR, Gøtzche PC: 108-9.
17 The application of terms such as "marker" and "risk factor" appears not to be consistent in the literature. Different professions apply them differently.
18 Whittle M. Ultrasonographic "soft markers" of fetal ultrasound. Detecting them may do more harm than good [editorial]. *British Medical Journal* 1997;**314**:918.
19 Signs and markers have been denoted *soft end points*, in contrast to *hard end points* such as survival and morbidity. We do not feel our blood pressure or cholesterol level.
20 Wolf S, Berle BB. *The technological imperative in medicine*. London and New York: Plenum Press, 1981.
21 Fagot-Largeault A. On medicine's scientificity–did medicine's accession to scientific "positivity" in the course of the nineteenth century require giving up causal (etiological) explanation? In: Delkeskamp-Hayes C, Cutter MAG, eds. *Science, technology and the art of medicine. European-American Dialogues.* Dordrecht: Kluwer, 1992:105-26.
22 Juengst ET. *Patterns of reasoning in medical genetics*. Dordrecht: Kluwer, 1993:143.
23 See reference 22: 144.
24 Engelhardt HT. *The foundations of bioethics*. New York: Oxford University Press, 1986.
25 Engelhardt HT, Wildes KW. Health and disease–philosophical perspectives. In: Reich WT. *Encyclopedia of bioethics*. New York: MacMillan, 1995: 1103.
26 Susser M. *Causal thinking in the health sciences*. New York: Oxford University Press, 1973: 14.
27 Jensen UJ. *Sygdomsbegreber i praksis: det kliniske arbejdes filosofi og videnskabsteori*. København: Munksgaard, 1983: 107.
28 von Engelhardt D. Health and disease–history of the concepts. In: Reich WT ed. *Encyclopedia of bioethics*. New York: MacMillan, 1995:1088.
29 In the introduction to *Leviathan* Thomas Hobbes gives a parallel account of man, describing the heart as a spring, the nerves as strings and the joints as wheels. Accordingly Julien Offroy de La Mettrie in *L'homme-machine* gives an explicit account of man as a machine, which supports René Descartes's clockwork man.
30 Lenihan J. Descartes versus Hippocrates–a conflict resolved? *The British Journal of Radiology* 1984;**57**:862.
31 Turner BS. *Medical power and social knowledge*. London: Sage Publications, 1995: 237.
32 World Health Organization. *International statistical classification of diseases and related health problems, IDC-10.* Geneva: World Health Organization, 1992-4;**II**:143.
33 Mitcham C. *Thinking through technology. The path between engineering and philosophy*. Chicago: The University of Chicago Press, 1994: 35.
34 See reference 27: 131.
35 Wulff HR, Pedersen SA, Rosenberg R. *Medicinsk filosofi*. København: Mungsgaard, 1997: 95.
36 Feinstein AR. ICD, POR and DRG. Unsolved scientific problems in the nosology of clinical medicine. *Archives of Internal Medicine* 1988;**148**:2269.
37 See reference 35: 92.
38 Hering HE. Das Elektrocardiogramm des irregularis Perpetuus. *Deutsche Archive für klinische Medizin* 1908;94:185.
39 See reference 13: 140.
40 See reference 28: 1087.
41 A particular subclass of asymptomatic diseases is called pseudodiseases. They are asymptomatic diseases that do not develop into illness during the bearer's lifetime. Fischer ES,

Welch HG. Avoiding the unintended consequences of growth in medical care. *Journal of the American Medical Association* 1999;**281**:446-53.
42 Faber K. *Nosography in modern internal medicine*. London: Oxford University Press, 1923.
43 Feinstein AR. *Clinical judgment*. Baltimore: The Williams and Wilkins Company, 1967.
44 Hempel CG. Introduction to problems of taxonomy. In: Zublin J, ed. *Field studies in the mental disorders.* New York: Grune and Stratton, 1961: 16.
45 Scadding JG. *Sarcoidosis*. London: Eyre & Spottiswoode, 1967: 877-8.
46 See reference 13: 324.
47 Peitzman SJ. From Bright's *disease to end-stage renal disease*. In: Rosenberg CE, Golden J, eds. *Framing disease: studies in cultural history*. New Brunswick NJ: Rutgers University Press, 1992: 3-19.
48 Papaspyros NS. The History of Diabetes Mellitus. Stuttgart: Georg Thieme Verlag, 1964.
49 See reference 44: 18.
50 Evans AS. Clinical syndromes in adults caused by respiratory infection. *Medical Clinics of North America*1967;**51**:803-15.
51 Rothman DJ. *Beginnings count: the technological imperative in American health care*. New York : Oxford University Press, 1997: 45.
52 Temkin O. The scientific approach to disease: specific entity and individual sickness. In: Crombie AC, ed. *Scientific change: historical studies in the intellectual, social and technical conditions for scientific discovery and technical invention from antiquity to the present.* New York: Basic Books, 1963: 636.
53 Reiser SJ. *Medicine and the reign of technology*. New York: Cambridge University Press, 1978: 1-90.
54 See reference 53: 91-157.
55 See reference 52: 642.
56 English PC. Emergence of rheumatic fever in the nineteenth century. In: Rosenberg CE, Golden J, eds. *Framing disease: studies in cultural history*. New Brunswick NJ: Rutgers University Press, 1992: 29.
57 See reference 53: 225.
58 See reference 35: 95, 99.
59 See reference 11: 34.
60 Veatch RM. Against virtue: a deontological critique of virtue theory in medical ethics. In: Shelp EE, ed. *Virtue and medicine*. Dordrecht: Reidel, 1985: 329-45.
61 Sontag S. *Illness as metaphor*. New York: Farrar, Strays and Giroux, 1978.
62 Blume SS. *Insight and industry. On the dynamics of technological change in medicine*. Cambridge Mass: The MIT Press, 1992: 36.
63 See reference 53: 91.
64 See reference 53: 228.
65 Cooper MW. The gastroenterologist and his endoscope: The embodiment of technology and the necessity for a medical ethics. *Theoretical Medicine* 1996;**17**:394.
66 See reference 47: 9.
67 Rothman DJ. *Strangers at the bedside. History of how law and bioethics transformed medical decision making*. New York: BasicBooks, 1991.
68 See reference 47:16.
69 McLellan F. "A whole other story": the electronic narrative of illness. *Literature and Medicine* 1997;**16**:88-107.
70 Redlich FC. Editorial reflections on the concepts of health and disease. *Journal of Medicine and Philosophy* 1976;**1**:275.
71 Engelhardt HT. The concepts of health and disease. In: Engehlardt HT, Spicker SF. *Evaluation and explanation in the biomedical sciences*. Dordrecht: Reidel, 1975: 137.
72 Campbell EJ, Scadding JG, Roberts RS. The concept of disease. *British Medical Journal* 1979;**2**:757-62.
73 Anonymous [editorial]. The concept of disease. *British Medical Journal* 1979; **6193**: 751.
74 See reference 62:21.
75 "An operational definition of a scientific term S is a stipulation to the effect that S is to apply to all and only those cases for which performance of test operation T yields the specific outcome O." Bridgman PW. *The logic of modern physics*. New York: Macmillan, 1927.
76 See reference 62: 48
77 Album D. The prestige of diseases and medical specialities. *Tidsskr Nor Lægeforen* 1991;**111**:2127-33.
78 Technology is not only constitutive of diagnosis and treatment, but plays an important role in palliation as well. Rognum TO. ["Home monitoring" does not prevent crib death. Managing possibilities and results of new technology] *Tidsskr Nor Laegeforen* 1995;**115**:2790-3.
79 See reference 28: 1085.
80 See reference 5: 7.
81 Kennedy I. *The unmasking of medicine*. London:Allen and Unwin, 1981: 25.
82 Taylor FK. A logical analysis of the medico-psychological concept of disease. *Psychological Medicine* 1971;**1**:356-64; 1971;**2**: 7-16.
83 Taylor FK. Disease concepts and the logic of classes. *British Journal of Medical Psycholo*gy 1981;**54**:284.
84 Taylor FK. A logical analysis of disease concepts. *Comprehensive Psychiatry* 1983;**24**:47.
85 See reference 4: 317.
86 Le Fanu points out that the laparascope facilitated the treatment of infertility, and thereby established it as a disease. (Le Fanu J. *The rise and fall of modern medicine*. London: Little Brown, 1999: 159.) Correspondingly, chlorothiazide and propanolol established hypertension as a disease (page128-38).
87 Anspach RR. Prognostic conflict in life-and death decisions: the organization as an ecology of knowledge. *Journal of Health and Social Behavior* 1987;**28**:215-31.
88 Tymstra T. The imperative character of medical technology and the meaning of "anticipated decision regret". *International Journal of Technology Assessment in health Care* 1989;**5**:207-13.
89 See reference 47: 15.
90 Mitcham C. Philosophy of technology. In: Reich WT, ed. *Encyclopedia of bioethics*. New York: MacMillan, 1995: 2477.
91 See reference 53: 144-58.
92 See reference 81: 22.
93 Twaddle A. Disease, illness and sickness revisited. In: Twaddle A, Nordenfelt L. *Disease, illness and sickness: three central concepts in the theory of health.* Linköping: Department of Health and Society, 1993: 9.
94 Fulford KWM. Praxis makes perfect: illness as a bridge between biological concepts of disease and social conceptions of health. *Theoretical Medicine* 1993;**14**:309.
95 See reference 72: 759.
96 This paradigmatic position of technology in medicine has been criticised. It has been argued that technology is applied prior to a proper evaluation of its outcome. Its application has been criticised as excessive by Illich and Davidson and as futile, by Fisher *et al.* Illich I. *Medical nemesis: the expropriation of health.* London: Calder and Boyars, 1975; Davidson SN. Technological cancer: its causes and treatment. *Healthcare Forum Journal* 1995;**38**:52-58. Fischer ES, Welch HG, Schneidermann LJ, Jecker NS. *Wrong medicine: doctors, patients and futile treatment.* Baltimore: Johns Hopkins, 1995.
97 See reference 10: Cohen H: 167.
98 See reference 12: 530-1.
99 See reference 41: Fischer ES, Welch HG: 449.
100 Feinstein AR, Sosin DM, Wells CK. The Will Rogers phenomenon: stage migration and new diagnostic techniques as a source of misleading statistics for survival in cancer. *N ew England Journal of Medicine*1985;**312**:1604-8.
101 Plato. *Gorgias* 356d4-e2.
102 See reference 10: Wulff HR, Gøtzche PC.
103 Ellul J. *The technological society*. New York: Alfred A Knopf, 1964.
104 Winner L. *Autonomous technology*. Cambridge Ma: MIT Press, 1977.
105 Rosenberg CE. Framing disease: illness, society, and history. In: Rosenberg CE, Golden J, eds. *Framing disease: studies in cultural history*. New Brunswick NJ: Rutgers University Press, 1992: xiii-xxvi.
106 Bennett IL. Technology as a shaping force. In: Knowles JH, ed. *Doing better and feeling worse*. New York: Norton & Co, 1977: 125-33.
107 Barley SB. The social construction of a machine: ritual, superstition, magical thinking and other pragmatic responses to running a CT skanner. In Lock M, Godon DR, eds. *Biomedicine examined*. Dordrecht: Kluwer, 1988: 497-539.
108 Sundström P. Interpreting the notion that technology is value-neutral. *Medicine, Health Care and Philosophy* 1998;**1**:41-5.

Paper 4

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Scientific Contribution

On the value-ladenness of technology in medicine

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Abstract. The objective of this article is to analyse the value-ladenness of technology in the context of medicine. To address this issue several characteristics of technology are investigated: i) its interventive capacity, ii) its expansiveness and iii) its influence on the concept of disease, iv) its generalising character, v) its independence of the subjective experience of the patient. By this analysis I hope to unveil the double face of technology: Technology has a Janus-face in modern medicine, and the opposite of its factual face is evaluative.

Key words: ethics, technology, value-ladenness, values

Introduction

In order to address the issue of the value-ladenness of technology in the context of medicine, it is urgent to make clear what "value free" means.[1] "Value-free" apparently does not mean that something is free of being associated with values. There seems to be a general agreement that technology is related to issues of value. Technology has widely enhanced the possibilities of acting and producing which poses the question of how we *ought* to realise these possibilities (Schrader-Frechette & Westra 1997). Rephrased we might say that what *is* urges questions of *ought*. In this respect technology is part of the general question of what *the good life* is and clearly is associated to issues of value. Understanding value-ladenness as anything that poses value issues certainly answers the question of whether technology is "value-laden". It also replies to the question of how this influences medicine: by giving rise to a variety of ethical challenges technology makes medicine "value-laden".

However, this understanding of value-ladenness does not add to our theoretical knowledge of medicine.[2] Even proponents of "value-free" technology will agree that technology is associated with issues of value. In particular they argue that the values associated with technology are values of society at large (Bijker 1990; Hollander 1997; Tatum 1997), certain social classes (Rothman 1997) or particular interest groups (Vos 1991; Payer 1992; Moss 1991; Blume 1992).

Therefore in this study "value-free" will mean that values are aspects external to technology as such. Correspondingly, the claim that "technology is value-laden" will denote that values are related to technology qua technology. Technology does not only generate issues of value, but it is related to values as such. In other words, if technology is value-laden, it is not only a matter of what *is*, but also what *ought* to be, not only of what *could be done*, but what *ought* to be done.

Hence, the objective of this study is to analyse the value-ladenness of technology in the context of medicine. How then, can technology be conceived of as value-laden? There appears to be two major approaches to answer this question. The most common way to analyse the value-ladenness of technology is by an overall theoretical approach. There are several positions conceiving of technology as value-laden. It has been argued that technology represents an imperative enforcing humans to act in certain ways. Technology, under cover of being a mean, directs human ends and values. This position has been labelled *technological determinism* and its main issue is to investigate this *technological imperative* (Ellul, 1964; Winner, 1977; Smith and Marx, 1994).

From a phenomenological position it is claimed that technology is part of human understanding of being (Heidegger, 1953; Idhe, 1990). Man and his world are shaped by technology, which is of value not only as means for certain ends, but as a basic part of our being.[3]

An alternative approach to this theoretical analysis of value-ladenness of technology is to analyse technology's value-ladenness from a practical point of view: How do we recognise values of technology in medical practice? Instead of subscribing to any of the

mentioned monistic perspectives on technology and value, I will try to analyse how values are related to technology on a practical and detailed level. In other words, I will investigate whether the monistic theories of technology are adequate for analysing the issues of value. In particular, I will analyse a collection of well known examples to illustrate the wide range of value-ladenness related to medical technology. The examples will demonstrate how difficult it is to comprise technology's value-ladenness within a monistic theory. As a framework for this analysis I will investigate some key characteristics of technology in medicine. Technology is characterised as being:

i) *Interventive:* Through technology medicine has changed from assisting the healing capacity of nature to controlling and manipulating bodily healing itself.
ii) *Expansive:* Due to its interventive capacity technology has greatly expanded the field of medicine and increased its specialisation.
iii) *Defining disease:* By providing the basic phenomena to be studied and manipulated in medicine, technology strongly influences the concept of disease, and hence medical action. It defines what is diagnosed and what is treated.
iv) *Generalising:* It represents a general method for diagnosis, palliation and treatment. Its ability to generate reproducible results has made medicine a science.
v) *Liberating:* Technology has made medical knowledge independent from the subjective experience of the patient.

Hence, the objective is to investigate these characteristics in order to analyse the value-ladenness of technology in the context of medicine. In particular, it will be argued that technology does not only generate (external) issues of value, but it represents issues of values as such. Technology is value-laden on a constitutive level, which becomes particularly clear in medicine.

1. Interventive medicine

Hence, one of the main characteristics of technology in medicine is that it is interventive (*interveniere*). It has come to control and manipulate the organs, functions and processes of the human body. Conditions that earlier were fatal are today treated and cured. This interventive capacity of technology has greatly expanded the field of medicine, and it has changed medicine in several ways.

Firstly, whereas medicine earlier mainly was explanatory, it has now become manipulative. The function of humoral pathology was mainly to explain the observed phenomena. Practical measurement of and intervention with the processes of nature were of little interest (Hippocrates: *On ancient medicine*). The role of medicine was to explain and foresee the processes of nature. Today its function is to intervene in the observed processes. Practice comes before theory: Interventive methods are applied if they prove effective, independent of whether their mechanisms are known.

Secondly, the interventive capacity has altered the content of medicine. The explanatory entities of assistive medicine have been replaced by the manipulatory entities of technological medicine. Physiology, biochemistry and molecular biology have become basic subjects in medicine because they identify entities that can be manipulated. The interest, for example in the chemical substances of the human body, is due to the possibility of manipulating them. Hence, the interventive capacity of technological medicine has changed the subject matter of medical knowledge.

Thirdly, technological medicine has strongly influenced the classification of diseases. What is possible to manipulate and treat has been defined as a disease. The influence of technological medicine on the concept of disease will be dealt with later. Suffice it here to note that its interventiveness has influenced medical taxonomy. It influences what is and what is not subject to medical attention.

Fourthly, technology's interventive capacity has changed the status of medicine. Through the extended potential of action it represents power. The medical profession has gained power by the interventive and manipulative capacity of technology.

Altogether, the interventiveness of technology has altered medicine in a profound way, and this is an issue of value in several aspects.

Evaluative aspects of interventive medicine

This is not the place to enter into a discussion of the vast number of examples of evaluative challenges inherent in the *interventive capacity* of medicine. Only some issues will be investigated to illustrate the spectrum of fundamental evaluative issues: Firstly, technology challenges the concept of the patient. Secondly, it urges medicine to define its goals, and thirdly, to set limits to its activity. Additionally, there is an extended responsibility inherent in the extended potential of technological medicine.

The interventive capacity challenges the concept of the patient. It gives rise to the question: Who is the subject of the treatment – who is the patient? Technological medicine involves other subjects than

the traditional one-to-one patient-physician relationship. Transplant technology forces the physician to pay attention to the donor. Foetal surgery forces health care professionals to balance the concerns for the mother with the concerns for the child. In vitro fertilisation poses similar challenges. Perfusion of a brain-dead mother until her foetus is viable or of an anencephalic child until its vital organs can be transplanted into another baby represent similar types of evaluations. Xenotransplantation and cloning are other examples. These cases illustrate how technology challenges traditional values in medicine: the personal physician-patient relationship.

Moreover, the interventive capacity of technology challenges the goals of medicine (Kass, 1975; Hanson and Callahan, 1999). The case of life-sustaining treatment is a widely applied example. The possibilities for keeping comatose patients alive with respirators forced us to answer the question of *why*: What is the end of such treatment? Is it survival and extension of life, or is it the welfare of the patient? Inherent in issues of foetal surgery, human enhancement and genetic engineering there reside questions concerning the purpose of interventive treatment. The same questions are posed in cases where technological medicine is applied in excess, is futile, or is detrimental.[4] If the interventive capacities of technological medicine influence the actions and ends of medicine, they are issues of value. They do not only tell us what is, but also question what ought to be.[5]

Determination of the goals for interventive medicine touches upon an additional evaluative question: *Whose* goals? Does the interventive treatment serve the patient, the relatives, the professionals or society? The case of *hypoplastic left heart syndrome* might illustrate this (Bove and Lloyd, 1996; Hagemo et al., 1997; Kern et al., 1997). Here it is not obvious whether the complex, painful and risky treatment with low efficacy and effectiveness serves the benefits of the child, the parents, the skills of the professional or society. The difficulty of defining the goals of interventive medicine therefore relates to the concept of *who* is the subject in medical treatment. Hence, the interventiveness of technological medicine challenges patient autonomy.

Related to this urge for defining the goals of medicine due to technological interventiveness is a requirement to set limits to its activity. Where are the limits to what medicine should do? When the possibilities of treatment are substantially extended it becomes important to know when to abstain from or when to terminate treatment. Inherent in technology's interventiveness there is an issue of its limits, which is clearly displayed in medicine.

Additonally, the comprehensive capacity of interventive medicine is associated with an extended responsibility. The thalidomide case illustrates how the increase in interventive capacity of medicine also increases the seriousness of its consequences if applied erroneously. An increase in the possibility of doing good also enhances the potential of doing wrong. The extensive possibilities related to technological medicine lead to extended responsibilities.[6]

So, as a result of the interventive capacity of technological medicine, the concept of *patient* in medicine is challenged. Due to the increased interventive capacity the goals and limits of medicine have to be redefined, and physicians face an enhanced responsibility. Altogether, what is possible in technological medicine is related to the questions of what *ought* to be done. *Can* implies the question of *ought*. Hence, inherent in the interventive capacity of technology in medicine we encounter issues of value. Inherent in factual issues of *how* to do things, there is an evaluative question of *if* and *what* to do. The new possibilities force us to cope.

2. The technological expansion of medical knowledge

Related to the expanded possibility to intervene, there is an expanded possibility to know. Due to the interventive capacity and the widespread application of technology, the *Corpus Medicorum* has become more extensive and specialised than ever.

This has given rise to a set of demanding questions: Is the new knowledge *good or bad*? Furthermore, *how* is this comprehensive knowledge to be applied? For example, is it right to clone humans, or to make hybrid pigs for xenotransplantation? How shall we ration technological medicine? It has been argued that the evaluative aspects of this expansion of medical knowledge have been ignored (Jonas, 1985; Gadamer, 1993) and, as a consequence, that medicine does more harm than good (Illich, 1975; Lewis, 1977; Stewart-Brown and Farmer, 1997; Sharpe and Faden, 1998; Fischer and Welch 1999). Is it true that we have grown to become technological giants, while we are still to be considered as ethical embryos? Science and technology does not appear to liberate medicine from ethical issues, on the contrary: "It is paradoxical, perhaps, that to apply the creations of our newest scientific disciplines, physicians must reexamine the moral principles by which they act, and turn to ethics, one of our oldest humanistic disciplines" (Reiser, 1977, p. 55).

It is beyond the scope of this study even to sketch the features of this technologically determined expansion of medical knowledge. Only the case of predictive testing will be employed to exemplify the expansion of medical knowledge and its evaluative challenges.

Predictive testing – a case study

Particular to predictive testing is that it can be used to detect cases of disease where the patient has no subjective experience of being ill. Such *asymptomatic diseases*[7] seem to be rich in evaluative consequences. The aims of treatment are altered from removing causes and symptoms of experienced illness to treating unperceived disease. This represents a fundamental epistemological and evaluative change in medicine. Epistemologically, medical knowledge seems to be independent of the patient's subjective experience. This will be discussed in detail later. Evaluatively, the initiative of care and cure is shifted from the patient seeking help to the health care provider offering assistance.[8] Hence, medicine seems to have liberated itself from the initial initiative of the patient.

It has transgressed its traditional ethical basis where a person seeks help because of pain, discomfort, weakness, or ailment. Furthermore, medicine's independence of the patient's illness gives health care unrestricted power to prescribe treatment. Misuse of such power is not difficult to imagine, and how to manage this power is obviously an evaluative challenge. Predictive diagnostics, therefore, represent a change in the ethical status of the patient.

Additionally, some cases of *asymptomatic diseases* would never have become apparent to the patient if they had not been detected by a predictive test. The patient would never have developed symptoms during his or her lifetime. (Black and Welch, 1993; Stewart-Brown and Farmer, 1997; Kevnanagh and Broom, 1998). Papillary carcinoma of the thyroid, ductal carcinoma in situ of a woman's breast and adenocarcinoma of the prostate are examples of such cases.[9] So far, there is no way of predicting who will develop symptoms and who will not. If all the detected instances were followed up therapeutically, more healthy persons would be treated. Predictive testing, hence, increases the prevalence of the disease. Whether it is *good* or *bad* for medicine to "make people diseased" in this manner is a question of value.

Correspondingly, knowledge of a detected disease may make a person anxious and ill. The uncertainty related to this kind of medical knowledge may have a negative physical and psychosocial effect.[10] It has been shown that technological markers, e.g. foetal ultrasound, can result in anxiety and can have a negative influence on health (Malone, 1996). In this respect the technological expansion of medical knowledge can be harmful.[11] This illustrates the evaluate aspects related to new knowledge, which is especially important with diagnostic methods where no treatment exists for the detected disease.

Furthermore, predictive tests embody the evaluative issue of how much pain and inconvenience a person should be exposed to in cases where the probability for a disease developing is small. Is it right to remove the colon of a patient who has a hereditary polyposis and a mutation of the APC-gene (Ponder, 1997)? There is a profound difference between a person who is ill and needs help and a person who is not ill, when it comes to exposing them to treatment and the related pain and risk (Skrabanek, 1994, p. 36).

Altogether, predictive tests can make people diseased. Firstly, they can define people who do not feel ill as diseased. Thus they transgress the initiative of the patient. Secondly, they might lead to treatment of persons who never in their lifetime would have developed symptoms. Thirdly, the knowledge of an unperceived disease may make people both ill and diseased. They force us to deal with risk and uncertainty. Hence, predictive tests represent a *medicalisation* of human conditions. At what level we will allow this to happen is not a purely factual matter, but a matter of values as well.

Epistemic insufficiency

One of the difficulties due to this technological expansion of medical knowledge is, as argued, knowledge of disease without illness. But the opposite situation might also be problematic: where the patient is ill, but no disease can be detected. Is the patient then not diseased? Does he not qualify for treatment or care? If he does, by what means? Is he socially, but not medically diseased (Räikkä, 1996)?

Cases of illness without disease equally represent basic evaluative challenges to technological medicine. Despite the impressive amount of medical knowledge in ever more specialised sub-domains they illustrate an *epistemic insufficiency* in medicine. The knowledge of technological medicine is imperfect (Thomas, 1977). "There is a vast ocean of ignorance at the heart of medicine" (Le Fanu, 1999 p. 178).[12] This does not, however, differ from other systems of medical knowledge. All theoretical frameworks of medicine seem to be insufficient. The difference is that technological medicine appears to be *omnipotent* and *omniscient*. If the limits of medical knowledge are not acknowledged, many patients may suffer. Thus, ignorance of the *epistemic insufficiency* appears to be an issue of value. Ignoring the *docta ignorantia* in technological medicine is a matter of *good* and *bad*.

In addition there is a high turnover of medical knowledge. Yesterday's method is out-dated today. This turnover pushes the evaluative questions forward: What knowledge is *good* and how ought it to be applied? Is it immoral not to offer patients help

according to the most up-to-date knowledge? In particular it raises a practical question highly relevant for clinicians: How is it possible to be updated? When is the right time to change to a new method? How much better must a new method be before its benefits outweigh the costs of abandoning a well-established method? How are we to evaluate the efficacy, effectiveness and efficiency of new methodology?

Furthermore, technological medicine presents more possibilities for diagnosis and treatment than available resources can realise. Thus technological medicine has enhanced the problem of triage and forced us to ration recourses (Reiser, 1978; Aron and Schwartz, 1984; Anspach, 1987; Rothman, 1997). Some of the patients with diseases that can be detected and treated will not receive treatment. Which patients are to be given a heart-transplant? Who shall be treated for cataracts or have dialysis and who shall not have? The questions of *whom* shall be given health care services and *who* is to decide are practical and evaluative questions. They cannot be answered by simply referring to the descriptive powers of technology or resolved by implementing more technology.

Hence, the technological expansion of medical knowledge includes evaluative challenges. Knowledge of *how* the human body works and reacts, and *what* to do to influence it, comprises the question of *when* and *how* this knowledge *ought* to be applied and when to recognise its limits.

3. The technological constitution of disease

Technology appears to have become a paradigm in medicine by prescribing ways of detecting, identifying and treating disease. Disease now can be measured with objective instruments (Twaddle, 1993, p. 9). *Epilepsy*, originally conceived as a spiritual influence (Hippocrates: *The sacred disease*), through technology (electroencephalography, microscopic techniques, chemical analysers) has become a disturbance of electrical activity of the brain caused by paroxysmal malfunction of cerebral nerve cells. In the same manner a variety of cardiac conditions are defined by specific ECG-patterns, ultrasound flow measurements and radiographical morphology. The ability to measure blood pressure and to identify *Helicobacter pylori* has made such signs and markers define disease.

The technological influence on the concept of disease is not, however, limited to diagnosis. The success of technology in medicine has made technology the criterion of demarcation for treatment (Brown, 1985, p. 317). The methods of technology determine what is treatable and thereby set a precedent for what is to be treated.[13] Medical technology has become the measure of all things; a kind of *ars mensura*, or a *technê metrikê*[14] of the modern age, being the measure of what is good and bad, what is diseased and what is not diseased, what is to be treated and what is not to be treated.

Therapeutically, the technologies of corrective surgery, blood pressure regulation and artificial fertilisation have made health care professionals treat these conditions as diseases: *hypoplastic left heart syndrome, hypertension* and *infertility*. Decisions and prognosis have come to be based on technology (Anspach, 1987; Tijmstra, 1989). Mitcham elegantly summarises this influence of technology on concepts of medicine:

> Medicine is increasingly defined . . . by the type and character of its instruments (from stethoscope to high-tech imaging devices) and the construction of special human-artefact interactions (synthetic drugs, prosthetic devices). Indeed, the physician-patient relationship, medical knowledge, and the concept of health are all affected by technological change. (Mitcham, 1995, p. 2477).

Technology is not only involved in defining disease, but also in generating knowledge of disease. It has become the *definiens* of disease and appears to have become the paradigm method of medicine. Technology constitutes the categories of the medical gaze. "The technology mediates between the seer and the seen and what is seen becomes largely constituted by technology. This is why practices change with the development of new technologies" (Cooper, 1996, p. 394). Advances in technology facilitate the identification of new markers that will be treated as disease (Whittle, 1997). Technology comprises the physiological, biochemical and bio-molecular objects and events that constitute the disease entities in both diagnostics and treatment. For example, angiography, echo-doppler and tissue-velocity-imaging have resulted in an extended classification of myocardial infarction. Thus, epistemologically, ontologically and practically, technology is involved in constituting the concept of disease.

Technology, disease and value

Does this technological constitution of disease mean that technology has enabled a descriptive conception of disease? This does not seem to be the case. As previously argued, the interventive capacity of technology and its expansion of medical knowledge is not able to transcend issues of value. The concept of disease will be subject to the same evaluative challenges as the technology that defines it. Some of these

have already been discussed. However, other evaluative aspects appear to be related to the technological constitution of disease as well.

Defining disease by setting limits to what is normal and what is pathological is a matter of value (Canguilhem, 1991). Although technology offers a method of reproducible detection and identification of diabetes, defining the limits of normality is nevertheless an evaluative issue. The limits of diabetes defined by the American Diabetes Association (ADA) or by WHO are not factual descriptions. If one applies the WHO limit instead of that of ADA, then the prevalence of the disease is almost doubled (Wahl et al., 1998). Hence, the WHO definition of diabetes makes people diseased. The definition of normality, and thus disease, is an evaluative matter (Robinson and Bevan, 1993).

Furthermore, the sensitivity to the markers used to detect disease is continuously improved, as technology develops. This *increased sensitivity* expands the range of conditions qualifying for the status of disease. Thus, technology lowers the limits of disease and increases its prevalence. The detection of increasingly milder cases results in treatment of an increasing number of conditions. In practice technologically increased sensitivity results in a *lowered treatment threshold*. Increased sensitivity and lowered treatment comprise the evaluative issues of what is *good* diagnosis and what is *good* treatment. They include issues such as futile treatment and medicalisation (Fischer and Welch 1999).[15]

Moreover, technology has altered the end-points of medical activity. Technology defines the entities and markers to be studied and manipulated. In practice it tends to make medicine pursue *soft end-points* like *cardiac blood flow* and *cholesterol concentration*, and constitutes such conditions as diseases. When these markers are within normal limits, the patient is per se healthy.

However, the selection of end-points is a matter of value, and manipulating soft end-points does not guarantee results in terms of *hard end-points* such as survival and morbidity. Clinically the prevalence of prostate cancer in men aged between 60 and 70 is about 1%. However, by applying transrectal ultrasound or MRI more than 40% of men in the same age group have been diagnosed as having prostate cancer (Monti et al., 1989). Technology's focus of attention is on diagnostic and therapeutic impact and not on patient outcome (Bruke, 1994; Pickering, 1996). This technological affinity to soft end-points can be conceived of as a form of medicalisation and a form of disregard of patient autonomy.

Thus, inherent in the technological constitution of disease the measure of disease is changed, the limits to normality must be set and the prevalence of disease and the outcome of treatment are altered. Hence, the *technological constitution of disease* is a matter of value. It influences who is diseased and who is not, who is entitled to treatment and who is not, who will receive economic support, and who will not.

The objective here was neither to give a detailed description of a technological conception of disease, nor was it to give an exhaustive analysis of the evaluative issues of the disease concept. More modestly, the objective was to argue that the conception of disease is influenced by technology and that this reveals its value-ladenness. The issues of value cannot be removed from a technologically constituted concept of disease.

4. Generalising technology

One important characteristic of technology is its generalising ability. Technology facilitated the study and identification of the general in the particular. The ECG and X-ray rendered an objective way to scrutinise disease.

> Ophthalmoscope, broncoscope, etc. allow him [the physician] a direct view of the conditions of many parts. Experimental medicine enables the physician to interpret his findings so as to translate the language of symptoms and tests into the language of physiological processes. Here then is a scientific approach to individual sickness (Temkin, 1963, p. 636).

Technology eliminated both the singularity of the patient and subjectivity of the physician (Reiser 1978) and strongly influenced the postulates of causation in medicine (Evans, 1991). In short, technology made medicine a science (Temkin, 1963; Cassell, 1993, p. 38).

Technology facilitates the translation of individual illness into the objective language of physiology (Ferkiss, 1969; Jonsen, 1990, p. 25).[16] Through technology medicine gains objective data (Jonsen, 1990, p. 25), and technology represents a standard method of detection, identification and treatment of disease. In this way technology accounts for the reproducibility of results and for the accumulation of nomological knowledge. The MRI-machine presents a standard image of the human brain and automated laboratory analysers produce positive test results when the number and shape of blood cells deviate from normal statistical values.

This abstracting and generalising characteristic has been crucial for the argument that technological medicine is value-neutral (Sundström, 1998). Nevertheless,

rather than escaping the evaluative, the generalising attribute of medicine emphasises its value-ladenness. This value-ladenness can be illustrated by scrutiny of some of the flaws of this generalising characteristic.

Evaluative aspects of generalising technology

Let me briefly mention four flaws due to technological generalisation frequently referred to in the literature and then investigate some of the value related issues. Firstly, technological generalisation is based on populations rather than on the individual. The single patient might gain from general methodology, but might also suffer from it, due to natural variation in a population (Jonas, 1985; Gadamer, 1993, Delkeskamp-Hayes and Cutter, 1993).

Secondly, no technological method is absolutely effective, nor perfectly accurate and reliable. The same blood sample tested with the same chemical analyser may give different results for consecutive tests, e.g. blood gas measurements. There is statistical variation in the results due to the technological method. This might lead to erroneous diagnosis and treatment. The test can fail to detect disease and can detect disease when there is none.

Thirdly, inter-observer and intra-observer variability reduces the effectiveness of the method. Even if there was no variation in the population and the method was perfectly accurate and reliable, there would still be variation in the application of diagnostic and therapeutic technology. Different physicians apply technology differently in different cases (Jennett, 1988; 1994). Hence, the practical implementation and particular application of even a perfect method might be flawed.

Fourthly, technology is applied to different populations than the one they are tested on. Obviously tested technology is not applied to the test population again. This calls for careful judgement. It is well-known that diagnostic procedures and types of treatment that have been tested on hospitalised patients have been applied in general practice, and methods tested on men have been applied to women, which has resulted in erroneous diagnosis and treatment.

These profound flaws of the technology of medicine present evaluative challenges. On a general basis it is argued that the generalised method in medicine is erroneous (Gorovitz and MacIntyre, 1976, Leape, 1994). How we handle this inherent error in medicine is a matter of *value* and not only of *fact*. Let me briefly investigate some of the evaluative aspects.

Firstly, the question of how we handle the insufficiency of the generalising technology is an evaluative matter. How many false positives and false negatives will we allow? What level of significance do we accept? How much are we willing to let some patients suffer to help others? What responsibilities do health care professionals have towards the healthy persons that are treated and the diseased persons who are ignored? The very definition of confidence intervals is evaluative and the concepts of false negatives and false positives are issues related to *good* and *bad*.

Secondly, the ability to communicate the possibilities and restrictions of medicine due to its generalisation relate to ethical matters such as patient autonomy, informed consent and paternalism. Does the patient understand the uncertainty and risk? How do we act if he does not?

Thirdly, it has been claimed that the generalising method of technology in medicine tends to alter the physician's responsibility for the individual patient (Jonas, 1985; Gadamer, 1993, Delkeskamp-Hayes and Cutter, 1993). It is accused of freeing the physician from personal obligation towards the patient. "Western medicine and the modern paradigm of knowledge are heavily biased towards abstraction, we all tend to feel drawn away from the attempt to identify with the patient's experience" (McWhinney, 1997).

In other words, generalisation by technology leads to what might be called an *epistemic abstraction* from the particular patient, which has adherent evaluative aspects. Whether this *epistemic abstraction* also results in a corresponding *evaluative abstraction* from the patient will be discussed in the following section. The point here is that the generalising characteristic of technology does not make medicine escape issues of value. Handling the *epistemic abstraction* and its flaws is not a matter of how nature *is*, but of how we *ought* to live. The technological generalisation in medicine is in itself an evaluative matter.

5. Technological emancipation from the subjective patient

A crucial aspect of the technological generalisation discussed above is its abstraction from the individual person. Technology has altered the relationship of medicine to its subject matter: the patient. In other words, the objectivity of medicine is achieved by making the patient an object and liberating itself from the patient's subjective experience. However, this independence from the patient is an evaluative issue.

It is argued that before the Eighteenth Century, medicine was based on the patient's narrative of his or her symptoms. In addition to this subjective portrait of the illness, the physician observed the patient's appearance and behaviour as well as any signs of disease. During the Eighteenth and Nine-

teenth Centuries medical instrumentation enabled and extended the physical examination of patients, which made the physician less dependant on subjective narration (Reiser, 1995, pp. 1–90). The stethoscope gave the physician direct access to the disease. Measuring blood pressure gave an objective measure of internal conditions in the patient. The introduction of machines such as the ECG, X-ray and chemical laboratory analysers during the Nineteenth and Twentieth Centuries further enhanced the objectivity of medicine (Reiser, 1995, pp. 91–157). In addition to removing the subjective errors introduced by the patients, technology also reduced the number of erroneous judgements made by physicians. Technology liberated medicine from the subjective, individual and emotional factors, which confused the conception of the real objective disease. "Twentieth-century technology with all its progress had tended to push the human dilemmas of illness out of the doctor's thoughts, and replace them with laboratory facts derived from tests on the patient's body" (Reiser, 1978, p. 225).

Due to the generalisation in medicine the individual patient today contributes to the *Corpus Medicorum* only as one of many. The epistemic significance of the individual is reduced to a statistical entity. Accordingly, technology creates a physical distance between the physician and the patient (Jennett, 1994, p. 862), making it a 'stranger medicine' (Veatch, 1085; Rothman, 1991).

"Technological methods move the evidence employed in diagnosis away from the patient and reduce the impact of the patient's particularity on the physician" (Cassell, 1993, p. 36). The capacities of technological medicine have excluded the individual patient as the epistemic basis of medicine (Le Fanu, 1999 p.194). The essential question following from this is whether the evaluative status of the patient has been altered correspondingly.

Critics of modern medicine claim that technology's focus on the objective and the general has resulted in a neglect of the individual patient (Glover, 1977; Pellegrino, 1979; Jonas1985; Cassell, 1993; Gadamer, 1993). This transgresses the traditional normative basis of medicine. Ever since the awakening of medical self-consciousness, the raison d'etre of medicine has been to heal and help the individual patient.[17] The objective of medicine was the *good* of the particular patient. With technology in medicine there has been "a detachment from the suffering of [the] patient" (Cassell, 1993, p. 34). This is a detachment of the professional from the personal, disease from illness and signs from symptoms, making medicine face profound evaluative challenges such as medicalisation, reductionism, curative bias and paternalism. As already mentioned, there is a shift in initiative due to technology: the patient does not seek the health care system because he or she feels *bad*, but because the technological method detects something that is considered to be *bad* for the patient. The evaluative initiative is shifted from the patient to the health care system.

Hence, there appears to be a reduction of the evaluative status of the patient corresponding to the reduction in epistemic significance; there is an *evaluative abstraction* from the patient matching the *epistemic abstraction*. This represents what might be called an *evaluative ignorance of the individual* in technological medicine.

Evaluative characteristic of technological medicine

Altogether, the technology of medicine has been characterised by the following attributes:

i) *Interventive capacity:* Taking on an interventive and manipulative attitude.
ii) *Epistemic expansion:* The substantial extension of *Corpus Medicorum* due to technology.
iii) *Constituting disease:* The influence of technology on the concept of disease.
iv) *Generalising:* The technological generalisation of medical knowledge.
v) *Liberating from the subjective experience of the patient:* Making medical knowledge independent of the subjective experience of the patient.

The practically oriented analysis of these characteristics has revealed their inherent evaluative aspects. Within the possibilities of technology resides the question of whether it is *good* or *bad* to realise them. In concert with the potential of technology we face issues of *how, when, why, for whom*, and *by whom* it is to be applied. Within the knowledge of what *is* and what *can* be done with medical technology resides the challenge of what we *ought* to do. At the same time as technology expands our potential for action it urges us to define the ends of and set limits to its application. The relationship between technology and value comes particularly clear in medicine, explicitly dealing with issues of *good* and *bad* of the body (and mind).

In this study I have not dealt with the details on how in particular values relate to technology. This is the issue of another study. Here the main objective has been to argue that there is a close relationship between technology and value, particularly apparent in medicine. In other words: there is a close relationship between technology and ethics. Technology represents a Janus-face in medicine. The opposite of technology's descriptive face is evaluative.[18]

Concluding remarks: The Janus-face of medicine

The investigation of the relation between technology and value seems to be rich in consequences. Firstly, it is apparent that technology does not exclusively represent value-neutral means towards an external end. The study seriously questions the commonplace value-neutrality dictum.[19] The evaluative challenges related to technological medicine are not issues of conflicting external ends and cannot be resolved by agreeing upon external goals of medical activity. Technology, being inherently evaluative, constitutes medical knowledge. Technology makes medicine a scientific, but also a moral enterprise.

Secondly, even though the study has made me question the value-neutral dictum of technological medicine this is done without subscribing to one of the monistic theories of technology. The examples illustrate a wide range of value-ladenness of technology in medicine and demonstrate the difficulties of subscribing them all to one of the traditional critiques in the philosophy of technology. The monistic theories appear to fail to comprise the vast variety of value-aspects of technology in medicine. Additionally, the analysis shows the fruitfulness of a detailed approach to medical practice.

Thirdly, medicine is particularly suitable to study the value-ladenness of technology because its evaluative aspects are easily recognisable. Issues of value are widely recognised in medicine, and (bio)medical ethics is an important branch of moral philosophy (Toulmin 1986).

Hence, the conclusion of the study can be phrased: "*is* implies *ought*", but in the sense that the matter of what *is* in medicine comprises the evaluative issue of how it *ought* to be. There is reciprocity between *is* and *ought*; between the possible and the actual; between knowledge and its application; between fact and value. That is, there is a constitutive relationship between values and technology in medicine. By stepping into the doorway (*januae*) of technology we are already in the realm of value.

Notes

1. There appear to be many kinds of value: economic, esthetical and moral. To restrict the topic, "value" will in this study refer to moral value.
2. Value is not related to technology as such, but in the same manner as value relates to other objects and actions: they can be of value.
3. In the philosophy of medicine we can recognise both the position of technological determinism (Bennett, 1977; Hellerstein, 1983; Tijmstra, 1989; Cassell, 1993; Davidson, 1995; Muraskas et al, 1999) and the phenomenological approach (Cooper, 1996).
4. In particular, see (Illich, 1975; Reiser, 1978; Jennett, 1986; Payer, 1992, pp. 37–52; Cassell, 1993; Schneidermann et al., 1995; Tijmstra, 1989; Fischer and Welch, 1999).
5. Screening is a case that further exemplifies the difficulties of defining goals of medical treatment (Black, 1993; Stewart-Brown and Farmer, 1997; Kevnanagh and Broom, 1998; Kerbel et al., 1997; Whittle, 1997; Malone, 1996; Chevenak, 1998). The benefits of discovering disease have to be weighed against their costs, such as medicalisation of people, false positive or false negative results, detection of cases that are untreatable, anxiety among patients, and application of technological methods by doctors who lack clinical competence. The task of weighing the ends involved in such complex situations is certainly an evaluative matter.
6. The substantial increase in malpractice suits may be an indication of this.
7. Cases of detected disease without any symptoms have also been called lanthanic diseases (Feinstein, 1967).
8. Cases of health care where patients do not request help have been called non-iatropic diseases (Feinstein, 1967). Such cases seem to be of ethical relevance in profit maximising health care systems appealing to people's uncertainty, anxiety and concern for their health.
9. Cases of detected disease that would never have become appearent to the person have been called pseudodiseases (Helman, 1985; Fisher and Welch, 1999, p. 449).
10. See for example (Tijmstra, 1989; Green, 1990; Black and Welch, 1993; Kevnanagh and Broom, 1998).
11. The way that technological knowledge may be harmful can be called technological stigmatisation.
12. The incompleteness of medical knowledge is also demonstrated by the fact that a large number of diseases have unknown aetiology. In many cases medicine can only treat the symptoms and not the causes.
    However, can technological medicine ever reach complete knowledge? Gorovitz and MacIntyre argue that medical knowledge will always be incomplete, and that ignorance of this fact makes medicine errenous (Gorovitz and MacIntyre, 1976). Gadamer also argues that there is an epistemic insufficiency in technological medicine. "Aber trotz allen Fortschritten, die die Naturwissenschaften für unser Wissen um Krankheit und Gesundheit gebracht haben, und trotz dem enormen Aufwand an rationalisierter Technik des Erkennens und Handelns, der sich auf diesem Gebiete entfaltet hat, ist der Bereich des Unrationalisierten hier besonder hoch" (Gadamer, 1987, p. 259). Correspondingly, Paul argues that there is a theoretical insufficiency due to a gap between theory and practice in medicine, termed "Hiatus theoreticus". This is an epistemological void typically inherent in the stock of medical knowledge itself (Paul, 1998, p. 247).
13. The technological focus on treatment has contributed to what has been called the curative bias in modern medicine, which also is rich in normative consequences.
14. See (Gorgias 356d4–e2).
15. Among these are cases that would otherwise have healed by themselves (*trivia*).

16. For example, the stethoscope enabled the physician to listen to sounds from vessels. The classification of these sounds (Korotkoff) gave a general method of measuring blood pressure. This facilitated the correlation of blood pressure and certain pathological states.
17. See (Hippocrates: *The oath; On the art* III). Both Plato and Aristotle recognised that the challenge in medicine was not the content of medical knowledge, but how it should be applied in particular cases (*Phaedrus* 268a7–c4; *Nicomachean Ethics* 1104a4–6; 1137a10–25; 1097a11–4; 1143b18–32; 1180b5–23).
18. Temkin discusses the "Janus-face" of medicine in the context of the history of medicine (Temkin, 1977). The one face looks into the past, enabling the other to view into the future of the profession. In this study the concept of 'the Janus-face of medicine' is applied to emphasise the relationship between medical technology and ethics. The one face looks into the world of how things *are*, the other how they *ought* to be.
19. In the philosophy of technology the value-neutrality dictum has also been characterised as the voluntarist position (Winner, 1977, pp. 53–54; 60–63; 76–77).

References

Anspach, R.R.: 1987, 'Prognostic Conflict in Life-and Death Decisions: The Organization as an Ecology of Knowledge', *Journal of Health and Social Behavior* 28, 215–231.

Aron, H. and Schwartz, W.: 1984, *The Painful Prescription: Rationing Health Care*. Washington DC: Brookings Institution.

Bennett, I.L.: 1977, 'Technology as a Shaping Force', in: J.H. Knowles (ed.), *Doing Better and Feeling Worse*. New York: Norton & Co, pp. 125–133.

Bijker, W.E.: 1990, *The Social Construction of Technology*. Cambridge MA: Ph.D. Thesis, MIT.

Black, W.C. and Welch, H.G.: 1993, 'Advances in Diagnostic Imaging and Overestimation of Disease Prevalence and the Benefits of Therapy', *New Engl. J. Med* 328, 1237.

Blume, S.S.: 1992, *Insight and Industry. On the Dynamics of Technological Change in Medicine*. Cambridge Mass: The MIT Press.

Bove, E.L. and Lloyd, T.R.: 1996, 'Staged Reconstruction for Hypoplastic Left Heart Syndrome. Contemporary Results', *Annals of surgery* 224, 388.

Brown, W.M.: 1985, 'On Defining "Disease"', *Journal of Medicine and Philosophy* 10 (4), 311–328.

Bruke, G.: 1994, 'High Tech, Low Yield: Doctor's Use of Medical Innovation', *J Am Health Policy* 4 (1), 48–53.

Canguilhem, G.: 1991, *The Normal and the Pathological*. New York: Zone Books.

Cassell, E.J.: 1993, 'The Sourcer's Broom. Medicine's Rampant Technology', *Hastings Center Report* 23 (6), 32–39.

Chevenak, F.A and McCulloch, L.B.: 'Ethical Dimensions of Ultrasound Screening for Fetal Abnormalities', *Ann NY Acad Sci* 847, 185–190.

Cooper, M.W.: 1996, 'The Gastroenterologist and His Endoscope: The Embodiment of Technology and the Necessity for a Medical Ethics', *Theoretical Medicine* 17, 379–398.

Davidson, S.N.: 1995, 'Technological Cancer: Its Causes and Treatment', *Healthcare Forum J* 38 (2), 52–58.

Delkeskamp-Hayes, C. and Cutter, M.A.G.: 1993, *Science, Technology, and the Art of Medicine: European-American Dialogues*. Dordrecht: Kluwer Academic.

Ellul, J.: 1964, *The Technological Society*. New York: Alfred A. Knopf.

Evans, A.S.: 1991, 'Causation and Disease: Effect of Technology on Postulates of Causation', *The Yale Journal of Biology and Medicine* 64, 513–528.

Feinstein, A.R.: 1967, *Clinical Judgment*. Baltimore: The Williams and Wilkins Company.

Ferkiss, V.: 1969, *Technological Man*. New York: Braziller.

Fischer, E.S. and Welch, H.G.: 1999, 'Avoiding the Unintended Consequences of Growth in Medical Care', *JAMA* 281, 446–453.

Gadamer, H.G.: 1987, *Gesammelte Werke*. Tübringen: Mhor, Vol. 4.

Glover, J.: 1977, *Causing Death and Saving Lives*. Harmondsworth: Penguin.

Gorovitz, S. and MacIntyre, A.: 1976, 'Toward a Theory of Medical Fallibility', *Journal of Medicine and Philosophy* 1, 51–71.

Green, J.M.: 1990, 'Prenatal Screening and diagnosis: Some Psychological and Social Issues', *Br J Obs and Gyn* 97, 1974–1976.

Hagemo, P.S., Rasmussen, M., Bryhn, G. and Vandvik, I.H.: 1997, 'Hypoplastic Left Heart Syndrome Multiprofessional Follow-up in the Mid-term Following Palliative Procedures', *Cardiol Young* 7, 248–253.

Hanson, M.J. and Callahan, D.: 1999, *The Goals of Medicine: The Forgotten Issues in Health Care Reform*. Washington: Georgetown University Press.

Heidegger, M.: 1962, *Die Technik und die Kehre*. Stuttgart: Verlag Günther Neske.

Hellerstein, D.: 1983, 'Overdosing on Medical Technology', *Technol Rev* 86 (6), 12–17.

Helman, C.G.: 1985, 'Disease and Pseudo-disease: A Case History of Pseudo-angina', in: R.A. Hahn and A.D. Gines (eds.), *Physicians of Western Medicine. Anthropological Approaches to Theory and Practice*. Dortrecht: D. Reidel Publishing Company.

Hollander, R.D.: 1997, 'The Social Construction of Safety', in: K. Schrader-Frechett and L. Westra (eds.), *Technology and Values*. New York: Rowman & Littlefield Publishers, pp. 107–114.

Ihde, D.: 1990, *Technology and the Lifeworld: From Garden to Earth*. Bloomington: Indiana University Press.

Illich, I.: 1975, *Medical Nemesis: The Expropriation of Health*. London: Calder and Boyars.

Jennett, B.: 1986, *High Technology Medicine – Benefits and Burdens*. Oxford: Oxford University Press.

Jennett, B.: 1988, 'Variations in Surgical Practice: Welcome Diversity or Disturbing Differences', *British Journal of Surgery* 75, 630–631.

Jennett, B.: 1994, 'Medical Technology, Social and Health Care Issues', in: R. Gillon (ed.), *Principles of Health Care Ethics*. New York: John Wiley & Sons, pp. 861–872.

Jonas, H.: 1985, *Technik, Medizin und Ethik*. Frankfurt a.M: Insel Verlag.

Jonsen, A.R.: 1990, *The New Medicine and the Old Ethics*. Cambridge MA: Harward University Press.

Kass, L.R.: 1975, 'Regarding the End of Medicine and the Pursuit of Health', *Public Interest* 40, 11–42.

Kern, J.H., Hayes, C.J., Michler, R.E., Gersony, W.M. and Quagenbeur, J.M.: 1997, 'Survival and Risk Factor Analysis for the Norwood Precedure for Hypoplastic Left Heart Syndrome', *Am J Cardiol* 80 (2), 170–174.

Kevnanagh, A.M. and Broom, D.H.: 1998, 'Embodied Risk: My Body, Myself?' *Soc Sci Med* 46, 437–444.

Leape, L.L.: 1994, 'Error in Medicine', *JAMA* 23, 1851–1857.

Le Fanu, J.: 1999, *The Rise and Fall of Modern Medicine*. London: Little Brown.

Lewis, T.: 1977, 'On the Science and Technology of Medicine', in: J.H. Knowles (ed.), *Doing Better and Feeling Worse*. New York: Norton & Co, pp. 35–46.

Malone, P.S.J.: 1996, 'Antenatal Diagnosis of Renal Tract Anomalies: Has it Increased the Sum of Human Happiness?' *J R Soc Med* 89, 155–158.

McWhinney, I.R.: 1997, *A Textbook for Family Medicine*. Oxford: Oxford University Press.

Mitcham, C.: 1994, *Thinking Through Technology. The Path Between Engineering and Philosophy*. Chicago: The University of Chicago Press.

Mitcham, C.: 1995, 'Philosophy of Technology', in: W.T. Reich (ed.), *Encyclopedia of Bioethics*. New York: MacMillan, pp. 2477–1484.

Monti, J.E., Wood, D.P., Pontes, E., Boyett, J.M. and Levin H.S.: 1989, 'Adenocarcinoma of the Prostate in Cytoprostatectomy Specimens Removed from Bladder Cancer', *Cancer* 63, 531–538.

Moss, R.W.: 1991, *The Cancer Industry: The Classic Exposé on the Cancer Establishment*. New York: Paragon House.

Muraskas, J., Marshall, P.A., Tomich, P., Myers, T.F., Gianopoulos, J.G. and Thomasma, D.C.: 1999, 'Neonatal Viability in the 1990s: Held Hostage by Technology', *Camb Q Healthc Ethics* 8 (2), 160–170.

Paul, N.: 1998, 'Incurable Suffering from the "Hiatus Theoreticus"? Some Epistemological Problems in Modern Medicine and the Clinical Relevance of Philosophy of Medicine', *Theoretical Medicine and Bioethics* 19, 229–248.

Payer, L.: 1992, *Disease Mongers: How Doctors, Drug Companies, and Insurers Are Making You Feel Sick*. New York: John Wiley & Sons.

Pellegrino, E.D.: 1979, 'Medicine, Science, Art: An Old Controversy Revisited', *Man Med* 4 (1), 43–52.

Pickering, W.G.: 1996, 'Does Medical Treatment Mean Patient Benefit?' *Lancet* 347 (8998), 379–380.

Ponder, B.: 1997, 'Genetic Testing for Cancer Risk', *Science* 278, 1050–1054.

Reiser, S.J.: 1977, 'Therapeutic Choice and Moral Doubt in a Technological Age', in: J.H. Knowles (ed.), *Doing Better and Feeling Worse*. New York: Norton & Co, pp. 47–56.

Reiser, S.J.: 1978, *Medicine and the Reign of Technology*. New York: Cambridge University Press.

Robinson, D. and Bevan, E.A.: 1993, 'Defining Normailty – Art or Science?' *Methods Inf Med* 32 (3), 225–228.

Rothman D.J.: 1991, *Strangers at the Bedside. History of How Law and Bioethics Transformed Medical Decision Making*. New York: Basic Books.

Rothman, D.J.: 1997, *Beginnings Count: The Technological Imperative in American Health Care*. New York: Oxford University Press.

Räikkä, J.: 1996, 'The Social Concept of Disease', *Theoretical Medicine* 17 (4), 353–361

Schneidermann, L.J. and Jecker, N.S.: 1995, *Wrong Medicine: Doctors, Patients and Futile Treatment*. Baltimore: Johns Hopkins.

Schrader-Frechett, K. and Westra, L.: 1997, *Technology and Values*. New York: Rowman & Littlefield Publishers.

Sharpe, V.A. and Faden, A.I.: 1998, *Medical Harm. Historical, Conceptual, and Ethical Dimensions of Iatrogenic Illness*. Cambridge: Cambridge University Press.

Skrabanek, P.: 1994, *The Death of Humane Medicine and the Rise of Coercive Healthism*. Suffolk: The Social Affairs Unit.

Smith, M.R. and Marx, L. (eds.): 1994, *Does Technology Drive History? The Dilemma of Technological Determinism*. Cambridge: MIT Press.

Stewart-Brown, S. and Farmer, A.: 1997, 'Screening Could Seriously Damage your Health. Decisions to Screen Must Take Account of the Social and Psychological Costs', *BMJ* 314, 533.

Sundström, P.: 1998, 'Interpreting the Notion that Technology is Value-Natural', *Medicine, Health Care and Philosophy* 1, 41–45.

Tatum, J.S.: 1997, 'The Political Construction of Technology: A Call for Constructive Technology Assessment', in: K. Schrader-Frechett and L. Westra (eds.), *Technology and Values*. New York: Rowman & Littlefield Publishers, pp.

Temkin, O.: 1963, 'The Scientific Approach to Disease: Specific Entity and Individual Sickness', in: A.C. Crombie (ed.), *Scientific Change: Historical Studies in the Intellectual, Social and Technical Conditions for Scientific Discovery and Technical Invention from Antiquity to the Present*. New York: Basic Books, pp. 629–647.

Temkin, O.: 1977, *The Double Face of Janus*. Baltimore: Johns Hopkins University Press.

Thomas, L.: 1977, 'On the Science and Technology of Medicine', in: J.H. Knowles (ed.), *Doing Better and Feeling Worse: Health in the United states*. New York: W.W. Norton.

Toulmin S.: 1986, 'How Medicine Saved the Life of Ethics', in: DeMarco, R.M. Fox (eds.), *New Directions in Ethics: The Challenge of Applied Ethics*. New York: Routledge and Keagan Paul, pp. 265–281.

Twaddle, A.: 1993, 'Disease, Illness and Sickness Revisited', in: A. Twaddle and L. Nordenfelt (eds.), *Disease, Illness and Sickness: Three Concepts in the Theory of Health, Studies in Health and Society 18*, Linköping University, pp. 1–18.

Tijmstra, T.: 1989, 'The Imperative Character of Medical Technology and the Meaning of "Anticipated Decision Regret"', *Int J of Technology Assessment in Health Care* 5, 207–213.

Veatch, R.M.: 1985, 'Against Virtue: A Deontological Critique of Virtue Theory in Medical Ethics', in: E.E. Shelp (ed.), *Virtue and Medicine*. Dordrecht: Reidel Publishing Company, pp. 329–345.

Vos, R.: 1991, *Drugs Looking for Diseases: Innovative Drug Research and the Development of the Beta Blockers and Calcium Antagonists*. Dordrecht: Kluwer Academic Pbulishers.

Wahl, P.W., Savage, P.J., Psaty, B.M., Orchard, T.J., Robbins, J.A. and Tracy, R.P.: 1998, 'Diabetes in Older Adults: Comparison of 1997 American Diabetes Association Classification of Diabetes Mellitus with 1985 WHO Classification', *Lancet* 352 (9133), 1012–1015.

Whittle, M.: 1997, 'Ultrasonographic "Soft Markers" of Fetal Ultrasound. Detecting Them may do More Harm Than Good' (Editorial). *BMJ* 314, 918.

Winner, L.: 1977, *Autonomous Technology*. Cambridge MA: MIT Press.

Paper 5

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Scientific Contribution

Technological medicine and the autonomy of man

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Abstract. Is technology value-free or is it value-laden? How does technology affect human autonomy? These questions, viewed within the context of medicine, are the focus of attention in this article. The central argument is that we need neither to subscribe to the value-neutrality dictum nor to the all-encompassing value-ladenness thesis to explain the pertinent position of technology in medicine. Technology is constitutive of and strongly implicated in difficult questions of value. This, however, does not mean that technology is identical to (or neutral to) these value-laden questions. Technology poses issues of value, but only some of these relate to technology *qua* technology. Hence, it makes a difference whether we discuss general questions of value posed by technology or whether we discuss the value-ladenness of technology. Admitting technological value-ladenness does not imply that we are subject to a technological imperative that reduces our autonomy, on the contrary, it explains how technology increases our responsibility. This is particularly prominent in medicine.

Key words: imperative, responsibility, technology, value-ladenness, value-neutrality, values

Introduction

During the last two centuries technology has substantially changed medicine. Instruments like microscopes, electrocardiographs, chemical analysers, X-ray tubes, dialysis machines and pacemakers have revolutionized medical research and practice. Technology has facilitated the eradication of several diseases, established the diagnosis and treatment of new conditions and provided the ability to predict the prognosis of a wide range of diseases. "The concept of progress in medicine is now defined almost exclusively in terms of its technological, curative function extending even to death itself" (Hanson, 1999, p. 144).

How are we to understand this influence of technology on medicine? One account of technology in medicine is the value-neutrality dictum, according to which technology represents value-neutral means to an external end. Technology is applied to obtain a goal which is independent of technology, but which technology can achieve. This view has been strongly opposed by positions claiming that technology is inherently value-laden.

Why is this discussion on the value-ladenness of technology so important? One reason is because the value-ladenness of technology has been related to the issue of human autonomy (Ellull, 1964; Winner, 1977; Mitcham, 1994). It is argued that technology directs our values, or that it impels values beyond human control, representing a technological imperative that reduces human autonomy.[1] If technology really reduces our autonomy, then it also reduces our responsibility, because we are not fully responsible for actions that are compelled. Such a reduced responsibility for technology would be consequential, even if the reduced autonomy is only imaginary. Common statements such as: "we have to grasp the new technological possibilities", "we can't stop progress" and "we have to follow the development" tend to disclaim responsibility. In order to avoid admitting a reduced responsibility for technology some scholars tend to insist that technology is value-neutral, while others insist that we are still responsible for our actions even though technology directs and impels our values.

This article will investigate both these positions. In particular it will scrutinize whether technology is value-neutral or whether it is value-laden and how this affects our autonomy and responsibility. The article does not pretend to be a review of the general debate about the philosophy of technology, but will be restricted to the discussion within the philosophy of medicine. One reason for this is that issues related to value come out strongly in medicine. Furthermore, the article will present one prominent advocate for each of the two positions: Eric Cassell's article *The Sorcerer's broom. Medicine's rampant technology* represents an outstanding account of value-laden technology, whereas Per Sundström's article in MHCP

Interpreting the notion that technology is value-neutral presents a sophisticated version of the value-neutrality dictum. These articles introduce the conceptual issues of the general discussion on technology in a brilliant way.

It will be argued that we do not have to accept either the value-ladenness stance or the neutrality dictum. The paradox of why we feel that the technology that we design, produce, implement and use reduces our autonomy, can be resolved by acknowledging the complexity of technology: our incomprehensibility of technology makes us feel heteronomous despite our being the autonomous constructor, producer and user of technology. It will be argued that technology is value-laden, but in a restricted manner: only in issues concerning its function. Hence, to handle technology we have to acknowledge its value-ladenness.

The value-ladenness of technology in health care

Cassell describes the value-ladenness of technology in terms of its imperative and its autonomy. He gives several characteristics of how the technological imperative determines human actions. First, technology influences existing human values. "Technological values . . . foster medical values that are intolerant of ambiguity, which subsequently leads to a new stage of technology" (Cassell, 1993, p. 35). Technology redirects the fundamental goals of health care (Cassell, 1993, p. 32). Instead of applying technology as a neutral means to a given goal, we adapt our values and goals to technology itself in what Winner has called *reverse adaptation* (Winner, 1977).

Second, technology promotes its own values. This is illustrated by the application of technology contrary to the benefit for man. "It is . . . used where it is inappropriate, defined by the capabilities of the technology and the consequent expertise of physicians rather than – or even contrary to – the good of the sick person" (Cassell, 1993, p. 32). There is an "irresistible spread of technology into every level of medicine – irresistible to doctors, patients and nations alike" (ibid.).

According to Cassell, the way that technology promotes its own values is through certain technological characteristics. Technology is reductive, oversimplifying, impatient and intolerant of ambiguity. It enhances power and it spreads more quickly than the ideas that form it. Cassell does not give a detailed outline of these characteristics of technology. Only the reductive and self-perpetuating traits are described in more detail.

Historically, he points out, diseases were reduced to anatomical and biochemical characteristics and

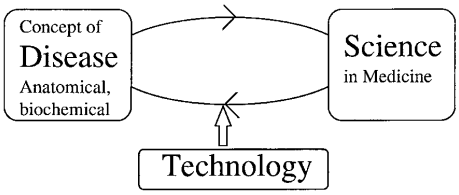

Figure 1. Self-perpetuating circle of technology.

causes. This permitted precise definitions of diseases, which promoted the entrance of science into medicine. Science in turn employed technology and gained increased technological (reductive) knowledge of disease: "These definitions, identifiable characteristics, scientific investigations, and consequent technologies perpetuated the oversimplification of human illness" (Cassell, 1993, p. 33). This closed the circle: The scientific knowledge of disease that was gained by technology further promoted the application of technology. Cassell's circle of technological self-perpetuation is illustrated in Figure 1.

How can we explain that technological characteristics, such as reductiveness, oversimplification and impatience, can direct human values and behaviour? Cassell's answer is that the characteristics of technology correspond to deficiencies in human nature. Cassell mentions five values of the defective human nature: the human tendency to wonderment, our attraction to the immediate and to the unambiguous; the human avoidance of uncertainty, and our desire for power. As the characteristics of technology satisfy these values of the defective human nature, technology therefore comes to direct man. Here Cassell follows the same strategy as Ellul, Winner and Reiser, ascribing the technological values to human deficiencies (Ellul, 1964; Winner, 1977; Reiser, 1978).

As the characteristics of technology correspond to vices in human nature, Cassell's solution to the problem of technology is to alter our nature and to "tolerate uncertainty, accept ambiguity, deal with the complex, and turn away from mere wonder" (Cassell, 1993, p. 39). To be able to handle the value-ladenness of technology, we have to govern our values, to be able to control technology we have to control ourselves, and to manage the ethical challenges due to technology, we have to manage our *ethos*.

The sorcerer's broom

Hence, Cassell follows a double strategy in explaining the value-ladenness of technology. On the one hand, it is explained by the imperative and autonomous characteristics of technology. On the other hand it is accounted for by deficiencies in human nature. With

this double strategy Cassell achieves both to explain why we feel that we are directed by technological values and to relate the responsibility of this to man. In relating the characteristics of technology to deficiencies in human nature he is able to explain how technology can be conceived as an imperative to human life, at the same time as the human being invents, produces, uses and is responsible for the technology. With a Kantian turn Cassell tries to unite autonomy and heteronomy.

This double strategy is brilliantly displayed in Cassell's metaphor of the sorcerer's broom. The broom is a powerful product. It is a technology with characteristics of its own. However, in the hand of the apprentice, who fails to have the controlling qualifications of the sorcerer, it enforces its own values and runs out of control. That is, technology becomes autonomous due to the apprentice's deficiencies. Cassell's article heavily leans on this metaphor of the broom. He argues that technology has become "a thing unique unto itself", that technologies "have a life of their own . . . because of their own properties", and that "technology . . . should be blamed for the troubles it brings". The broom is a marvel and a good in the hand of the sorcerer who is able to command it, but a disaster in the hand of the ignorant assistant. The technological broom comes to be autonomous, it advances its own values and takes control if it is not controlled.[2] The sorcerer's broom illustrates a conception of technology as compelling and autonomous, and the metaphor provides technology with a personality that impels its values and threatens the autonomy of man.

So, according to Cassell, the value-ladenness of technology is due to the impelling characteristics of technology itself, which correspond to deficiencies in human nature. This doubleness of technology is illustrated by the metaphor of the sorcerer's broom.

Challenging the value-ladenness thesis

The strength of Cassell's conception, then, is that it addresses both the value-ladenness of technology and the autonomy of man. By giving a detailed account of the technological imperative as the result of human deficiencies, he is able to combine the notion of a value-laden technological imperative with the conception of human responsibility. There are, however, several difficulties with this account.

First, the stance presupposes a permanency of human nature (and its deficiencies). Cassell seems to presume that human beings are not changed by technology. However, if we are able to alter our life totally by technology, how can we explain that we are not changed by it? If we have the power to use technology to satisfy and even compensate for certain deficiencies in our character as human beings, why do we not become better? This difficulty is closely connected to the second difficulty: the ideal of the genuine man. To declare deficiencies in man, even only in relation to handling technology, presupposes an ideal *ethos* of man. Where are we to find this ideal character to determine our deficiencies? This appears to be a difficult task.[3]

Third, Cassell's theory appears to need a broom and a sorcerer. The broom explains the autonomous character of technology. Furthermore, as the affinity to technology actually is the result of human deficiencies, we can blame our nature or Creator. To stay within Cassell's terminology, his theory needs a sorcerer that is accountable for his broom. The sorcerer should never have left the broom in reach of the ignorant apprentice. Hence, the sorcerer's broom is a metaphor that plays an important role in establishing the characteristics of technology. Actually, it is more than a mere metaphor, it is the cement of Cassell's theory.

Fourth, technology is actually contrived by man, and to say that man has created his master is a strong and controversial claim. How can man control what controls him? Cassell's answer to this question is that man is controlled by the compensational measures to his defective nature. A friendly interpretation of Cassell's position would be that man is still responsible for his actions even if his nature is defective. However, any issue of defective human nature appears to bring us back to the question of the ideal man and the requirement of a sorcerer. Cassell's impressive effort to combine technological value-ladenness with human autonomy is based on a controversial concept of man.

So far I have discussed the "human" characteristics of technology. Let me now turn to the "non-human" traits of technology and in particular to its self-perpetuating characteristic. Cassell explains the self-perpetuating trait of technology by a self-promoting circularity. There are however difficulties with this circle.

The perpetual circle

As we recall, Cassell argues that the reductionistic definition of disease facilitated the entrance of science into medicine (Figure 1). But this initial condition that allowed the entrance of science into medicine already presupposes science. Physical entities with anatomical and biochemical characteristics and unique causes are already based on scientific categories in anatomy and biochemistry.

Cassell then continues to argue that scientific knowledge advancing the reductionistic concept of

disease, further promoting the position of science in medicine. Technology enters the circle by the fact that it is applied by science and that it increases the scientific knowledge of disease, which in turn promotes the further application of technology. However, adding technology to the circle does not make the argument less problematic. The anatomical and biochemical concept of disease seems to presuppose a certain level of technology.

Furthermore, Cassell runs into the controversy of the relationship between science and technology. It is not obvious that science is the precondition for technology (Veatch, 1976; Mitcham, 1994). The application of science without technology appears to be difficult in medicine. The manifestation of disease in scientifically treatable entities is based on technology (Hofmann, 2001). Thus, the science that establishes and promotes technology already presuppose technology. It seems therefore difficult to differentiate science, technology and the definition of disease as presented in Cassell's circle. Hence, the self-perpetuating characteristic of technology might as well lie in the circularity of the argument as well as in technology itself.

Another difficulty with Cassell's account of the perpetuation of technology can be found in his definition of technology. Cassell conceives technology as something that alters human thought, sensation, power and volition. However, according to this conception, technology is value-laden by definition.

The ghost in the machine

There appear to be other difficulties with the "non-human" characteristics of technology as well. Characterising technology as being reductive, oversimplifying, self-perpetuating, impatient and intolerant of ambiguity describes an almost impersonated autonomous technology: the "technological broom", then "technology . . . should be blamed for the troubles it brings" (Cassell, 1993, p. 39).

Cassell, like Ellul and Winner, describes a personified technology, and appeals to a *ghost in the machine* (Ryle, 1976). Technology is described as a thing with a character, like a "Monster" or a "Broom".[2] However, it appears to be difficult to give a reasonable account of such a monstrous character of technology. The autonomous technology lacks a subject. This, however, makes us chase a *ghost in the machine*, and it can even cause us to be directed by it! If we believe in "the technological broom" that conducts our actions, we become subject to a technological imperative (Merton, 1995), and we come to blame technology as Cassell suggests (p. 39).

This relates to a paradox typical to "technological determinism". If we really were determined by technology, there would be no reason to warn against it. Cassell claims that there is a technological imperative directing our goals that is self-perpetuating and that results in applications which are contrary to our interests. At the same time he claims that it can be controlled. "Technology is not the problem; it is the relationship to it of those who employ it that is problematic" (Cassell, 1993, p. 32). If we really are determined by technology due to our deficient character or otherwise, how could we and why should we change it?

Furthermore, the premise that we have to change the nature of man to be able to control technology can be questioned. It might be argued that whatever is called "human nature" is called so because it is conceived of as unchangeable. There might be other reasons why we feel controlled by technology, and we might well be able to control technology without changing our nature. In other words, technology might be value-laden without relating to our (deficient) nature.[4]

Hence, the strength of Cassell's theory also appears to be its weakness. To be able to explain the common conception of technology as being compelling, he gives a description of its value-laden, imperative and autonomous characteristics. However, in order to maintain that we are still responsible for technology, its characteristics correspond to deficiencies in human nature. As argued, both these claims appear to be problematic.

Thus, the account of the characteristics of technology, such as self-perpetuation, appears to be circular. By establishing these characteristics on the basis of deficiencies in human nature, there is the danger that we reduce our responsibility towards technology. Furthermore, the metaphor of the sorcerer's broom is more than a mere metaphor. It appears to be the cement of the theory. It represents a ghost invoking resignation more than appealing for change.

Therefore, technology cannot be value-laden in the sense that Cassell argues. What then does this mean? Is technology neutral? This issue will be pursued in the next section.

The neutrality of technology

According to the neutrality dictum, technology represents value-neutral means to an external end. Value judgements concerning technology are related to the value of its application. As already mentioned, this study will neither present the value-neutrality dictum

in general nor all its accounts in medicine, but rather it will concentrate on one version of the position presented by Per Sundström (1998).

Sundström maintains that technology can be regarded as value-neutral in three different aspects. First, technology is value-neutral vis-à-vis different possible uses and ends. It can be applied in miscellaneous ways with different purposes: technology is neutral in terms of its *ambiguous use*. Second, technology has no value properties as long as it is not used or applied in practice. "Human subjects/beings are free to say 'yes' or 'no' to technological projects that emerge as attractive possibilities, and they are free to choose among alternative uses of available tools and techniques. Moreover, they are free to say 'no' to the mental image of an autonomous, self-perpetuating technology – technology as imperative and as totalitarian system" (Sundström, 1998, p. 43). Abstracted from the context of action, technology is value-neutral, that is, there is a *neutrality before action*.

Third, technology is an application of a neutral scientific account of nature. Technology is part of the neutral scientific project and has a value-neutral theoretical cognitive core. The reason why technology actually *works* is because it is value-neutral, and it is 'good' to the user because it works (Sundström, 1998, p. 44). Hence, technology has a *neutral cognitive content*.

Sundström's main issue is to emphasise the moral responsibility concerning technology. Only the neutrality of technology can pave the way for moral imperative. Technology has a psychological power that has to be defeated, because if technology is autonomous, we may claim to be free from any responsibility. Based on the works of Hans Jonas, Sundström claims that liberation from the fiction of technological imperative is necessary for acknowledging our moral responsibility. Value-neutrality is necessary to overpower the prevailing *quasi*-autonomy, and *quasi*-determinism or *quasi*-necessity. "The *moral* of the story is, again, that the value-neutrality of technology does not free its wielders from moral responsibility. In fact, quite the opposite is the case" (ibid.).

Hence, the value-neutrality dictum addresses human responsibility for the development, production and application of technology. Sundström explains the "value-ladenness of technology" as a psychological fiction, and his objective is to point out how dangerous this can be. However, there seem to be some difficulties with the neutrality dictum in general and with Sundström's account in particular.

Difficulties with the value-neutrality dictum

The essence of Sundström's position, but also its difficulty, is the abstract conception of technology being expressed in all three aspects of value-neutrality. Neutrality vis-à-vis possible uses and ends represents an abstraction from the actual use. An ultrasound machine can be applied for diagnosing abdominal metastases and for prenatal sex selection. The ultrasound machine, as technology, is dissociated from these uses. The second sense of value-neutrality, neutrality before action, represents an abstraction from the particular action. The physician can abstain from using an ultrasound machine. In the third sense of value-neutrality, where technology is a cognitive object, Sundström refers to the value-neutral view of nature that is a prerequisite for the development of technology. There is a theoretical basis for the development and production of the ultrasound machine. This represents an abstraction both from practical and possible applications of technology.

Hence, Sundström's conception of 'value-neutral technology' is based on the abstraction from its use and its ends, from its context of action, and its possible use. It seems hard not to agree that it is possible to use an ultrasound machine for different purposes, that it is possible to abstain from its use and that the design and production of the machine presupposes a theoretical account of nature. However, the difficulty with this account is whether the abstractions establishing value-neutrality also detach the discussion from its subject matter: technology. If we disregard the possible, actual and practical use of a device, is it then still technology? This question will be addressed in the following analysis of Sundström's three accounts of value-neutrality.

Ambiguity of technology

The ambiguity of technology is due to a "practical and moral *openness* of techniques and tools/devices" (Sundström, 1998, p. 42). The example of the ultrasound machine makes this point seem obvious. The question of whether we use it for detecting metastases in the abdomen or for prenatal sex selection is a question of value and is not implicit in technology itself. Accordingly, a gun can be applied for target shooting and for murder, and as often quoted: "it is not guns that kill people, people kill people".

That technology can be applied in miscellaneous ways with different values does not make it value-neutral. On the contrary, it illustrates that technology is related to value – it is applied according to different values. Obviously, there are evaluative challenges to the application of technology, e.g. whether an ultra-

sound machine is used for diagnosing abdominal metastases or for prenatal sex selection is an evaluative issue. However, this is evaluative in a general and rather trivial manner. We might use our words in a good or bad way, and we may work for a good or bad cause. This does not answer the question of whether words or work are good or bad, or value-neutral.

In this perspective the ambiguous application of technology does not differ from the uses of other things. We use a chair according to its value. In most cases we might find it good to sit in, but in some situations it might be good to stand on. This, however, does not show that a chair is value-neutral. Hence, that some issues of value are external to technology does not make all issues of value external to it. In other words, neutrality due to "ambiguous use" is not specific to technology.

It is not a characteristic of the ultrasound machine that it diagnoses cancer or is applied for sex selection. Nor is the feature of the gun to shoot at targets or people. These kinds of value questions are not related to the technology *qua* technology. What kinds of values, then, are specific to technology? How is technology value-laden with respect to use? A (diagnostic) ultrasound machine cannot be used to cut tissue or to manipulate genes. It is an ultrasound device due to its ability to generate images of intracorporal structures by means of ultrasonic reflections. The evaluative challenges related to guns *qua* guns is not whether it is right to shoot at targets or people, but whether we should allow devices that spurt objects which have the ability to destroy the objects they hit. When an ultrasound machine is applied to knock in a nail (e.g. with the transducer) it becomes a hammer, and its value as a scanning device becomes irrelevant. Correspondingly, the value-ladenness of a respirator is related to its very ability to provide artificial respiration. Even nuclear explosives could be used for peaceful purposes (e.g. digging canals), however, this does not make them value-neutral. That is, there are characteristics of technology that are constitutive to the particular technology, and these characteristics are value-laden. The diagnostic ultrasound machine *is* an ultrasound machine because it has the valued characteristic that it generates images of intracorporal structures by means of ultrasound reflection.

Hence, the issue of value-neutrality with respect to technology's ambiguous use is not relevant to the value-ladenness of technology, because it does not address the questions of technology's use *qua* technology.

Neutrality before action

The main question in the case of neutrality before action is whether it is possible to abstract from the context of action. Values are involved in the design of technology. It is developed because it serves a certain function. Will values not be involved in their application or abstention from application too? Sundström addresses this matter himself: "Guns are made to wound and kill; respirators are not. But there is always a last step to be taken before anything in terms of value comes out of the existence of these tools and devices; their very existence has not finally decided their status in terms of value . . ." (Sundström, 1998, p. 43).

There appear to be some difficulties with this abstraction because it is not the pulling of the trigger that makes the gun value-laden. The development of the nuclear bomb has been questioned morally, not just its use at Hiroshima and Nagasaki. The cold war taught us that the bomb had a value even without being used. More precisely, the nuclear bomb had a value because it was not applied. There are certain types of technology we do not want because of their values. The technology for cloning human beings seems to be an example of this.

That we might apply or abstain from application is not typical for technology. We might use or not use words, e.g. "idiot", but this does not make the word value-neutral. On the contrary, it is its value-ladenness that makes us decide to use or, preferably, not use the word. The point is that there are some uses that we cannot abstain from without violating the core characteristics of technology.

What then, is this core characteristic of a particular technology? As indicated in the previous section, it is the *function* of technology. There appears to be agreement that a given technology is characterized by its function and that function is value-laden.[5] If "neutrality before action" abstracts from technology's function, it abstracts from the issue: technology. A radiologist might be supposed to use the CT scanner to investigate the head for metastases. She can of course abstain from doing so, but then she might threaten her professional integrity. The CT scanner is a CT scanner in terms of a particular function and not as an abstraction from it. In other words: the possibility of not using a CT scanner in a particular situation does not free the CT scanner from being constituted by exactly such a function. If the CT scanner could not be used to make CT scans, it would not be a CT scanner. It is its function that makes it valued.

Being able to choose between action and non-action does not make the choice value-neutral. Both the action and the non-action can be value-laden.

Technology is constituted by the possibility of action related to its *function*, and as such is value-laden. "Neutrality before action" abstracts from issues of value that are constitutive to technology.[6]

Neutrality of cognitive content

According to Sundström, technology is 'good' to the user because it works, and it works because it is value-neutral. This can be interpreted in several ways. One interpretation would be that value-neutrality is an *a priori* good, i.e. a value. This, however, makes the argument circular. A more friendly interpretation would be that in order to be of any good, technology has to work, and in order to be able to use technology for the users own good, it has to be value-neutral. Thus, in order to be of value, technology has to be value-neutral. Otherwise, technology would enforce the user's action and, hence, would not be useful or valuable.

To reject the technological imperative by presupposing that there is no imperative appears to make the argument of cognitive content vacuous. Technology can be useful even if it is not value-neutral. If you want to obtain a certain good you apply the technology that acquires this good, that is, has a particular function. If you think that it is good to see an image of the intracorporal structure by means of ultrasonic reflections, you use an ultrasound machine. Accordingly, the cognitive content of the nuclear bomb is not value-neutral. The value of its cognitive content was effectively applied during the cold war. It seems difficult to maintain that it was the cognitive neutrality that kept the power balance. Hence, the cognitive content of technology has function and value.

Moreover, Sundström argues that technology presupposes a value-neutral view of nature. On the contrary, one could argue, it is because nature has value that we use technology. If ventricular fibrillation were not recognized as a state of nature with negative value, we would not use a defibrillator for resuscitation. Furthermore, the value-neutral view of nature is challenged in the philosophy of science.

Moreover, it is difficult to conceive of the cognitive abstraction of technology as anything other than science. If there is a difference between science and technology, the difference is that technology is related to *use* in some way (Nordin, 1999). Abstracting from this use abstracts from the characteristic of technology. Furthermore, it makes the discussion about the neutrality of the 'cognitive content of technology' a debate about the neutrality of science. This is not the place to enter into the comprehensive discussion on the relationship between science and technology. It is sufficient to point out here that this relationship and the issue of value-neutrality of science are not trivial topics (Gordon, 1969; Veatch, 1976; Mitcham, 1994; Schrader-Frechette, 1997).[7]

Abstracting from technology

Altogether, according to Sundström's account, the neutrality of technology is gained by abstracting it from its function and its use. The point here is that this abstracts from the features that are typical to technology. Sundström discusses general issues of value that are common to many things, e.g. words and chairs, but ignores that it is the function and the use that constitutes technology and its relationship to value. An ultrasound machine is an ultrasound machine even if it has never been used for producing a single image of intracorporal structures. What makes it a ultrasound machine, however, is the possibility of the particular practical act of making an image of intracorporal structure by means of ultrasonic reflections. Without this function, it is not an ultrasound machine. Hence, abstraction from the practical function abstracts from the very characteristic of technology. The neutrality Sundström describes is certainly the neutrality of action and thought, but it does not seem to be the neutrality of technology.

The reason for this can be found in his conception of technology. Sundström conceives technology mainly as "techniques and tools/devices". In this he appears to miss some important aspects of technology. Winner has given a widely referred to definition of technology that includes *apparatus*, *methodology* and *organisation* (Winner, 1977). Mitcham has added the aspect of human *volition* to this definition (Mitcham, 1994, 1995). Sundström's conception of technology addresses the apparatus and methodology, but he seems to miss important aspects of the social organization and the human will as constitutive to technology.

Although it might be argued that a tool/device is neutral as a black box, it is not so as a tool/device. A defibrillator (heart starter) is not a defibrillator because it is a box with wires, electrodes and electronic components (*apparatus*). It is a defibrillator because of the *methods* of medical resuscitation. Furthermore, the device and these methods would not make it a defibrillator if they were not applied in the *organization* of health care. What we call a 'defibrillator' would not be technology to a so far unknown population in the Amazon, even if we taught them its function and how to use it. Only within an organizational framework of emergency medicine would it be a defibrillator. Mitcham would add that the device would not be a defibrillator unless it was so by human volition. In

addition to the rational objective represented by the device, the methodology and the organization, there is a *will* for constructing, producing and using the defibrillator.

Thus, in insisting on the value-neutrality of technology, Sundström appears to loose the subject matter: technology. "Abstract technology" might be neutral, but it is no longer technology. Of course, theoretically Sundström obviously has a point: any concept might be abstracted to a level where it is not a matter of value. The point here is simply that this abstraction makes value-neutrality irrelevant to human actions related to technology.

Technology and value

Even though Cassell and Sundström appear to hold contrary positions, their conclusions are not far apart. Cassell states that: "Technology is not the problem: it is the relationship to it of those who employ it that is problematic" (Cassell, 1993, p. 32). This is close to Sundström's objective: to highlight human responsibility for the social implementation of technology. How can their conclusions be so close, even though their perceptions of technology are contrary?

One answer to this question would be that they apply different strategies to reach the same end. They both explain our undesired submission to technology indirectly and in terms of human deficiencies. Cassell explicitly identifies five negative human character traits, which we have to improve to take control over technology. Sundström on the other hand appeals to deficiencies in human rationality to explain why we appear not to acknowledge our responsibility for technology. An improvement in cognitive ability would enable us to address the ethical issues related to technology. Whereas Cassell bases his theory of technology on the deficiencies in the human nature, Sundström bases his theory on man's defective cognitive capacity to acknowledge and handle the value-neutrality of technology.

A second similarity between their approaches is that both appear to hold an idealised conception of technology, and that neither of them addresses technology as such. Cassell relates the value-ladenness of technology to human characteristics and not only to technology. He is preoccupied with the value of actions, but in relation to human nature and not to technology. Sundström on the other hand, abstracts from technology's "intimate connection with purposeful human action", which he intended to analyse. He generalises from cases where value is external to technology, and in this way he departs from the subject matter. Thus, both appear to abstract from technology, and both appear to appeal to an ideal concept of man. Cassell abstracts from technology and into anthropology, whereas Sundström abstracts into science. While Cassell ascribes too many aspects of life to the value-ladenness of technology, Sundström ignores the important ones.

However, Cassell appears to be right in that it is important to take human nature into account in order to understand our application of technology and also to appeal for an awareness of the goals of medicine to be able to control technology. Accordingly, Sundström's observation that the psychological and social aspect of the *technological imperative* may result in an ignorance of the *imperative of human responsibility* appears sound.

While Cassell insists that technology is involved in general evaluative issues of human nature and Sundström focuses attention on general issues of value that are external to technology, both point to a significant, but maybe trivial point: technology poses issues of value. All evaluative issues posed in relation to technology are of course highly significant, but they may have no other relationship to technology than that they are implied by it.

In a situation where only one respirator is available, the question of whether the respirator should be used for a nine-year-old girl with severe injuries from a car accident or a ninety-year-old man with acute renal failure is an issue of value, but it is not specific to the technology. The question is facilitated by technology, but it is a matter of who we want to help, of values of old versus young and of how we ration. The technology poses the particular question, but the value-question itself is not an issue specific to the technology, and is not related to its function or use.

However, whether we apply the respirator to prolong life beyond the interest of the patient, or in order to use his or her organs for transplantation are evaluative issues relating to technology in a profoundly different manner: they concern the function and purpose of the technology: to prolong the life of a person by artificial respiration. Hence, Cassell and Sundström appear to miss the most interesting and important evaluative issues related to technology, those that are related to its function. Cassell appears to pay too much attention to the characteristics of man, whereas Sundström seems to ignore the attributes of technology.

Function and value

If we want to evaluate the actions related to technology, we have to differentiate general actions from actions specific to the technology in question. If we

again return to the case of the ultrasound machine, the question of whether we should do sex selective scanning of pregnant women is an evaluative matter of general character: is sex selection right or wrong, good or bad? This is a general question posed by technology, but it is independent of the function of a (diagnostic) ultrasound machine. The evaluative matter concerning the technology of diagnostic ultrasound is whether it is right or wrong, good or bad to produce images of intracorporal structure by means of reflected ultrasonic waves in tissue.

Thus, technology is value-laden, but its value-ladenness is restricted to its constitutive function. To be able to evaluate a technology we must ask whether we accept or reject its function. We do not submit to a "linguistic imperative" or claim that language is value-neutral although it can be applied for good and bad, and certainly is compelling to human activity.

Hence, I do not contend that there are no other evaluative issues at stake in relation to technology other than those which concern its *function*. On the contrary, technology is involved in human action and has to be evaluated like all other actions: we have to evaluate the consequences of actions involving technology and whether they contradict any of our moral principles.[8] However, these are evaluative issues relevant for actions in general, and are only posed by technology. So, there is a position between the all-encompassing value-ladenness stance and the value-neutral dictum. Cassell attempts to resolve the paradox of man controlling the technology that controls him by referring to deficiencies in the nature of man, whereas Sundström attempts to omit the paradox as such. The alternative suggested here is to resolve the paradox by recognizing the value-ladenness of technology found in its function, and as will be discussed in the following, to acknowledge its incomprehensibility.

Complexity and responsibility

Today technology has become so complex that few persons, if any, have complete knowledge about even common products like cars and televisions. The car builder knows little about the electronic devices used in the ignition control system. Technology is so specialized that nobody has a complete overview. The process of constructing, producing and using technology is part of an extensive and complicated social system, which appears to be compelling and out of control. In a complex social system where nobody can grasp, explain, or control technology, it appears autonomous. Complexity and incomprehensibility does not, however, imply that technology poses values beyond human control. Lack of understanding of the details of a particular type of technology does not make it compelling as such.

Conversely, complexity and incomprehensibility explains why technology appears to be an autonomous phenomenon at the same time as it is designed, produced, implemented and used by man. Cassell however, interprets this as an impersonated imperative – the sorcerer's broom – whereas Sundström conceives of it as a reduced cognitive capacity. This presupposes that we have to understand the complexity of technology in order to be able to control it. This, however, brings us back to the start, as it appears impossible to know about all aspects of even simple technologies.

We do not have to know all the technical details to be able to handle the value-laden issues of technology. We can discuss and decide about whether we want to clone human beings, even if we do not know all about genetics. The issue of a given technology's value-ladenness is restricted to its function. Ascribing all issues of value related to actions with technology to the technology misses the point, in the same manner as ignoring the actions constituted by technology through its function.

This leads us to another important point. Both Cassell and Sundström wish to emphasise our responsibility for technology, but they tend to do the opposite. If the technological imperative is due to deficiencies in human nature (Cassell), we might argue that our actions with technology are due to these deficiencies, and that we are therefore not responsible for them. Sundström argues that we have to acknowledge the value-neutrality of technology to be able to recognise our responsibility. However, as argued, it is always possible to identify situations where we cannot free technology from issues of value, that is, issues of its function. Furthermore, tying moral actions regarding technology to a cognitive capacity to conceive of it as value-neutral may restrict our responsibility. Hence, instead of trying to emphasise our responsibility for technology, both the all-encompassing value-ladenness stance and the value-neutrality dictum tend to reduce it.

Conclusions

Altogether, in this article I have argued that we do not need to accept either the all-encompassing value-ladenness stance or the commonplace neutrality dictum. The paradox that technology, which is designed, produced, implemented and applied by us, actually directs our values can be resolved by acknowledging the incomprehensibility of technology and by recognising the value-laden *function* of technology.

Our ignorance makes us feel heteronomous, even though we are autonomous beings: technology does not have a soul, not even in terms of a human antipode. There is no ghost in the machine.

Another conclusion appears to follow from this analysis. Discussing the evaluative status of technology it appears to be crucial not to idealise or abstract from the subject matter. To be able to address the evaluative aspects of technology it is important to stay close to the core characteristics of the technology in question, and discuss cases such as ultrasound machines, CT scanners and micro-matrixes for genetic testing. This appears to address the issue of technology more basically than the topic of the deficient characteristics of man or his cognitive capacities (which obviously are important issues in general, but not in particular in relation to technology). If the study of technology disregards its possible, actual and practical use, becomes too general, and tries to embrace everything, there is a danger that it will end up saying nothing. This is consequential for our conception of technology. Technology is more than "techniques and tools/devices", it is complex social organisation, and constitutively relates to value.

Technology, then, is value-laden, but not all issues of value related to technology stem from its value-ladenness. Whether we drive our car when we are drunk is an issue of value, but it is not an issue of the car as technology, but a matter of action in general: Is it right to break the rule and to expose others to danger? Therefore, it becomes essential to differentiate between the evaluative issues related to technology *qua* technology, and general issues of value implied by technology or where technology happens to be applied.

If we accept diagnostic ultrasound machines we cannot reject technology that generates images by means of ultrasonic reflections in tissue. It is impossible to abstract from the function of a technology without abstracting from the technology itself. That is, there are some issues of values that cannot be ignored without evading the issue of technology altogether. Technology is constitutively value-laden.

Instead of falling into theoretical pitfalls that tend to reduce our responsibility for technology, we should recognise that technology emphasises our responsibility for our actions, both by the general issues of value that technology poses, and by its functionally constituated value-ladenness. Hence, technology is value-laden, but it is not imperative, and does not reduce our autonomy. This is particularly prominent in medicine, where issues of value are conspicuous.

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Notes

1. The value-ladenness of technology has been described by technology being self-augmenting, compelling and imperative (Tijmstra, 1989; Jennett, 1994). "Technologies, history shows, can be imperative: We may be impelled to use the capacities they provide us without adequate reflection on whether they will lead to the humane goals of medical care" (Reiser, 1995, p. 2477). It is argued that technology compels our reasoning and restricts our actions: we have a biased view of technology and we ignore its side-effects (Jennett, 1994). We apply imperfect, *halfway technology* (Thomas, 1977, p. 37), and technology is used "too much, too soon" causing "technological cancer" (Hellerstein, 1983; Davidson, 1995). High-tech methods are applied where they are futile or even detrimental (Fisher and Welch, 1999), and we tend to seek technological solutions to all our problems: there is a *technological fix* in medicine (Callahan, 1996, p. 18).
2. The metaphor of the Sorcerer's broom is not the only one applied in the literature on technology. Dr. Frankenstein's monster in Mary Shelley's classic novel has been applied to make the same point. Like Dr. Frankenstein we are controlled by our creation if we do not control it (Winner, 1977). As in the myth of Prometheus, man is punished for breaking out of his boundaries and seeking illegitimate power (Landes, 1969). Accordingly, metaphors like the *robot*, the *android*, the *cyborg*, and the *golem* address our relationship to technology.
3. It might of course be argued that Cassell's theory could be defended if it was concerned with human circumstances and not human nature. Then we could claim that the situation where technology has come to compensate for our deficiencies is a circumstance that could be changed. Cassell, however, appears to be quite explicit that he addresses profound human characteristics.
4. It might be argued that these objections could be addressed if we interpret Cassell as to say that we get the technology that we deserve. As man is partly good and partly bad he makes technology that is partly good and partly bad. There is little evidence for this in Cassell's article, as he only describes the bad sides of technology and man. Furthermore, such an interpretation would presuppose that there exists technology that is genuinely good and technology that is genuinely bad, as we can imagine genuinely good persons as well as genuinely bad persons. There seems to be no evidence, however, that there exists good or bad technology, as all technologies appear to have side effects or can be abused. Moreover, if there really exist technologies that are genuinely good and technologies that are genuinely

bad, what is the difference? If there is a profound difference between them – can they both be technology? Furthermore, does the good technology not direct values at all or does it direct good values? Is the bad thing that we submit to something that directs our values, or is it that we in our deficiency choose bad technology?

5. My argument parallels that of Mitcham (1994) who identifies three different kinds of *use* of technology: (1) its *function*, (2) its *purpose* and (3) the application of technology according to (1) and (2). Mitcham points out that while it is possible to defend value-neutral use of technology in (3), (which parallels Sundström's *ambiguity of use* and *neutrality before action*), but not in (1), and that many fail to acknowledge the difference between (1) and (3) (Mitcham, 1994, pp. 231–232). For the value-ladenness of *function* see for example (Cragg, 1974).
6. A weaker account of the *neutrality before action* stance would be that within the possibilities of actions facilitated by a specific technology one can decide whether to use it or not, but this is very close to Sundström's *ambiguous use* statement. There is little difference between discerning between purpose 1 and purpose 2, and differentiating purpose 1 from not-purpose 1.
7. Sundström acknowledges that the research process is not value-neutral, but claims that the cognitive content of both science and technology are value-neutral. The significant difference in cognitive content between science and technology is not accounted for.
8. A widespread argument is that technology in its vast variety of possibilities creates a wide range of moral dilemmas that we did not have to handle before, and thus makes technology value-laden. However, this argument rests on two dubious premises. First, it presupposes that choice as such is negative. Second, it presupposes a certain moral deficiency in man: that he is not able to handle moral dilemmas, and thus has to be protected against them. Regarding the first, Dworkin has convincingly argued that it is far from obvious that choice as such is either good or bad (Dworkin, 1982). The second premise leads us back to the discussion on the deficient character of man.

References

Callahan, D.: 1996, *The Goals of Medicine: Setting New Priorities*. Hastings Center Report, November–December.

Cassell, E.J.: 1993, 'The Sorcerer's Broom. Medicine's Rampant Technology', *Hastings Center Report* 23 (6), 32–39.

Cragg, A.W.: 1976, 'Functional Words, Facts and Values', *Canadian Journal of Philosophy* 6, 77–94.

Davidson, S.N.: 1995, 'Technological Cancer: Its Causes and Treatment', *Healtcare Forum J* 38 (2), 52–58.

Dworkin, G.: 1982, 'Is More Choice Better than Less?', *Midwest Studies in Philosophy* 7, 47–62.

Ellul, J.: 1964, *The Technological Society*. New York: Alfred A. Knopf.

Fischer, E.S. and H.G. Welch: 1999, 'Avoiding the Unintended Consequences of Growth in Medical Care', *JAMA* 281, 446–453.

Gordon, T.J. 1969, 'The Feedback Between Technology and Values', in: K. Baier and N. Rescher (eds.), *Values and the Future*. New York: The Free Press.

Hanson, M.J.: 1999, 'The Idea of Progress and the Goals of Medicine', in: M.J. Hanson and D. Callahan (eds.), *The Goals of Medicine: The Forgotten Issues in Health Care Reform*. Washington: Georgetown University Press, pp. 137–151.

Hellerstein, D.: 1983, 'Overdosing on Medical Technology', *Technol Rev* 86 (6), 12–17.

Hofmann, B.: 2001, 'The Technological Invention of Disease', *J Med Ethics: Medical Humanities* 27, 10–19.

Jennett, B.: 1994, 'Medical Technology, Social and Health care Issues', in: R. Gillon (ed.), *Principles of Health Care Ethics*. New York: John Wiley & Sons, pp. 861–872.

Jonas, H.: 1985, *Technik, Medizin und Ethik*. Frankfurt a.M: Insel Verlag.

Landes, D.S.: 1969, *The Unbound Prometheus: Technological Change and Industrial Development in Western Europe from 1750 to the Present*. Cambridge: Cambridge University Press.

Merton, R.K.: 1995, 'The Thomas Theorem and the Matthew Effect', *Social Forces* 74, 379–424.

Mitcham, C.: 1994, *Thinking Through Technology: The Path between Engineering and Philosophy*. Chicago: University of Chicago Press.

Mitcham, C.: 1995, 'Philosophy of Technology', in: W.T. Reich (ed.), *Encyclopedia of bioethics*. New York: MacMillan, pp. 2477–2484.

Nordin, I.: 1999, 'The Role of Science in Medicine', *Theoretical Medicine and Bioethics* 20, 229–244.

Reiser, S.J.: 1978, *Medicine and the Reign of Technology*. New York: Cambridge University Press.

Reiser, S.J.: 1995, 'Technology', in: W.T. Reich (ed.), *Encyclopedia of Bioethics*. New York: MacMillan, pp. 2472–2477.

Ryle, G.: 1976, *The Concept of Mind*. Harmondsworth: Penguine Books.

Sundström, P.: 1998, 'Interpreting the Notion That Technology is Value-Neutral', *Medicine, Health Care and Philosophy* 1, 41–45.

Thomas, L.: 1977, 'On the Science and Technology of Medicine', in: J.H. Knowles (ed.), *Doing Better and Feeling Worse: Health in the United States*. New York: W.W. Norton.

Tymstra, T.: 1989, 'The Imperative Character of Medical Technology and the Meaning of "Anticipated Decision Regret"', *Int J of Technology Assessment in Health Care* 5, 207–213.

Veatch, R.M.: 1976. *Value-Freedom in Science and Technology: A Study of the Importance of the Religious, Ethical, and other Socio-cultural Factors in Selected Medical Decisions Regarding Birth Control*, Harvard dissertations in religion; no. 8 (Missoula, Montana: Published by Scholars Press for Harvard Theological Review).

Winner, L.: 1977, *Autonomous Technology*. Cambridge MA: MIT Press.

Paper 6

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Medicine as *téchne* - a perspective from antiquity

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Medicine as *téchne* - a perspective from antiquity

Abstract

The objective of this article is to investigate whether the concept of *téchne* is fruitful as a framework to analyse some of the pressing challenges in modern medicine. To do this, the concept of *téchne* is scrutinised, and it is argued that it is a complex concept integrating theoretical, practical and evaluative aspects, and that this makes it particularly suitable to analyse the complex activity of modern medicine. After applying this *techn*ical framework in relation to modern medicine, some of its general consequences are elaborated. In particular, it is argued that the concept of *téchne* is appropriate to address the constitutive role of technology in medicine. *Téchne* thus appears to be as fruitful as a philosophical concept today as it was in antiquity.

Key words: *téchne*, technology, theory, practice, ethics

Introduction

Modern medicine faces fundamental epistemological, ethical and practical challenges. How are we to understand and face these challenges? This article will try to find a theoretical framework for addressing this issue. In particular, it will scrutinise an approach that addresses one of the foremost characteristics of modern medicine: its extensive and constitutive use of technology.

There appear to be many alternative frameworks for facing the challenges of modern medicine. Various theories and models in health care management, in organisational theory or in philosophy have been applied.

Some promising approaches refer to ancient conceptions to face the fundamental challenges of modern medicine. E.g. one approach has focused its attention on the ancient concept of practical wisdom (*phronesis*) (Pellegrino, 1979; Pellegrino & Thomasma, 1981; 1993;

MacIntyre, 1985). An alternative approach, referring to another of the ancient intellectual virtues, conceives of medicine as an art (*téchne*). Contemporary commentators have followed the author of *On the art* (Peri téchne) insisting that medicine is an *art*. In particular it has been argued that medicine as an art is opposed to medicine as a *science* (Robinson, 1993; Gillies, 1996; Jonas, 1985; Gadamer, 1993), and that there is a basic dichotomy in medicine where the subjective, evaluative, particular and intuitive, opposes the objective, factual, general and rational.

However, few of these theories appear to address the pertinent position of technology in modern medicine. Both theories based on *phronesis* and theories supporting the art-science distinction seem to rule out technology as a constitutive aspect of medicine. This appears to be problematic, as technology seems to be at the heart of both the rise and the fall of modern medicine (Le Fanu 1999). The objective of this analysis will therefore be to investigate whether the ancient conception of medicine can be fruitful as a model for modern medicine. In particular, I will scrutinise whether such a conception can address the puissant position of technology in medicine.

In order to do this I will begin with the claim of the author of *On the art*, that medicine is an art, and ask: what is *téchne*? I will start to scrutinise the concept of *téchne* in general and the concept of *téchne iatriké* in particular. This will be done in order to see whether the concept can be applied to analyse actual challenges in modern medicine, and to outline some general consequences of such a *techn*ical theory of medicine. In particular I will investigate how this approach addresses the challenges of technology in medicine.

The Hippocratic concept of Téchne

Although there is an extensive scholarly debate, there appears to be a fair agreement on some key characteristics of the pre-Aristotelian concept of *téchne*. To avoid highly interesting, but complex conceptual controversies, I will take these key characteristics as a point of departure.

i. Téchne is knowledge of a specific field. That is, it has a determined subject matter and studies the nature of this subject matter.
ii. Téchne is oriented to a specific end.
iii. It produces a useful result.
iv. Téchne requires mastery of general rational principles that can be explained and therefore taught.[1]

In short, *téchne* "is a deliberate application of human intelligence to some part of the world, yielding some control over *tuchê* [accident]" (Nussbaum, 1986, p.95). How then, do these

characteristics of *téchne* correspond to the ancient concept of medicine? According to the main conception of the *Corpus Hippocraticum*, *téchne iatriké* is characterised as follows:

1. The specific subject matter of medicine is the diseased human body.
2. The end of medicine is to heal and to help the patient.
3. The product of medicine is health for the individual patient.
4. Medicine investigates its general principles and gives a rational account of its actions.

Before I turn to investigating whether such a concept of *téchne* can be of any relevance to modern medicine, let me scrutinise some of these characteristics in some detail.

1. The subject matter of medicine

Medicine had limits determined by nature of its given subject matter (*pragma*) (*On the art* VIII; *Regimen in acute diseases* 39; *Prognostic* I; Edelstein, 1994, p.106). Thus, the subject matter, and thereby the limit of medicine, was the diseased body. Physicians who did not recognise this limit of the medical profession were physicians in name only (Edelstein, 1994, p.102). "If a man demand from an art [téchne] a power over what does not belong to the art … his ignorance is more allied to madness than to lack of knowledge" (*On the art* VIII).

The limitation to its subject matter had some practical consequences. Firstly, medicine was a study of *soma* and did not include treatment of the soul or the good life in general.[2] Secondly, the physician should refuse to treat desperate cases where the disease was too serious or had progressed beyond the possibility of cure. Medicine should keep within its domain and "refuse to treat those who are overmastered by their diseases" (*On the art* III 10)[3]. Hence, the subject matter represented a delineation of medical activity, being an element in a tradition of self-limitation (*Prognostics* I).[4]

2. The end of medicine

Furthermore, medicine was characterised by its end: to heal and to help the patient (*On ancient medicine* III; *On the art* VI; *The oath*). The author of *On the art* argues that *téchne iatriké* "is to do away with the sufferings of the sick, [and] to lessen the violence of their diseases" (*On the art* III 8-9). The end of medicine was to rid the patient of the evils of the body, such as weakness (*asteneia*), ugliness (*aiskos*), and sickness (*nosos*). Without this goal *téchne iatriké* would not be a legitimate activity.

The physician, like all other craftsmen, had a purpose: to re-establish bodily order (*kosmos*), i.e. health and strength.[5] Contrary to the intervention and manipulation of modern medicine, the task of the ancient physician was to recognise disease and assist (*therapeuein*) nature in its natural healing capacity (*vis mediatrix naturae*, *kastastasis*).[6]

Medicine was a result of the necessity to help (Longrigg, 1993, pp.102-3). As stated in *The oath*: "I will use treatment to help the sick according to my ability and judgement, but never with a view to injury and wrong-doing". Medicine was concerned with the good of the human body. The love of man made the physician love his art (*Precepts* VI)[7].

The end of medicine was not only the patients and their bodies in general. Its aim was to fulfil the needs of a particular patient (*Regimen in acute diseases* IX) and to take into account the particular situation (*On ancient medicine* XI; XII). It was medicine's concern for the sufferings of the individual person that made it a *téchne* (Jaeger, 1989, p.543). The physician was not only to know how the *pharmakon* influenced the body in general, but also how it acted on the particular patient (*On ancient medicine* XX).[8]

Hence, the end of medicine was not the universal, but the particular (Gadamer, 1993, pp.11-49). The reason for this relationship is that the *téchne iatriké* related to its subject matter in a special way (Jonas, 1985, p.149). The subject matter of medicine was at the same time its end: the diseased human body. In bringing the body back to its equilibrium and order medicine displayed its end (Jonas, 1985, p.146).

3. The result of medicine

Medicine was also characterised by having a defined result (*ergon*) (*Precepts* II) and the result of medicine was health.[9] Health was conceived of as bodily balance, arrangement and order. It was its productive activity that granted medicine its paradigmatic status as *téchne*. It was the product of its activity, rather than its argumentation, which counted (Edelstein, 1994, p.103), and the result of *therapeia* was related to the end of medicine. In the same manner as medicine's end was not patients in general, health was not a general result, but a particular product related to the individual patient.

Furthermore, it was the productive trait of ancient medicine that made the author of *On ancient medicine* reject the monistic theories of the natural philosophers. Disease could not be explained and treated by monistic laws of air (Diogenes of Apollonia) or water (Hippon of Samos) (Longrigg, 1993, p.85-87). That kind of theoretical activity was not productive in the same manner as *téchne*.

4. The rational account of medicine

The author of *On the art* defended medicine against prejudice and religious belief by insisting that medicine was an art (Joos, 1957). *Téchne* vouched for medicine's rational account and distinguished it from mere speculations and religious influence. That is, *téchne* was an epistemic guarantee for an activity and answered for a homogenous knowledge of a defined subject matter.[10]

The author of *On the art* takes intelligence to be an important criterion in order for something to be an art (*On the art* I). Disease is mastered by the eye of the mind and tracked by reason, and its causes and treatment is understood by intelligence (*On the art* XI). The physician had to recognise and understand the symptoms, estimate their powers and infer from this the right prognosis (*Prognostic* XXV). He had to have scientific insight in the discussion and use of remedies (*Regimen in acute diseases* III).

Hence *téchne* was closely related to both *logos* and *episteme* and had a theoretical and rational provenance (*On ancient medicine* XII, Jones, 1931, p.xxiii; Lenk & Moser, 1973, pp.47-49; Roochnik, 1996, p.52). In particular, medicine was dealing with generalisable facts (*Precepts* 2). It, thus, included knowledge of 'universal' and 'necessary' things. If this was not so, medicine would again be subject to mere speculation (*On the art*). Thus, even though medicine to some extent was different from (pure) *episteme* it was constitutively related to it.[11]

How, then, was this general knowledge of *téchne iatriké* characterised? *Téchne*'s general knowledge was related to the causality (*aition*) of its subject matter (Mitcham, 1994, p.118). In particular, it was related to the causes of disease in the human body. Every disease had to have a natural cause (*On the art* V,VI; *On airs, waters, places* XXII; *On the sacred disease* I, V). Whatever caused the disease disturbed the balance of nature. E.g. turbid urine disturbed the balance and caused headaches (*Aphorisms* IV, LXX). It was knowledge of the cause, converse of both self-government (*automaton*) and accident (*tuche*), that made medicine a *téchne* (*Diseases* I). Moreover, because medicine was a *téchne* investigating the causality of disease, systematic treatment of patients was possible (Joos, 1957, p.242). *Téchne iatriké* was man's skilful contribution to the removal of the disturbing causes of disease. With the knowledge of the history of disease (*anamnesis*) and its present state (*diagnosis*) the physician was able to predict the course of disease (*prognosis*) and know the right time for treatment

(*kairos*). In this way the physician could assist nature. A knowledge based *téchne* therefore shared the same goal and had the same effect as nature itself (Joos, 1957, p.249).

Thus, medicine was based on general principles and was to give a rational account of its activity. One basic way of doing this was to explain the causality of disease. The rational criterion of medical activity did not prescribe or favour a particular theory to be "medical", but enabled to differentiate medicine from mere speculations.

Before I apply ancient medicine as a model for modern medicine, let me briefly study what made ancient medicine a social and intellectual model in antiquity. In particular, how did the characteristics of *téchne iatriké* (1-4) contribute to medicine's paradigmatic position?

The paradigmatic status of ancient medicine

It would be wrong to give the impression that there was one general and consistent conception of medicine in antiquity or even that we can give a coherent and consistent conception of any of the many medical schools of the time. However, there appears to be a wide agreement that medicine had a special theoretical, practical and evaluative status in antiquity. As my objective is to apply the conceptual framework of ancient medicine to modern conditions, let me therefore briefly investigate some of the ways in which medicine was applied as a paradigm in antiquity.

Medicine as a model for other arts

Medicine was applied as a model for the other arts (*technai*). E.g. Plato extensively refers to medicine. The authority of the art of government was modelled by the disinterested *techn*ical attitude of medicine (*Statesman* 293b5-c3). Furthermore, like medicine was based on knowledge of the nature of the body, so would an art of rhetoric have to include knowledge of the nature of the soul (*Phaedrus* 270b10f; Solbakk, 1993, p.122). The difference between medicine and cooking was applied to illustrate the difference between *téchne* and flattery (*kolakeia*). The real *téchne*, like medicine, was able to give a rational account of its activity with respect to a defined subject matter. It was not just following a recipe (*Gorgias* 464d4-e1; 521e3-4; *On ancient medicine*; Jaeger, 1989, p.544). Hence, medicine represented a paradigm of true knowledge and a norm of a real *téchne* (Heinimann, 1961). The characteristics (1-4) appeared to contribute to this paradigmatic position. "Since antiquity, medicine has been

regarded as the very model of an art, of a rational activity whose powers were all bent towards a clear and identifiable end." (Kass, 1975, p. 12).

Medicine as a norm of order

The *téchne* of medicine represented a certain conception of health, which was applied as an intellectual norm of natural arrangement and order. In *Corpus Hippocraticum* health was recognised as natural balance of the elements (*krasis*) (*On ancient medicine*). In particular it is conceived of as a proper mixture of humors: "All these substances [humors], then, are always present in the body but vary in their relative quantities, each preponderating in accordance to its natural characteristics [*phusis*]." (*On the nature of man* VII). Medicine addressed the natural arrangement (*taxis*), order (*kosmos*) and balance (*isorropon*) of the human body (*Prognostics* XXI, *On the nature of man* VII, *On the articulations* XXXIV).[12] Accordingly, the task of the physician was to forecast, and if possible assist, the natural process of restoration of nature's balance (*Prognostic* I).

Hence, the end of *téchne iatriké*, health, was conceived of as a natural arrangement, order and balance in the human body, and disease was any disturbance of this optimal situation.[13] This conception of health was applied as an intellectual norm of nature in general. It was e.g. used to give an account of the principles for the creation of the earth (*Timaeus* 41d5-7) and for the teleology of nature (*Timaeus* 42d5-6; e7-9). Phenomena in nature did not happen by chance. In the same manner as the body was an ordered system, guided by some admirable reason or intelligence, nature behaved according to arrangement and order (*Philebus* 28d; Longrigg, 1993). Plato's investigation of the human body in *Timaeus* was "to demonstrate that the universe works in accordance with reason and moral law" (Longrigg, 1993, p.114).[14]

Moreover, nature was not run by accident (*tuche*) or by self-determination (*automaton*), but by *téchne*. It was a result of divine craftsmanship in the same way as the artefacts of an artist were the result of that particular art (*On the heart* VIII; *Sophist* 265c-e). Hence, nature could be conceived of as an intelligibly ordered system by way of a medical model. The world was the result of the productive activity of a divine craftsman in the same manner as health was the result of the physician's work, and the philosopher could understand nature in the same manner as the physician understood the human body.

Medicine as a moral model

Ancient medicine did not only explain the arrangement, order and balance of nature, but was also applied as a norm for human action. The *technê* of medicine, differentiating good from

bad in the realm of the body, was applied as a model of how to discern good and bad in general.[15] The competence of the professional (*technikós*) was used as a model for facing ethical challenges (Heinimann, 1966, p.105). For the Platonic Socrates medicine was the paradigm case that made it possible to establish scientific ethics (Hoffmann, 1922, p.1076; Heinimann, 1966, p.105; Solbakk, 1993, pp.226-7). Accordingly, "[t]he healing of diseases, as well as the preservation of health provided an analogy which served to emphasize the validity of certain significant ethical concepts and thus helped to establish the truth of philosophy." (Edelstein, 1994, p.350).[16] In his pursuit of a *techn*ical, and in particular medical, model of morality Plato appeals to the characteristics of *téchne* (1-4). Hence, the Platonic Socrates tried to establish a *techn*ical foundation of ethics. Additionally, medicine also appeared to be a model to philosophy in general.

Medicine as a norm to philosophy

The author of *On ancient medicine* argued that medicine was the basis for any understanding of man (*On ancient medicine* XX). To be able to discuss general issues concerning the human being, one had to know the art of medicine. Medicine was basic to philosophy.

Furthermore, medicine provided an analogy and a model for philosophy. Martha Nussbaum has pointed out how ancient medicine was a model for and legitimated ancient philosophy. A "medical" philosophy was to help people in handling difficulties in their lives (Nussbaum, 1994). "Empty is that philosopher's argument by which no human suffering is therapeutically treated. For just as there is no use in a medical art that does not cast out the sickness of bodies, so too there is no use in philosophy, unless it casts out the suffering of the soul." (*Epicureus*)[17]. The philosopher had to be as wise and as useful as the physician.

Theoretical, practical and evaluative aspects of *téchne*

Hence, medicine was applied as a model for human activity in several ways. Firstly, it was a norm for other arts. Secondly, it served as a model of nature. Thirdly, medicine served as a model for ethics, and lastly and most generally, medicine was a model for philosophy.

One of the reasons for this paradigmatic position of *téchne* was that its characteristics (1-4) represented criteria of demarcation. They were applied to distinguish various types of activity, in particular to differentiate a real *téchne* from other activity and to set limits to a *téchne*.

Another reason for its paradigmatic position might be that the characteristics of ancient medicine were diverse. *Téchne* was a complex concept involving descriptive, evaluative and

practical issues. The demand for a rational account of its activity (4) appears to be an epistemic criterion. This was an important issue for the author of *On the art* in order to defend medicine against speculative activity. Correspondingly, medicine should be productive (3), which appears to be a practical issue, differentiating it from pure science. Additionally, medicine should have a defined end: to heal and help the particular patient (2). This apparently is an evaluative issue.[18] The author of *On ancient medicine* defends medicine against the natural philosophers that reduced all medical questions to relations of basic substances. It was exactly medicine's evaluative aspects that made the author defend medicine against mechanistic conceptions (Joos, 1957, p.243, 249). Additionally, medicine was to have a defined subject matter (1). This can be conceived of both as an epistemic and a practical issue. The subject matter limited both medicine's area of knowledge and its area of action.

Altogether, these four criteria represented a *norm* of how a real art should be, and constitutively integrate epistemic, evaluative and practical issues. This constitutive integrative complexity appears to be an important reason why medicine was frequently referred to in ancient debates about social life and human virtues, and it may explain medicine's paradigmatic position. How then, can this ancient conception of medicine be of any value for us today? One way to investigate this is to analyse some of the major challenges of modern medicine in the perspective of *téchne*.

Facing challenges

I have no intention of covering all challenges in modern medicine or to treat the selected examples in great depth. The point will be to indicate the fruitfulness of the concept of *téchne iatriké* as a norm to modern medicine. The examples are selected to cover a certain variety of challenges.

1. Limits to medicine: its subject matter

The subject matter represented a limit and demarcation of ancient medicine. There appears to be a general agreement on the need to delimit modern medicine, and there is a cry for setting limits to its activity due to economic, ethical, legal or practical reasons. However, the means and criteria for limiting modern medicine appear to be controversial.

Following the conception of *téchne iatriké*, the subject matter of medicine is the diseased human body. Accordingly, issues beyond the diseased human body do not belong to the realm of medicine. This sets limits to medicine's concern for people's well-being. To try to see

dissatisfaction with a PET scanner and cure *unhappiness* with paroxetinhydroklorid would thus be beyond the scope of *techn*ical medicine. In particular, the restriction to *soma* addresses the issue of *somatisation*. Modern medicine is accused of uncritically transferring the methods successful in somatic medicine to all cases of illness. Hence the *subject matter* of the diseased body might be a fruitful criterion to delimit medicine.

Moreover, there was a limit to this subject matter itself. The physician should not treat the diseased body that was beyond the level of cure. This appears to be a fruitful reminder also to modern medicine, which is accused for *overtreatment* and *futile treatment*. The need to set limits to medical *hubris* appears to be as relevant for the potent, interventive and technological medicine of today as it was in antiquity. To restrict medical activity to the treatable diseased human body thus appears to be a relevant restraint.

2. The end of medicine: helping the patient

Another major challenge to modern medicine appears to be to handle the threat of *medicalisation*. Medicalisation can be interpreted in many ways. Modern medicine can through new methods detect new diseases and treat conditions that were earlier left untreated. In this manner medicine has increased the number of diseased people in society (Aaron & Schwartz, 1984). It has made conditions that were earlier conceived of as part of everyday life subject to medical treatment. Furthermore, medical methods are not perfect. There are false positives "making people diseased" who have not experienced any illness.[19] Additionally, medicine's predictive and preventive capacity has promoted intervention in "healthy" people's life to prevent development of disease. This might also be conceived of as a form of medicalisation.

What appears to be common to the various aspects "medicalisation" is that it makes something subject to medical diagnosis or treatment that is not perceived by the person in question or that was earlier a part of his or her everyday life. Medicalisation has made medicine being accused of being too eager to treat in terms of *futile treatment*, *overtreatment* and *curative bias*. With respect to these challenges, the ancient concept of *téchne iatrike* might represent a fruitful restraint by asking: *whom* does this medical action serve? Is this particular patient the *end* of the treatment? These questions can assist us in delimiting medical activity and help us to handle hard cases, e.g. where to stop life support. Does further treatment with respirator actually benefit the patient or is it done due to fear of judicial consequences.

The criterion of medicine's *end* can also guide us in the challenging growing area of diseases labelled "lanthanic diseases" (Feinstein, 1967), that is, diseases that are detected by technological means, but where the person having the disease does not experience it in any way. It has been widely acknowledged that persons who otherwise are well can become ill and diseased when they get to know that they have a positive test.[20] That is, medical knowledge that is obviously intended to do good, can actually do harm. A way to handle this according to the second criterion of *téchne iatriké* would be to ask whether gaining knowledge and breaking bad news is concerned with the person in question as an end.

Moreover, modern medicine is widely criticised for being too scientific and ignoring the individual patient. It is accused of having become so exhilarated with its success in acquiring and accumulating general knowledge, that it ignores the fundamental difficulty in generating general knowledge from and for particular cases (Gorowitz & MacIntyre, 1976). The *techn*ical focus on medicine's primary *end* appears to address this problem. Although *téchne iatriké* emphasises the need of general principles and the necessity to be able to give a rational account of its activity, this is directed towards its *end*: to heal and help the particular person.

3. Having a particular product

One of the important characteristics that differentiated *téchne* from pure science was that it had a productive result. What legitimised medical activity was that it resulted in health for the particular patient. Accordingly, medical activity that did not have this productive character was endangered of becoming medical *hubris*. Applying this to modern medicine all activity that is not productive with regard to the patient's health is beyond the scope of *techn*ical medicine. E.g. treatment that is futile and does not result in better health for the person (overtreatment) should as such be discarded.

It may be argued that euthanasia concurs with the first criteria, as it may be conceived of as a means to end peoples' bodily diseases. However, it appears to be difficult to conceive of euthanasia as producing health. It ends people's pain, but it also contributes to end their life. However, as long as it does not produce health, it should be expelled. This also concurs with other principles of ancient medicine, e.g. the non-maleficence clause of *The oath*.

What about human enhancement, is this not a productive activity enhancing a person's health? Contrary to euthanasia, human enhancement does not appear to reduce or end a person's health. However, trying to enhance some human characteristics disagrees with the traditional conception of *health* conceived of as a natural arrangement, order and balance,

where too much as well as too little is bad for the human being.[21] It does not address the diseased human body in order to regain its natural arrangement and order. Hence, human enhancement is not a natural task of medicine because it is not directed towards medicine's subject matter: the diseased human body, and because it does not produce health. Correspondingly, the *techn*ical approach rules out challenging issues in the bioethical debate such as circumcision and piercing as well as a wide range of plastic surgery.

One of the ever more pressing challenges to modern medicine appears to be prioritisation. This has become highly relevant due to comprehensive abilities, high expectations and limited available resources. Two of the main criteria for rationing are cost and benefit, which accord well to the criteria of a productive result: We should prioritise according to what results in health. E.g. methods that result in diagnoses which do not correspond to available treatment do not produce health. To know that you have a disease that cannot be cured does not make you healthy.

Additionally it appears to be important to notice that the result of *téchne iatrike* is not a general product, but is related to its end. It is not *health* in general, but *health* of the particular patient. This means that a *techn*ical approach poses restrictions towards actions that do not aim at the particular person. This seems to have relevance for *health promotion*. The concept of *téchne iatriké* limits how far medicine can go in promoting people's health on a general level. Intervening in people's life without producing health in the particular case would thus be beyond the scope of *techn*ical medicine, e.g. to make large parts of a population use drugs that are not likely to help the individual person.

4. Giving a rational account of its activity

The criterion of rationality was relevant to ancient medicine because it facilitated the exclusion of mere speculations. It seems to be of importance also today in at least two different ways. Firstly, the rationality criterion can be applied to rule out religious speculations in the same manner as in antiquity. There appear to be forms of alternative medicine that are based on intuition or revelation and where it seems to be difficult to give a rational account of their methods. Revelation and intuition cannot be taught or assessed. Other forms of alternative medicine try to give rational accounts of their activity in terms of modern physics. However, this appears to be done in a manner that the physicists themselves do not recognise, but specify as mere speculations. Thus, the rationality criterion might be applied to rule out alternative forms of medicine.

Secondly, the criterion can be applied to rule out scientific speculations. Modern medicine, although appearing to be *omniscient*, does not know all aspects of human bodily disease. Although it is a central task to find general principles of the diseased human body, it appears to be as important to realise the limits of these general principles today as in antiquity. Deductive speculations appear to be as dangerous a form of medicine as some forms of "alternative medicine". Sudden infant death syndrome (SIDS) may serve as an example. Physicians deduced that in order to be able to reduce the incidences of SIDS, the babies should sleep on their stomachs. This was widely recommended to parents. However, instead of decreasing the rate of SIDS, the rate significantly increased. The ability of modern medicine to give a rational account of its activity is not to be found in its deductive capacity, but in its ability to account for reproducible results. Within this framework there was no rational account for recommending parents to let their babies sleep on their stomachs in order to prevent SIDS. Thus, the rationality-criterion can be applied to rule out scientific speculations as well as religious conjectures.[22]

Additionally, ancient physicians were aware that their knowledge was of a particular kind: although it was general knowledge, it was related to practical and productive activity. Correspondingly, modern medical science, qua *medical science*, is related to practical application of knowledge. Medical knowledge, as being *medical*, constitutively has clinical implications.

Thus, the criterion of rationality sets limits to the activity of medicine and represents a defence towards *hubris*. This seems to be highly important in a time when *Corpus Medicorum* is more extensive than ever, and we are faced with ever more cases where we do not know enough, e.g. cases of illness, without any manifestations of disease.

These examples do by no means prove that the concept of *téchne* can be applied for resolving all the challenges of modern medicine. However, they indicate that the concept can be fruitful for analysing and facing some of them. Before I turn to some of the limitations of this approach, let me shortly investigate two other aspects of this *techn*ical approach: how it views the art-science distinction and the role of technology in modern medicine.

Téchne and the art-science-distinction

It has become common to distinguish between medicine as *science* and medicine as *art*. Medicine as *science* is frequently conceived of as being concerned with general, descriptive, objective and biological issues, whereas medicine as *art* is conceived of as dealing with particular, evaluative, subjective and personal issues. It is argued that these conceptions are opposite and represent an inevitable dichotomy in modern medicine.

How does this science-art conception of medicine relate to the Hippocratic conception of *téchne* as scrutinised here? It appears to be difficult to equate *medicine as art* (in the modern sense) with *téchne iatrike*. *Téchne* being a rational activity concerned with the diseased body as its particular subject matter corresponds to *medicine as a science*. On the other hand, having the individual person as its end and the health of the particular patient as its result, *téchne* corresponds to *medicine as an art*. Furthermore, as argued, *téchne* is a complex concept, integrating epistemic, evaluative and practical aspects, which does not explicitly correspond to the concept of either "art" or "science".

Thus medicine today seems to be neither only "science" nor only "art". As "pure science" medicine fails to recognise its purpose and its legitimacy: to help individual patients. As "pure art" medicine might loose sight of its limits and its ability to give a rational account of its activity. Thus, medicine conceived of as *téchne* seems to be able to bridge the conceptions of medicine as *science* and as *art*.

Technology in modern medicine

As indicated in the introduction, one of the reasons for investigating the concept of *téchne iatriké* as a model for modern medicine, was its potential for addressing the constitutive role of technology in modern medicine. How then, does the concept of medicine as *téchne* deal with the challenge of one of the most influential factors of modern medicine: technology? Does the arrant technology of medicine not reinforce the science-art dichotomy? Does technology not threaten medicine's position as an *art* and consolidate it as a *science*? Or even more, does not technology threaten medicine as a *téchne*?

I think we have good reasons for rejecting such concerns, because the concept of *téchne iatriké* appears to be particularly suited to handle the aspect of technology in medicine. Firstly, the term technology stems from *téchne*. Hence, there is at least an etymological

relationship between “téchne” and “technology”, indicating that historically there is some connection between medicine and technology.

Secondly, there has been an extensive debate in modern philosophy of technology on the status of technology. However, there appears to be a reasonable agreement among scholars that technology is a theory-based, value-laden and productive activity. That is, technology combines epistemic, evaluative and practical issues in the same manner as did the *téchne iatriké*. Many of the challenges concerning modern technology do occur in the realm of medicine. This is not accidental. Medicine appears to be a field that brilliantly exposes the complexity of technology. Hence, technology, in the same manner as medicine, is a complex activity integrating epistemic, evaluative and practical aspects. Therefore, technology appears as an integrated part of medicine. It does not introduce a different conceptual framework to medicine, nor does it require a special handling.

Thirdly, definitions of technology emphasise its productive, purposive and rational characteristics. This corresponds well with the criteria of *téchne* (i-iv). A specific technology has a determinate subject matter, is oriented to a specific end, effects a useful result, and masters general principles that can be explained and taught. Thus the criteria of *téchne* seem to be highly relevant for a modern conception of technology.

Consequently, a concept of *téchne iatriké* might offer a framework to assess technology as a constitutive part of medicine. This seems to be fruitful, as it appears to be extraneous to assess medicine as an activity without technology or to assess medical technology as something external to medicine.

Additionally, in the same way as ancient medicine can be applied as a perspective to analyse modern medicine, (including the aspect of technology), the concept of *téchne* can serve as a perspective to analyse technology in general. There is a parallel between the relationship between ancient and modern medicine, and the relationship between *téchne* and technology.

In this manner medicine might be a model for the modern *téchne* in the same way as Socrates applied it as a model for the ancient *téchne*. In the same manner as the author of *On ancient medicine* claims that to know the world one has to know medicine (*On ancient medicine* XX), we could argue that in order to know technology, we have to understand medicine.

Hence, there is a reciprocity between medicine and technology: On the one hand technology is a constitutive part of modern medicine, on the other hand medicine can be a model for technology in general.

So far some examples have been applied in order to indicate the fruitfulness of the concept of *téchne* in modern medicine, and some implications have been drawn. Now, the time has come to address some of the limitations and possible pitfalls of this anachronistic approach.

Some limitations

Firstly, it is obvious that my approach does not represent a full-fledged theory. It is more like a conceptual tool for structuring and analysing some of the pressing problems in modern society. Furthermore, as a method my approach is not historically, descriptively or evaluatively neutral. It is a practical as well as a theoretical and evaluative approach. Hence, the method of this study is itself a *téchne*. Its subject matter has been the challenges of modern medicine, its end has been to try to find a framework to analyse these challenges, and its product could hopefully be a way of facing the challenges. To this adds that a rational account of the method has been provided.

Another possible limitation is that my investigation does clearly not present a monistic approach. It integrates a variety of different aspects; theoretical, practical and evaluative, and could as such be accused of being eclectic. It would be hard to reject such an accusation. However, the complexity of the approach can be conceived of as a reasonable prerequisite of a model of modern medicine. The challenges in medicine appear to be complex, and it is not unreasonable to try to face complex problems by a complex approach.

It might also be argued that I have only selected some of many characteristics of *téchne*. This is obviously correct, and has been done partly to avoid some of the conceptual controversies and because it would be naive to believe that we could use all aspects of ancient medicine as a model in philosophy, ancient or modern alike. Hence, I do intend neither to present a genuine ancient concept of *téchne* nor to enter the scholarly debate on the concept of *téchne*: I only try to indicate that aspects of ancient medicine can be a fruitful framework for discussing challenges in modern medicine.

Moreover, it might be argued that the characteristics of *téchne* selected as a norm for medicine lack a theoretical foundation. This is obviously right. The concept of *téchne* or its four criteria are not explicitly part of any significant modern philosophical framework. However, as argued, *téchne* appear to have played an important role in ancient philosophy, and ancient concepts have been applied as foundation for theories in modern philosophy in

general, and in biomedical ethics in particular.[23] Hence, there are reasons to believe that the concept of *téchne* might be theoretically fruitful although it is not a theoretical concept of modern philosophy.

There are of course difficulties in interpreting the four criteria of ancient *téchne iatrike* (1-4). What for instance, is the definition of "disease" when we insist that the subject matter of medicine is "the diseased human body", or what does "rationality" mean when we claim that medicine is to give a rational account of its activity? The meaning of concepts such as "disease", "rationality", "end", "subject matter" and "health" obviously represent crucial and difficult medico-philosophical issues. However, the aim of this article is more modestly to investigate the feasibility of a *techn*ical model to modern medicine.

Another weakness of this approach is that there might be discrepancies between the criteria of a *téchne*. E.g. if the main criterion is that the product of medicine is health, *euthanasia* is beyond the limits because it does not contribute to the health of the patient. However, if the criterion of the end of medicine is made the major criterion and it is interpreted as helping the person, it might be argued that *euthanasia* might be approved of, that is, criterion 3 contradicts criterion 2. The difficulty is that the concept of *téchne* does not contain a prioritised order of criteria. In this particular example I argued that the *end* of ancient medicine was both to *heal* and to *help*, and that it was to produce health, so euthanasia might be ruled out on this ground (criterion 2 and 3). However, the contradiction between different criteria is clearly possible. How should we face such situations? One way would be to rely on other principles of ancient medicine conforming to the criteria of *téchne*, e.g. the principles of beneficence, non-maleficence and justice found in *The Oath* or the concept of natural arrangement, order and balance at the basis of *téchne iatriké*.

Another approach would be to compare the *techn*ical approach with that of principlism in bio-ethics. The concept of *téchne* meets the same difficulties as the four principles of bio-ethics: coherence. However, following the same route as defending the principles one could appeal to their lexical order. Furthermore, the *téchn*ical approach appeals to medical tradition in a manner that parallels principlism and that could even support it.

Additionally, criterion 2 was concerned with the *end* of medicine. Hence, the *téchn*ical approach to modern medicine might be conceived of as a way to define the goals of modern medicine. To identify common goals for modern medicine has turned out to be a difficult task (Hanson & Callahan, 1999), and this analysis in no way pretends to have solved the issue. More modestly, it has tried to find some criteria for delimiting what is, and what ought not to

be within the area of modern medicine. The analysis has only been concerned with the end in relation to the treatment of the particular patient and does not presuppose a general goal for the health care system.

Conclusions

The objective of this article has been to investigate whether the conceptual framework of *téchne iatrkié* might represent fruitful tool to structure and analyse some of the challenges in modern medicine. It has been argued that the framework of *téchne iatrkié* integrates theoretical, practical and evaluative aspects, and that this makes it suitable to structure and analyse a complex activity such as modern medicine. Additionally, it has been argued that this *techn*ical approach is particularly suitable to investigate the influence of technology in medicine, and that it also represents a framework for analysing technology in general.

One important aspect of this analysis is that it employs concepts from medicine itself. It is not based on an external philosophical framework, which is applied to the case of medicine. This shows that medicine has resources to face its challenges within its own conceptual framework. In the same way as philosophy finds its conceptual origin and inspiration in antiquity, medicine might as well find ancient medicine as more than just a supply of remarks for festive occasions.

Furthermore, the conceptual framework suggested in this article is complex. The concept of *téchne* integrates theoretical, practical and evaluative aspects. This corresponds well to the complexity of modern health care.

Additionally, the concept of *téchne* represents a normative approach. It presents norms to what medicine should be. However, this does not mean that it subscribes to a particular normative theory, e.g. to a particular kind of normative ethics. There might be deontologic and teleologic, as well as virtue-ethical, aspects of this *techn*ical approach: The norm of *téchne* represents a *duty* to the good physician, its focus of attention is on the *end* of its activity, and it can be conceived of as a way to educate the *professional character* of the physician.

Furthermore, the analysis reveals a particular relation between medicine and philosophy. On the one hand, philosophy can still be of value to medicine. In the same manner as ancient philosophers applied medical metaphors to argue that philosophy was useful, modern philosophers can argue that philosophy can be of value to medicine. That is, philosophy can

be “therapeutic” in that it can diagnose some of medicine’s problems and propose prognosis and treatment. In particular, a philosophy that takes into account theoretical, practical and evaluative issues appears to be useful to the complex activity of modern medicine. Hence, philosophy might again be applied to regulate and legitimate medical actions as it did in antiquity. On the other hand, it illustrates that medicine can still be of importance to philosophy. Medicine might gain a prolific position in philosophy and “save” more than just the branch of moral philosophy (Toulmin, 1986).

That is, there appears to be a fruitful reciprocity between medicine and philosophy, today as in antiquity. Medicine might be applied evaluatively in philosophical argumentation, and philosophy can be fruitful to the analysis of fundamental challenges to medicine.

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References

Aaron, H.J., Schwartz, W.B. (1984). *The painful prescription: rationing hospital care*. Washington: The Brookings Institution.

Edelstein, L. (1994). *Ancient Medicine*. Baltimore: Johns Hopkins University Press.

Evans, A.S. (1993). *Causation and Disease: A Chronological Journey*. New York: Plenum Press.

Gadamer, H.G. (1993). *Über die Verborgenheit der Gesundheit*. Frankfurt aM: Suhrkamp.

Gillies, M. (1996). Art or science? *Aust N Z J Opthalmol, 24*, 83-4.

Gorovitz, S., MacIntyre, A. (1976). Toward a Theory of Medical Fallibility. *The Journal of Medicine and Philosophy, 1*, 51-71.

Hanson, M.J., Callahan, D. (1999). *The Goals of Medicine: The Forgotten Issues in Health Care Reform*. Washington: Georgetown University Press.

Heinimann, F. (1961). Eine vorplatonische Theorie der τεχνη. *Museum Helveticum, 18*, 105-130.

Helman, C.G. (1985). Disease and pseudo-disease: A case history of pseudo-angina. In: Hahn RA, Gines AD (eds.) *Physicians of Western medicine. Anthropological Approaches to Theory and Practice* (pp. 293-331). Dortrecht: D.Reidel Publishing Company.

Hoffmann, E. (1844-1852/1922). Platon und die Medizin. Appendix in Zeller E. *Die Philosophie der Griechen: eine Untersuchung über Charakter, Gang und Hauptmomente ihrer Entwicklung*. Tübingen: Fues: Vol.II, Part I.

Jaeger, W. (1989). *Paideia. Die Formung des griechischen Menschen*. Berlin: Walter de Gruyter.

Jonas, H. (1985). *Technik, Medizin und Ethik*. Frankfurt a.M: Insel Verlag.

Jones, W.H.S. (1931). Hippocrates. Volume IV. London: Loeb Classical Library.

Joos, P. (1957). Zufall, Kunst, Natur bei den Hippokratikern. *Janus, 47*, 238 - 292.

Kass, L.R. (1975). Regarding the End of Medicine and the Pursuit of Health. *Public Interest, 40*, 11-42.

Le Fanu, J. (1999). The rise and fall of modern medicine. London: Little Brown.

Lenk, H., Moser, S. (1973). Téchne, Technik, Technologie. *Philosophische Perspektiven*. München: Pullach.

Longrigg, J. (1993). *Greek Rational Medicine. Philosophy and medicine from Alcmaeon to the Alexandrians*. London: Routledge.

Mitcham, C. (1994). *Thinking through Technology. The Path between Engineering and Philosophy*. Chicago: The University of Chicago Press.

Nussbaum, M. (1986). *The fragility of goodness: luck and ethics in Greek tragedy and philosophy*. Cambridge : Cambridge University Press.

Nussbaum, M. (1994). *The therapy of desire: theory and practice in Hellenistic ethics*. Princeton, N.J.: Princeton University Press.

Pellegrino, E.D. (1979). Medicine, science, art: an old controversy revisited. *Man Med, 4*, 43-52.

Pellegrino, E.D., Thomasma, D.C. (1981). *A Philosophical Basis of Medical Practice*. New York and Oxford: Oxford University Press.

Pellegrino, E.D., Thomasma, D.C. (1993). *The virtues in medical practice*. Oxford: Osford University press.

Robinson, D., Bevan, E.A. (1993). Defining normailty - art or science? *Methods Inf Med, 32*, 225-8.

Roochnik, D. (1996). *Of art and wisdom: Plato's understanding of techne*. University Park, Pa.: Pennsylvania State University Press.

Solbakk, J.H. (1993) *Forms and functions of medical knowledge in Plato: interpretations and research-historiography*. Thesis. Oslo: University of Oslo.

Toulmin, S. (1986). How Medicine Saved the Life of Ethics. In: DeMarco, Fox RM eds. New Directions in Ethics: *The Challenge of Applied Ethics* (pp. 265-81)New York: Routledge and Keagan Paul.

Usener, H. ed. (1887). Epicurea. Lipsiae : In aedibus B. G. Teubneri. See (Nussbaum, 1994, p. 13).

Notes

[1] It is worth noting that these characteristics of *téchne* are not unique to the Hippocratic authors, but that they can be recognised in a vast variety of ancient literature. Nussbaum shows how corresponding characteristics played a prominent part in the philosophy of Aristotle, the Epicureans, Sceptics and Stoics (Nussbaum, 1994, pp. 46-7). Accordingly, Roochnik investigates the characteristics of téchne in a broad range of ancient literature (Roochnik, 1996).
The objective of this article is to stay close to the Hippocratic authors. To illustrate that the Hippocratic conception of *téchne* was not extraordinary in antiquity some references to other ancient authors are provided, mainly to *Corpus Platonicum*. Hence, the article deals with a pre-Aristotelian conception of *téchne*, which deviates from the Aristotelian conception in several aspects. Although it would be interesting to make a comparison between the Hippocratic and the Aristotelian conceptions of *téchne* this is beyond the scope of this article.
The Hippocratic texts may be complex and divergent. However, they comprise what has been conceived of as the teaching of one of the most prominent ancient schools of medicine. Among the texts referred to in this article are *Prognostics*, *Regimen in acute diseases*, *Epidemics* I and III which are generally attributed to Hippocrates and written between 430 and 415 BC, *On the nature of man*, which is probably from the first quarter of the fourth century BC and is ascribed to Hippocrates and his son-in-law Polybus, *Aphorisms*, which are in part written by Hippocrates and are dated to about 415 BC, *On ancient medicine*, which is probably written by Hippocrates or a dedicated Hippocratic writer during the period 430-20 BC, and *On the art*, which is from the end of the fifth century BC, probably written by Hippas.

[2] Related to the issue of whether medicine should treat the soul, see also (*Charmides* 156d5-157a2; *Republic* 610a4-7).

[3] See also (*Republic* II 360e4; 361a1-2; Pindar *Pythians* 3.55-58)

[4] Although it might be argued that medicine's self-restriction was a result of ancient physician's self-interest, self-restriction was at the basis of medical self-conception. For a discussion on self-interest in ancient medicine, see also note 7.

[5] (*On diseases of women* I.3; *Prognostics* XX). See also (*Gorgias* 477b5-7; 477e12-478b1; 503d4-504c2; *Eryxias* 401c7-9)

[6] (*On ancient medicine*, *Epidemics* I, III, *On joints* LXXX; Edelstein, 1994, p.227; Mitcham, 1994, p.121). See also (*Laws*: X 889c-d; *Cratylus* 389a-390b)

[7] Edelstein opposes an altruistic interpretation of medicine arguing that *The Oath* as well as the passages in *Precepts* VI are fundamentally professional regulations. To secure the economic foundation of the profession, the physician had to win the trust of the patient (Edelstein, 1994: 6-63; 87-110). The traditional interpretation of *Corpus Hippocraticum*, however, and the application of medicine in the *Corpus Platonicum* strongly suggest that medicine must also have had other goals than economic. See for example (*Republic* I, 342C; *Lysis* 218e9-219a1; *Gorgias* 452a10-11).

[8] This is confirmed in *Corpus Platonicum*: "The one essential condition is that they [the doctors] act for the good of our bodies to make them better instead of worse, and treat men's ailments in every case as healers acting to preserve life." (*Statesman* 293b12-c1). See also (*Republic* I 342d2-6).

[9] See also (*Charmides*, 165d1-d2; 166a3-7; *Republic* I, 346d).

[10] See also (*Minos* 316c3-d9).

[11] To the Platonic Socrates *episteme* and *téchne* appeared to have been synonymous. This point I owe to Jan Helge Solbakk.

[12] The profoundness of balance in general is illustrated in *On the articulations*, where it is stated that it is better for a man to break both legs than only one, because the person will be in better balance with himself (*On the articulations* XXXIV).

[13] That is, health and disease were exhaustive and mutually exclusive concepts.

[14] However, the medical metaphor goes one step further. The organs of the body were tools, *organa*, of nature (Xenophon *Memorabilia* 4,6). With these tools nature breathed and regulated the temperature and the humours

of man. Thus the body was an ordered product of nature. At the same time its organs were tools for sustaining this very same order.

[15] Medicine, being concerned with the arrangement and order of the body, was a model for the arrangement and order of the soul (*Gorgias* 504b4-d3). As medicine dealt with the good and the bad in the body: health (hygieia) and disease (nosos), it was the model for the relationship between the congenital bad (emphuton kakon) and congenital good (emphuton agathon) (*Republic* X 608d12-610c1; Hoffmann, 1922: 1076-7; Solbakk, 1993: 226-7).

[16] Medicine was also applied as a norm of social relations (*Republic* VIII 567c4-5).

[17] (Usener, 1887, p.221), here cited from Nussbaum, 1994: 13.

[18] The productive aspect of medicine appears to be normative as well. The result of medicine should be health, which frequently is conceived of as a normative issue.

[19] To these cases count what have been called *pseudodiseases* (Helman, 1985), that is, diseases that are indicated by markers and that the person would never have experienced during lifetime if left untreated. Additionally there is type I error, that is, accepting a treatment that does not work, which makes people undergo futile or harming treatment.

[20] This has also been called "the information paradox" (Evans, 1993).

[21] See also (Jonas, 1985: 146)

[22] In the same manner as the author of *On ancient medicine* rejected the natural philosophers' monistic approach, we ought to be careful to submit to strongly deductive systems in medicine. In the same manner as ancient medicine realised it was an empirical activity, the success of modern medicine appears to depend on the same self-restrictive insight.

[23] E.g. the concept of *prhonesis*.