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Social Inequalities Beyond the Modern Nature-Society-Divide?

The Cases of Cosmetic Surgery and Predictive Genetic Testing[1]

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Abstract

Due to the accelerated dynamics of scientific and technological modernisation over the last few decades, the sharp and unambiguous categorical distinction and separation between "nature" and "society" that has been essential for the self-perception of Western modernity is increasingly subject to erosion or even dissolution. The article aims to explore the possible consequences of this blurring of boundaries with regard to the generation, social perception, and justification of social inequalities in "reflexive modern" societies. Using the examples of cosmetic surgery and predictive genetic testing, current tendencies of a seemingly paradoxical "renaturalisation" of inequality are outlined: contrary as well as parallel to the modern programme and promise of a "denaturalisation of society" (Jürgen Habermas), "natural" characteristics such as physical appearance or genetic constitution are gaining importance in terms of social distinction and discrimination. One should, however, not fail to see that this renaturalisation is not simply a revival of older (if by no means definitely overcome) forms of social inequalities based on (presumedly) natural collective categories (sex, race, ethnicity and so on). Rather, a hybrid, scientifically and technically manufactured human "nature" becomes a medium of novel forms of "individualised" discrimination: physical characteristics are no longer ascribed to certain groups or people as their inalterable natural qualities, but are increasingly conceived of as open to fashioning and therefore as socially achieved by the individual person. For this reason, the new inequalities "beyond" the modern nature-society divide are apparently not considered fundamentally illegitimate or "pre-modern". What seems to be needed in present-day societies is the establishment of new, socially accepted regulations and boundaries for the complex and intertwined dynamics of denaturalisation and renaturalisation of the social.

[1] I would like to thank two anonymous reviewers and the editors of the journal for their helpful comments on an earlier draft of this article.

1 Introduction: Denaturalisation or Renaturalisation of Social Inequalities?

At least in their own self-esteem, modern Western societies follow a logic of a continuing "desocialising of nature" and "denaturalising of society" (Habermas 1981: 80).[2] According to Habermas (ibid.), the basis of this is the categorical distinction and separation between the "causal connections of nature" on the one hand, and the "normative orders of society" on the other. Apparently, this distinction is of central importance for the development and justification of social inequalities in modern societies. The self-perception and moral foundations of Western modernity legitimise only those forms of unequal treatment that are based on *social,* achieved traits of certain persons or groups, while discrimination referring to ascribed, (actually or presumedly) *natural* differences is attributed to "traditional" societies and is therefore no longer acceptable.[3] In the course of societal modernisation, one can thus expect that there will be an increasingly precise distinction between natural and achieved traits as well as a tendency to denaturalise social inequalities, which will result in a gradual repression of discrimination based on a certain person's or group's "natural" characteristics (sex, skin colour, race, ethnicity, etc.). Of course, modern societies do not reach the high standards they have set for themselves; discrimination based on natural categories still exists, and is even produced by those societies themselves. Nevertheless, modern laws and normative systems at least delegitimate nature-based social inequalities as, for instance, can be seen in the anti-discrimination laws the member states of the European Union are obliged to sign.[4]

The distinction, be it explicit or implicit, between "social" and "natural", between the "made" (*dem Gemachten*) and the "grown" (*dem Gewachsenen*) (Habermas 2001) should not be misunderstood in an objectivist sense. It is not a factual, ontological difference, but the result of a social practice of distinction, a "boundary work" (Gieryn 1995) performed mainly by science. It is not crucial whether certain characteristics individuals or groups are credited with are "really" of natural or social origin, but whether they can be *attributed* to either nature or society in an uncontested way.[5] However, according to Habermas (1981: 80), modern Western societies are convinced that they (and they alone) make the "correct conceptual cuts" between natural causalities and social actions. The constructive and contingent character of these "cuts" is hidden by scientific "purification practices" as described by Bruno Latour. He argues that only these purifications give rise to "two completely separate ontological zones, that of humans on the one hand, and that of non-humans on the other" (Latour 1995: 19). In this way, the modern distinction between nature and society presents itself as merely a "discovery" of an objectively existing ontological difference that can thus claim general validity and unambiguity.

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[2] The quotations from German books or journals have been translated by the author of this article.

[3] Talcott Parsons' (1951: 58-67) well-known distinction between "ascription" and "achievement" points in the same direction; it is based on the distinction between traditional "community" and modern "society" (cf. Münch 2004: 63-69).

[4] The massive protests in Germany in spring 2005 against proposed anti-discrimination laws can be regarded as an illustration of the fact that discrimination based on (ascribed) natural categories is still rampant in the everyday life of modern societies – regardless of the normative and legal superstructure.

[5] In some cases (for example, regarding intelligence) the attribution may be contested; in others it may be changed due to new scientific research, for example in the area of human genetics. Nevertheless, modern societies distinguish mainly with the help of the nature-society difference between legitimate and illegitimate reasons for differential treatment. It goes without saying that there is still illegitimate discrimination (for example, concerning religious beliefs or political convictions) that is not based on natural categories.

What does it mean for the production and legitimation of social inequalities that the distinction between "nature" and "society" has become ambiguous, and even seems to evaporate completely? This thesis is strongly supported by much of the research recently conducted, particularly in science and technology studies (e.g. Latour 1995; Amann 2000; Lindemann 2002; Karafyllis 2003) and in social theory, especially within the "theory of reflexive modernisation" (Lau/Keller 2001; Viehöver et al. 2004; Wehling et al. 2005). According to these theories, the growing scientific and technical control of natural processes itself as well as the intense social use of the resulting options are decisive in terms of blurring the nature/society distinction. I want to take up these arguments and show that both the cognitive-discursive and the practical-material erosion of the distinction between nature and society opens a new space of categorical and normative ambiguity. This new space allows the development of phenomena of inequality and domination that seem to be based on natural categories in a new way. The term "renaturalisation" can only tentatively describe this tendency since it is not just a revival of traditional, ascriptive inequalities. Instead, a hybrid, scientifically mediated, and technically manufactured "nature" gains relevance for forms and processes of social distinction which is not regarded as simply "premodern" or illegitimate.

In the following, I will first explain the extent to which it is possible to speak of an erosion of the modern distinction between nature and society in the light of recent scientific, technological, and social developments. I will then use two examples – cosmetic surgery and predictive genetic testing – to illustrate current tendencies towards the renaturalisation of social inequalities. Finally, I will present some general theoretical conclusions.

2 Beyond the Modern Nature-Society-Divide?

For a long time, modern societies and their institutions have relied on the belief that the distinction between the social and the natural can be drawn by science in an objective, unambiguous, and universally applicable way. Boundaries that have been fundamental to modern self-perception, such as those between facts and values, are based on this belief. These boundaries play a central role in many institutional spheres of modern societies. This is especially visible in professional sports: only the results the athlete is able to achieve naturally are considered valid, and this has led to the introduction of an extensive doping control system. But at this point it also becomes clear that the boundaries between the "natural" and the "manipulated" body are no longer unambiguous: they are blurred by the use of biological substances for doping or the supposedly imminent application of methods of genetic enhancement ("gene doping") (cf. Wehling 2003a).

In recent years, a multitude of topical societal debates – for example, about the beginning of human life and brain death, about global climate change and genetically modified organisms – have shown that the categorical separation of nature and society that had previously appeared unambiguous is becoming increasingly unclear. Developments in intensive care medicine and transplant surgery, for instance, have led to the fact that the commonsense notion of the end of human life – a failure of the heart and lungs – has not simply been replaced but supplemented by and contrasted with the criterion of brain death (cf. Lock 1998, 2003; Schlich/Wiesemann 2002; Lindemann 2003). The answer to the question of when a human being is considered dead and thus ceases to be a social being entitled to a certain protection has become open to interpretation and has generated widely differing answers. The intensely polarising debates in these areas are indicative of the fact that a sharp and uncontested "cut" between the natural and the social is becoming increasingly impossible. This is not to say that an objective boundary that once used to exist is now dissolving due to scientific and technical innovations. Rather, the sciences that used to guarantee the objectivity of this distinction are less and

less able to fulfil this role, be it that the sciences themselves develop varying interpretations or that sciences and commonsense knowledge come into conflict. The former holds true for the debate about the legal and moral status of the human embryo; although it is possible to draw several lines to determine when a human life starts, it seems impossible to name one objective, exclusive point in time (cf. Markl 2004). One example of the latter case is the social conflict concerning agricultural biotechnology. Widespread notions of the "unnaturalness" of genetically modified foods (cf. Shaw 2002) clash with the scientific statement that there is no substantial difference between such foods and traditional, "naturally" grown produce. The consequence of such disputes is not to say that modern societies can straightforwardly do away with the distinction between what is given or "grown" on the one hand and what is "made" (and thus to be accounted for) on the other. However, the redefined and re-established boundaries are increasingly demonstrating their "reflexive", contingent character. Examples of this kind of flexibilisation are the rules for dealing with cloned human embryos and genetically engineered foods, which vary greatly on an international level, or the ongoing debate about the man-made vs. natural origins of climate change (see Wehling et al. 2005).

As the historian of science Hans-Jörg Rheinberger (1996: 289) supposes in regard to biomedicine and genetic engineering, we are currently becoming "witnesses to a global and irreversible transformation of living beings, including humans, into purposefully constructed beings". The decisive factor is that with the advent of molecular biology, "for the first time ever" metabolic processes have become "open to manipulation on the level of *instruction*" (ibid.: 291 – italics in original). According to Rheinberger, the organism itself becomes a laboratory: "From now on, it is not the extracellular representation of intracellular processes, i.e. the 'understanding' of life, that counts. Instead, what matters is the intracellular representation of an extracellular project, i.e. the 'rewriting' of life." (ibid.) As a result, the social understanding of "natural" differences and inequalities as well as the collective and individual dealing with them can change profoundly. Rheinberger argues that the "mission of sociality" no longer seems to be "…to neutralise our natural – genetic – constitution, but to change it. We are becoming aware that the construction of a *natural* constitution of humankind is changing into a *social* construct – with the result that the distinction between the 'natural' and the 'social' no longer makes any proper ontological sense." (ibid.: 298 – italics in original). The fiction of ontology, promoted by the sciences, loses its persuasiveness, and thus the idea of the "natural" or "grown" no longer seems to serve the purpose of cultural and normative orientation. Using the examples of cosmetic surgery and predictive genetic testing, I want to show how not only the overarching distinction between the natural and the social has been eroded, but also how more specific boundaries – for example, between illness and health or between healing and optimising the human body – have become ambiguous. As a consequence, there is a tendency towards renaturalising social inequalities in modern societies.

3 Cosmetic Surgery: The Technical Improvement of the Body as a Social Norm?

With the help of aggressive advertising and media promotion, the surgical remodelling of the body has become almost completely disconnected from therapeutic contexts (for example, healing victims of war or accidents) during recent decades.[6] It is becoming a "mass phenomenon" (Davis 1995:

[6] Nevertheless, the boundaries between *healing* of physical deformities and/or the ensuing psychological traumas on the one hand, and the *enhancement* and *optimisation* of a "normal" and "healthy" body on the other are not fixed. Cosmetic surgery is thus a striking example of a wider tendency towards "dissolving the boundaries of therapy" (*Entgrenzung von Therapie*) in modern societies. The use of medical technologies is increasingly expanding beyond well-defined therapeutic contexts.

16), a virtually everyday practice that is no longer a taboo. In his book "Cultural History of Aesthetic Surgery", Sander Gilman states that "the stigmatising quality of the procedures seems to be diminishing" (1999: 33). It is estimated that the number of cosmetic operations in the Federal Republic of Germany has tripled over the last ten years, and that about half a million to a million procedures are carried out every year (Kahlweit 2004; cf. also Degele 2004: 19). For other countries, such as the United States, Brazil, or China, even more dramatic increases in numbers are estimated. Patients are becoming younger and younger, and although women are still in the majority, more and more men also use cosmetic surgery.[7]

One's "own" body increasingly seems to be regarded as something that can be shaped to suit one's wishes. Apparently, its "naturalness" and "integrity" no longer serve as barriers to technical interventions. This becomes interesting for social theory and the sociology of social inequalities inasmuch as cosmetic surgery is carried out not just to enhance self-esteem or recognition in the social sphere, but is also becoming a tool of career planning (cf. Degele 2004: 15). This seems to be an increasingly important motive for customers. In the People's Republic of China, more than half the university graduates interviewed stated that "beauty is a decisive advantage in the job market" (Maass 2004a: 1). There is no question that the use of make-up, hair dye, dieting, etc. has always been a means of enhancing one's chances in the job market or rising through the ranks in a company. Cosmetic surgery has transformed and radicalised these practices by no longer aiming at changes *on* the body but *of* the body. Moreover, these changes are brought about by "invasive" surgical interventions that used to be almost exclusively reserved for therapeutic purposes. Such interventions are not only risky, painful, and rarely reversible. They also massively question the classic modern idea of the integrity and physical invulnerability of the body (Negrin 2002: 29). Against this background, cosmetic surgery can be seen as an example of a transition from the "natural artificiality" of the human being that was conceived by Helmuth Plessner (1981) as an anthropological invariable to a new and apparently much more problematic "artificial naturalness" (cf. Schramme 2002: 266-269).

The optimisation of the body via surgical procedures is increasingly becoming a social normalcy and even an expectation, at least in certain social milieus and segments of the job or marriage markets. Along the "borderline" between nature and society, the look of the body is becoming "physical capital", as one could say in extension of Pierre Bourdieu's differentiation between certain kinds of capital (Bourdieu 1983).[8] Cosmetic surgery constitutes the body as an object and medium of investment and accumulation of capital to a much higher degree than practices such as cosmetics, sport, or diets (cf. Negrin 2002: 36). Instead of cultural refining or the long and disciplined route of doing sports, the direct investment of financial resources moves centre-stage; long-term individual "achievement" with uncertain results is replaced by short-term visible "success" (cf. Neckel 2001). In this process, new and mostly anonymous societal patterns of domination arise – not so much because a fixed and (for most people) unreachable ideal of beauty is established, but more because the flexibility and willingness to continuously shape and "correct" the body is set as a cultural norm: "(N)o one is so beautiful that she can-

[7] There is now a debate in the social sciences as to how far these equalizing tendencies will go. While Gilman (1999: 32) argues that men will gradually catch up with women, Davis (2003: 129) supposes "that the present gender gap in cosmetic surgery will prevail rather than it will disappear". In any case the motives and contexts vis-à-vis the use of cosmetic surgery are different for male and female "customers", and cosmetic surgery is by no means "gender-neutral" (ibid.)

[8] The US singer and actress Cher stated: "My body is my capital." She is said to have invested about 75,000 US dollars in cosmetic surgery. (Quote from Davis 1995: 18)

not become even more so with the help of surgery." (Davis 1995: 18)

At first sight, this development is taking place within the framework of the denaturalisation programme pursued by modern societies. The German philosopher Wolfgang Kersting emphatically celebrates the release from the arbitrariness of nature that the application of technical means has made possible: "With the help of technology, humans can emancipate themselves from nature and weaken the power of fate. Technology liberates via defatalisation and by increasing the power of control." (Kersting 2002: 294) The given and – with regard to beauty, strength, etc. – of course unequal as well as "unjust" distribution of physical attributes between individuals becomes the object of conscious and purposeful fashioning.[9] Feminist authors such as Kathy Davis (1995, 2003) rightly point out that women who underwent cosmetic operations try to regain control over their bodies and their heteronomous social perception. But this emancipation from the natural body, with all its real or imagined shortcomings, also results in a paradoxical effect of renaturalisation: physical attributes such as beauty or youthfulness gain enormous importance, can be used as a means of social distinction, and can even lead to advantages concerning one's career. Obviously this is seen less and less as questionable or illegitimate, because "body looks" are increasingly the result of technical modelling and can thus be attributed as an acquired trait to the respective person: "(W)e have become responsible for the design of our bodies." (Negrin 2002: 37) This is equally valid if the person has *not* had cosmetic surgery: even the "natural" body that has not been manipulated is regarded as something socially imputable and as an object of social responsibility. Denaturalisation and renaturalisation of the social merge into one another, the distinction between ascribed and achieved characteristics becomes blurred and starts to lose its function of normative orientation.

4 Predictive Genetic Testing: Discrimination or Legitimate Differentiation?

The case of predictive genetic testing demonstrates even more markedly than cosmetic surgery the newness, ambiguity, and ambivalence of the renaturalisation of social inequalities. The aim of predictive genetic testing is the diagnosis of individual genetic dispositions, based upon which it is possible to forecast, with a greater or lesser degree of probability, the occurrence of certain diseases such as hereditary breast cancer or Huntington Disease in later periods of life. For three reasons, this is a medical innovation with potentially serious consequences: firstly, predictive DNA tests make long-term prognoses over several years or even decades. Secondly, not only is it often unclear *when,* but also *whether* the disease will occur at all. This particularly applies when it comes to widespread diseases such as cancer or Alzheimer's that are not exclusively genetically determined, but are also dependent on environmental factors. Moreover, in many cases scientists dispute the extent to which genetic factors actually heighten the risk of becoming ill. Thirdly, the development of prevention and therapy falls short of the rapidly expanding diagnostics (cf. Damm 2004: 2).[10]

It is not surprising that this asymmetry can lead to grave social and psychological problems. On the one hand, the

[9] In this context, it is remarkable that at a beauty contest in the People's Republic of China in 2004, proof of having had at least one instance of cosmetic surgery was a precondition for registering for the contest, and not – as usual – a reason for immediate exclusion (Maass 2004b). The organisers rewarded not the ("unjustly" distributed) natural beauty, but an artificial one instead – but this of course cannot be attained and perfected without certain "natural" bodily preconditions and sufficient economic resources.

[10] Genetic factors are held responsible for more and more diseases. The number of these (putatively) "genetic diseases" registered in the so-called McKusick Catalogue – an important medical database – was about 5,000 in 1992, and rose to more than 14,000 in 2003 (Lemke 2004: 69).

people or families affected have to deal with the specific uncertainties of predictive genetic testing (cf. Cox/McKellin 1999): will the disease occur at all, when will it happen, and how serious will it be? How should one deal with the new knowledge and its ambivalences? Is it possible to protect oneself against the occurrence of the disease?[11] Or is it preferable to refrain from being tested at all because its use is dubious, given that prevention and therapy are lacking? On the other hand, this new form of diagnostics creates a new social category of "ill without symptoms" (Nelkin 1995) or "healthy ill" – the boundary between health and illness is being redefined, pluralised, and threatens to become blurred (Feuerstein et al. 2002: 42). Predictive genetic testing has thus become part of a tendency to "de-temporalise" illness, i.e. to expand the notion of illness beyond its acute, symptomatic manifestation and shift it to certain risk factors. Not only genetic dispositions, but also obesity and high blood pressure are part of these risk factors. Risk thus becomes an "illness category in and of itself" (Fosket 2004: 294), and the de-temporalisation of illness due to predictive diagnostics manifests itself in questions that are unusual and difficult to answer: "When does an hereditary disease 'begin'? At the moment of conception? With the knowledge that one has inherited the mutation? Once symptoms are undeniable? With diagnosis?" (Cox/Mc Kellin 1999: 137)

With regard to the "pre-symptomatic ill", concerns have been raised for a few years now about the emergence of new forms of "genetic discrimination" or even a new "genetic underclass". "The term 'genetic discrimination' has been used to describe the differential treatment of individuals or their relatives based on actual or presumed genetic differences, as opposed to discrimination based on phenotype." (Geller et al. 2002: 248) Especially in the United States, with its privatised social service and insurance systems, these effects are already starting to appear (Geller et al. 2002; Geller 2002): people who will only fall ill with a predicted disease in a few years' time - or perhaps never - are nonetheless discriminated against or even excluded from the job market, health services, and insurance. At the centre of the political and legal debates about predictive testing and genetic discrimination is the "right to ignorance" (*Recht auf Nichtwissen*, cf. Damm 1999; Wehling 2003b). Although quite unusual and unprecedented in modern societies, this right not to know one's own genetic constitution is in principle widely accepted. However, there is disagreement about the conditions under which individuals are obliged to get information about their genetic condition and reveal it to others (for example, to employers or insurance companies).[12] In addition, the question is how one can prevent the exercising of this "right to ignorance" from becoming a reason for social discrimination in itself.

The object of predictive genetic testing is not the factual visibility and actual presence of "phenotypical" differences between individuals. Thus, though not exactly in the same way as cosmetic surgery, genetic testing also creates and is concerned with a scientifically and technically manufactured "nature" that is taken out of its "real" temporal context. This results in many far-reaching categorical and normative ambiguities: may or must people who

[11] The best-known example of this dilemma is the prophylactic amputation of the breasts of women who are genetically "at risk" of developing breast cancer (cf. Hallowell 1999). The extent to which mutations of the so-called "breast cancer genes" BRCA 1 and BRCA 2 raise the real risk of developing the disease is still a matter of debate (cf. Lemke 2004: 71-72).

[12] For the legal aspects, compare Damm 2004. Recently, the Federation of German Insurance Companies has extended the voluntary renunciation of obligatory genetic testing for customers signing a new contract until 2011. However, the medical superintendent of the world's biggest reinsurance company, the 'Münchener Rück', declared only a few months later that, due to "fascinating developments", the insurance companies do not want any legal inhibition of the option to use genetic testing (*Frankfurter Rundschau*, 22.1.2005, 4).

are genetically "at risk" be treated like virtual patients, or is that an illegitimate discrimination against obviously healthy people? The epistemic status of predictive genetic knowledge itself thus becomes contested (cf. Damm 2004: 15): do the results of predictive diagnostics have a special status? Or can they be seen as a "normal" form of gathering medical information, as commonly used by insurance companies?[13] And if so, is it still appropriate to speak of genetic discrimination?

Scientific views on this issue differ widely, and mirror the categorical ambivalence of the problem. The debates focus on the question of whether a genetic disposition to certain diseases has to be regarded as an objective, *natural* cause or a *social*, scientific construct. The lawyer Jochen Taupitz, a member of the German national council on bioethics (*Nationaler Ethikrat*), argues that it is only possible to speak of discrimination if a person is treated differently "without a recognisable, factual reason" (Taupitz 2000: 31). According to Taupitz, the "potentially dangerous genetic disposition" (*die gefahrerhebliche genetische Disposition)* is "just as much as an illness, age, or (…) gender a factual reason for differentiation" (ibid.). Here, the genetic disposition is equated with an already manifest illness (or with old age and gender), and thus objectified as a natural fact and cause. The biologist and philosopher Christoph Rehmann-Sutter proposes a different view. He criticises the widely acknowledged "programme theory of DNA", which is also recognisable in Taupitz's statements; it presupposes that the genetic programme "contains an instruction to develop this characteristic or illness" (Rehmann-Sutter 2002: 217). Rehmann-Sutter contrasts this view with a "systemic theory of DNA", according to which a certain gene sequence is indeed a trace (*ein Indiz*), but does not already make the disease a latent reality in the present time (ibid.: 218): "The BRCA-1-mutation correlates with an increased probability of getting cancer in the future, and is statistically significant; however, it is not an already present instruction for cancer." (ibid.: 221) In this view, the mutation of the gene is certainly a natural fact, but the correlation with the disease is a statistical construct, not an objective causal mechanism. In any case, it becomes evident that the blurring of the boundaries between health and illness, between factual and interpretative statements, between illegitimate discrimination and objectively justified differentiation, creates new areas of categorical and normative ambivalences that modern societies are not yet prepared for.[14] As Taupitz's arguments illustrate, new discursive horizons are opened up, in which differential treatment of individuals due to their supposedly natural genetic disposition can be legitimised or even presented as necessary.

5 Conclusion: Neutralising or Optimising (Human) Nature?

What can be concluded from the examples I have given? First of all, I want to show why the recent tendencies differ from older forms of discrimination based on "natural" categories. Finally, I will show what constitutes the new challenges for normative self-perception as well as the institutionalised practices of modern societies.

Older forms of naturalising social inequalities are mostly based on stigmatising people according to supposedly natural *collectives* such as race, nation, gender, sexual orientation, etc. that were - of course - always socially constructed (more often than not with the help of the sciences). The individual is discriminated against because it is seen as part of a larger group, and the "natural", presumedly homogenous and inalterable characteristics of the group are ascribed to the respective person. By contrast, renaturalised ine-

[13] Similar debates have recently surfaced in Germany, especially with regard to (secret) DNA-based paternity testing and the so-called "genetic fingerprint".

[14] What is new here is that these ambivalences and uncertainties are the *results* of modern biomedicine itself rather than the consequences of a *lack* of "exact" scientific knowledge.

qualities follow a quite different pattern: they aim at a person's *individualised* body which is by no means regarded as stable and inalterable, but increasingly as flexible and shapeable. It can thus be attributed as an acquired characteristic. This fundamental difference between "naturalised" and "renaturalised" inequalities becomes very clear with regard to a shift in the meaning and role of cosmetic surgery over the last few decades. As Sander Gilman has shown, aesthetic surgery served for a long time as a means of rendering invisible physical features (such as an "Irish" or "Jewish" nose) that were used by dominant groups to stigmatise or exclude certain minorities. "Moving into and becoming invisible within a desired 'natural' group", was the objective of the surgical procedure (Gilman 1999: 22). In this context, it is important to notice that "the nineteenth-century 'Jew' who desired to be a 'German' assumed that 'German' was a real category defined in nature rather than a social construct" (ibid.) Certainly, current cosmetic surgery still serves as a means of covering or removing undesirable physical features that supposedly do not fit the "norm". Yet, it does not primarily aim at escaping from collective identity constructions and discriminations, but instead suggests a positive shaping and optimisation of the respective individual self, however much that may be an illusion. This holds particularly true in the case of women who, in the eyes of men, are of course regarded as members of a (putatively inferior) collective group and thus placed into a "constant condition of bodily insecurity" (Bourdieu 2005: 117). Nevertheless, even in this case the use of cosmetic surgery does not aim at denying or making invisible the individual woman's relationship with the "natural group", nor does it help to break the dominant patterns of perception. Feminist authors justly see this as "the dilemma of cosmetic surgery" (Davis 1995). "The limitation of cosmetic surgery is that it offers a technological solution to a social problem." (Negrin 2002: 25)

The promise of emancipation from the "naturally given", together with that of individual self-optimisation, is – perhaps surprisingly – also connected to predictive genetic testing. Genetic dispositions can of course not simply be done away with, but genetic testing goes along with both the promise and the social expectation that the people or families affected will adapt their lifestyles to their genetic constitutions (cf. Hallowell 1999; Conrad 2002; Lemke 2004). Under favourable circumstances, this may lead to the emergence of what Paul Rabinow has termed "biosocial" communities, for example self-help groups or patients' associations that meet on the basis of a common genetic diagnosis in order "to share their experiences, lobby for their disease, educate their children, redo their home environment, and so on" (Rabinow 1996: 102). What Rabinow links with the term "biosociality" is the ultimately optimistic expectation that, in the future, culture will no longer be "biologised" (as in sociobiology) but, in contrast, nature will "be modeled on culture understood as practice" (ibid.: 99). "Nature will be known and remade through technique and will finally become artificial, just as culture becomes natural." (ibid.) The results of this "overcoming the nature/culture split" (Rabinow) will probably be more ambivalent and questionable than Rabinow seems to be aware. Especially in the case of genetic testing, the "socialisation" of nature (denaturalisation) is likely to be outweighed and countered by a simultaneous "biologisation" of society (renaturalisation): "Culture invades nature, while from a dialectical point of view it becomes more and more 'naturalized'." (Bertilsson 2003: 119)

The tendency to renaturalise social inequalities does not make individuals subject to a fateful (collective) nature. Quite the contrary: they are supposed or even forced to be responsible for their "natural" or "genetic" fate on their own. Nevertheless, one should not draw too sharp a dividing line between the "old" and the "new" forms of inequalities based on natural categories. The fact that the insertion of an additional palpebral fissure to make the eye bigger and "more Western" is one of the most popular surgical procedures in the People's Republic of China (Gilman 1999: 98ff.; Maass 2004a),

illustrates that the optimisation of the individual body and the adaptation to hegemonial, "racialised" body images and norms may overlap and even reinforce each other. Rabinow points out a somewhat different potential interaction: "In complicated and often insidious ways, the older categories may even take on a renewed force as the new genetics begins to spread not only in the obvious racism so rampant today but more subtly in studies of 'blacks', alleged to have higher susceptibility to tuberculosis." (Rabinow 1996: 103)

The normative self-perception and institutional practices of modern societies have hitherto been based – more implicitly than explicitly – on a remarkable arrangement of natural differences and social inequalities that is by no means self-evident but rather fragile. According to this modern arrangement, natural differences among humans are seen as inalterable (or alterable only to a very limited degree) but at the same time contingent and not subject to the responsibility of the individual person. Biological inequalities and "injustices" are taken as given (or had to be taken as such for the lack of technical options). But exactly for this reason, it is even more urgent that their importance for (and influence on) social life should be restricted and "neutralised", as Rheinberger (1996) has put it, for example by introducing anti-discrimination policies. Where neutralisation is not possible, there should at least be compensatory measures on the part of the welfare state.[15] The new scientific and technical options of "body improvement" (Schlich 2001) seem to open up this arrangement: physical inequalities (even where they are far from being diseases or handicaps) are increasingly being "corrected" technically, instead of being politically neutralised and weakened vis-à-vis their social consequences. As Llewellyn Negrin following Gilman states, the advent of cosmetic surgery has shifted the modern expectation of personal development and self-transformation: "(T)he enlightenment belief in the ability of individuals to transform themselves, which has been articulated as a social and political task, came to be redefined in biological and medical terms." (Negrin 2002: 25). To a hitherto unprecedented extent, the biological constitution of individuals becomes a direct object of no longer mainly therapeutic but increasingly *optimising* medical and technical interventions (Council on Bioethics 2003). It is a seemingly paradoxical consequence that at the same time a manufactured "nature" is progressively established as a legitimate medium of social distinction and discrimination. What is more, the economic resources to participate in the benefits of body improvement are still distributed in a highly unequal way.

The arguments that only emphasize the increase in individual autonomy due to these new developments (cf. for instance Birnbacher 2002; Kersting 2002) negate the other side of the coin, namely the emergence of dominant new norms of behaviour as well as of new social inequalities. The negative flipside of "defatalisation" (Kersting) consists in expanding pressures and demands for the optimisation of the individual body or, at least, for the adaptation of one's lifestyle to one's "natural" genetic constitution. The emancipation from the natural body and its inadequacies merges in the self-subordination to the social norm of body enhancement.[16] Obviously, the given physical nature of humans – be it considered normatively inviolable or factually immutable – no longer serves as a boundary for technical manipula-

[15] How fragile and contested this arrangement actually is, is highlighted by current political and philosophical debates that aim at a discursive "renaturalisation of social inequalities" (Große Kracht 2004). One striking example is the ethics of natural merits *("verdienstethischer Naturalismus")* recently outlined by the philosopher Wolfgang Kersting. According to Kersting, contingent differences in the natural constitution of individuals are nevertheless attributable as a merit. There is thus neither a right to compensation nor a duty to neutralise or compensate for resulting social inequalities (Kersting 2000: 369-71; cf. for a critical discussion Große Kracht 2004).

[16] This is most visible in the doping scandals of professional athletes.

tion that should not be transgressed. "When nature no longer provides human society with its boundary conditions (for normal practices), where will they be settled?" (Bertilsson 2003: 119) Whether and how it will be possible to establish new, socially accepted, and institutionally stabilised boundaries for the interacting dynamics of denaturalisation and renaturalisation of individual differences and social inequalities turns out to be a key question for the present "reflexive modern" societies.

6 References

Amann, Klaus (ed.), 2000: *Natur und Kultur. Gentechnik und die unaufhaltsame Auflösung einer modernen Unterscheidung.* Dresden: Verlag des Deutschen Hygienemuseums.

Bertilsson, Thora M., 2003: The Social as Trans-Genic. On Bio-Power and its Implications for the Social. In: *Acta Sociologica* 46, 118-131.

Birnbacher, Dieter, 2002: Der künstliche Mensch – ein Angriff auf die menschliche Würde? In: Karl Kegler/Max Kerner (eds.), *Der künstliche Mensch*. Köln: Böhlau, 165-189.

Bourdieu, Pierre, 1983: Ökonomisches Kapital, kulturelles Kapital, soziales Kapital. In: Reinhard Kreckel (ed.), *Soziale Ungleichheiten*. Soziale Welt, Special Issue 2, Göttingen 1983, 183-198.

Bourdieu, Pierre, 2005: *Die männliche Herrschaft*. Frankfurt a.M. : Suhrkamp.

Conrad, Peter, 2002: Genetics and Behavior in the News: Dilemmas of a Rising Paradigm. In: Joseph Alper et al. (eds.), *The Double-Edged Helix. Social Implications of Genetics in a Diverse Society*. Baltimore: Johns Hopkins University Press, 58-79.

Council on Bioethics, 2003: *Beyond Therapy. Biotechnology and the Pursuit of Happiness*. A Report of the President´s Council on Bioethics. Washington D.C. www.bioethics.gov.

Cox, Susan/McKellin, William, 1999: "There's this thing in our family": predictive testing and the construction of risk for Huntington Disease. In: Peter Conrad/Jonathan Gabe (eds): *Sociological Perspectives on the New Genetics*. Oxford: Blackwell, 121-145.

Damm, Reinhard, 1999: Recht auf Nichtwissen? Patientenautonomie in der prädiktiven Medizin. In: *Universitas* 54, 433-447.

Damm, Reinhard, 2004: Gesetzgebungsprojekt Gentestgesetz – Regelungsprinzipien und Regelungsmaterien. In: *Medizinrecht* 22, 1-19.

Davis, Kathy, 1995: *Reshaping the Female Body. The Dilemma of Cosmetic Surgery*. New York: Routledge.

Davis, Kathy, 2003: *Dubious Equalities and Embodied Differences. Cultural Studies on Cosmetic Surgery*. Lanham, MD: Rowman & Littlefield.

Degele, Nina, 2004: *Sich schön machen. Zur Soziologie von Geschlecht und Schönheitshandeln.* Wiesbaden : VS-Verlag für Sozialwissenschaften.

Feuerstein, Günter/Kollek, Regine/Uhlemann, Thomas, 2002: *Gentechnik und Kranken-versicherung*. Baden-Baden: Nomos.

Fosket, Jennifer, 2004: Constructing "High-Risk Women": The Development and Standardization of a Breast Cancer Risk Assessment Tool. In: *Science, Technology and Human Values* 29, 291-313.

Geller, Lisa, 2002: Current Developments in Genetic Discrimination. In: Joseph Alper et al. (eds.), *The Double-Edged Helix. Social Implications of Genetics in a Diverse Society*. Baltimore: Johns Hopkins University Press, 267-285.

Geller, Lisa/Alper, Joseph/Billings, Paul/Barash, Carol/Beckwith, Jon/Natowicz, Marvin, 2002: Individual, Family, and Societal Dimensions of Genetic Discrimination. A Case Study Analysis. In: J. Alper et al. (eds.), *The Double-Edged Helix. Social Implications of Genetics in a Diverse Society.* Baltimore: Johns Hopkins University Press, 247-266.

Gieryn, Thomas, 1995: The boundaries of science. In: Sheila Jasanoff et al. (eds.), *Handbook of Science and Technology Studies.* London: Sage, 393-443.

Gilman, Sander, 1999: *Making the body beautiful. A cultural history of aesthetic surgery*. Princeton: Princeton University Press.

Große Kracht, Hermann Josef, 2004: Renaturalisierung sozialer Ungleichheiten? In: *Politische Vierteljahresschrift* 45, 395-413.

Habermas, Jürgen, 1981: *Theorie des kommunikativen Handelns*. Band 1. Frankfurt a.M.: Suhrkamp.

Habermas, Jürgen, 2001: *Die Zukunft der menschlichen Natur*. Frankfurt a.M.: Suhrkamp.

Hallowell, Nina, 1999: Doing the right thing: genetic risk and responsibility. In: Peter Conrad/Jonathan Gabe (eds), *Sociological Perspectives on the New Genetics*. Oxford: Blackwell, 97-120.

Kahlweit, Cathrin, 2004: Ich will nicht aussehen wie meine Mutter. In: *Süddeutsche Zeitung*, 21 September 2004, 15.

Karafyllis, Nicole (ed.), 2003: *Biofakte. Versuch über den Menschen zwischen*

Artefakt und Lebewesen. Paderborn: Mentis.

Kersting, Wolfgang, 2000: *Theorien der sozialen Gerechtigkeit*. Stuttgart: Metzler.

Kersting, Wolfgang, 2002: *Kritik der Gleichheit*, Weilerswist: Velbrück Wissenschaft.

Latour, Bruno, 1995: *Wir sind nie modern gewesen. Versuch einer symmetrischen Anthropologie.* Berlin: Akademie-Verlag.

Lau, Christoph/Keller, Reiner, 2001: Natur und Gesellschaft - Zur Politisierung gesell-schaftlicher Naturabgrenzungen. In: Ulrich Beck/Wolfgang Bonß (eds.), *Die Modernisierung der Moderne*, Frankfurt a.M.: Suhrkamp, 82-95.

Lemke, Thomas, 2004: *Veranlagung und Verantwortung. Genetische Diagnostik zwischen Selbstbestimmung und Schicksal*. Bielefeld: transcript.

Lindemann, Gesa, 2002: *Die Grenzen des Sozialen. Zur sozio-technischen Konstruktion von Leben und Tod in der Intensivmedizin*. München: Fink.

Lindemann, Gesa, 2003: *Beunruhigende Sicherheiten. Zur Genese des Hirntodkonzepts*. Konstanz: UVK.

Lock, Margret, 1998: *Twice Dead. Organ Transplants and the Reinvention of Death*. Berkeley: University of California Press.

Lock, Margret, 2003: On Making Up the Good-as-Dead in a Utilitarian World. In: Sarah Franklin/Margret Lock (eds.), *Remaking Life and Death*. Oxford: James Currey, 165-192.

Maass, Harald, 2004a: Für Sexappeal und einen Job liefern sich Chinesen ans Messer. In: *Frankfurter Rundschau*, 2 August 2004, 1.

Maass, Harald, 2004b: ... wer hat den besten Schönheitschirurgen im Land? In China boomt das Geschäft mit der plastischen Chirurgie. Jetzt wird in einem Wettbewerb die erste "künstliche" Schönheitskönigin gekürt. In: *Frankfurter Rundschau*, 18 December 2004, 1.

Markl, Hubert, 2004: Wer bestimmt, wann das Leben beginnt? Zur Frage der Deutungshoheit. In: *Merkur* 58, 128-138.

Münch, Richard, 2004: *Soziologische Theorie.* Band 3: *Gesellschaftstheorie*. Frankfurt a.M.: Campus.

Neckel, Sighard, 2001: "Leistung" und "Erfolg". Die symbolische Ordnung der Markt-gesellschaft. In: Eva Barlösius/ Hans-Peter Müller/Steffen Sigmund (eds.), Gesell-schaftsbilder im Umbruch, Opladen: Leske u. Budrich, 245-265.

Negrin, Llewellyn, 2002: Cosmetic Surgery and the Eclipse of Identity. In: *Body & Society* 8 (4), 21-42.

Nelkin, Dorothy, 1995: Die gesellschaftliche Sprengkraft genetischer Informationen. In: Daniel Kevles/Leroy Hood (eds.), *Der Supercode. Die genetische Karte des Menschen.* Frankfurt a.M.: Insel, 195-209.

Parsons, Talcott, 1951: *The Social System*. Glencoe, IL: Free Press.

Plessner, Helmuth, 1981: *Die Stufen des Organischen und der Mensch. Gesammelte Schriften*, Bd. IV, Frankfurt a.M.: Suhrkamp (orig.: 1927).

Rabinow, Paul, 1996: Artificiality and Enlightenment: From Sociobiology to Biosociality. In: Paul Rabinow, *Essays on the Anthropology of Reason.* Princeton, NJ: Princeton University Press, 91-111.

Rehmann-Sutter, Christoph, 2002: Prädiktive Vernunft. In: Nicole Karafyllis/Jan Schmidt (eds.), *Zugänge zur Rationalität der Zukunft*. Stuttgart: Metzler, 203-232.

Rheinberger, Hans-Jörg, 1996: Jenseits von Natur und Kultur. Anmerkungen zur Medizin im Zeitalter der Molekular-biologie. In: Cornelius Borck (ed.), *Anatomien medizinischen Wissens. Medizin, Macht, Moleküle*. Frankfurt a.M.: Fischer, 287-306.

Schlich, Thomas, 2001: Eine kurze Geschichte der Körperverbesserung. In: Gero v. Randow (ed.), *Wieviel Körper braucht der Mensch?* Hamburg: edition Körber-Stiftung, 131-144.

Schlich, Thomas/Wiesemann, Claudia (eds.), 2001: *Hirntod. Zur Kulturgeschichte der Todesfeststellung.* Frankfurt a.M.: Suhrkamp.

Schramme, Thomas 2002: Natürlichkeit als Wert. In: *Analyse & Kritik* 24, 249-271.

Shaw, Alison, 2002: "It just goes against the grain". Public understandings of genetically modified (GM) food in the UK. In: *Public Understanding of Science* 11, 273-291.

Taupitz, Jochen 2000: *Genetische Diagnostik und Versicherungsrecht*. Karlsruhe: Verl. Versicherungswirtschaft.

Viehöver, Willy/Gugutzer, Robert/Keller, Reiner/Lau, Christoph, 2004: Vergesellschaftung der Natur – Naturalisierung der Gesellschaft. In: Ulrich Beck/ Christoph Lau (eds.), *Entgrenzung und Entscheidung: Was ist neu an der Theorie reflexiver Modernisierung?* Frankfurt a.M.: Suhrkamp, 65-94.

Wehling, Peter, 2003a: Schneller, höher, stärker - mit künstlichen Muskelpaketen. Doping im Sport als Entgrenzung von "Natur" und "Gesellschaft". In: Nicole Karafyllis (ed.), *Biofakte.* Paderborn: Mentis, 85-100.

Wehling, Peter, 2003b: Das Recht auf Nichtwissen in der Humangenetik - ein

"Irrläufer" in der Wissensgesellschaft? In: Jutta Allmendinger (ed.), *Entstaatlichung und soziale Sicherheit.* Verhandlungen des 31. Kongresses der Deutschen Gesellschaft für Soziologie in Leipzig 2002, Opladen: Leske u. Budrich (CD-ROM).

Wehling, Peter/Viehöver, Willy/Keller, Reiner (2005), Wo endet die Natur, wo beginnt die Gesellschaft? Doping, Genfood, Klimawandel und Lebensbeginn: die Entstehung kosmopolitischer Hybride. *Soziale Wel*t 56 (forthcoming).

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How Experts Draw Boundaries

Dealing with Non-Knowledge and Uncertainty in Prenatal Testing

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Abstract

Categorical distinctions such as healthy/sick or dead/alive serve to provide orientation and to facilitate decision-making in medicine. This is a major issue in the theory of reflexive modernisation. Recently, new scientific insights within genetics have increasingly prompted the re-drawing of such boundaries. Taking the example of prenatal testing, with particular reference to late term abortion, I investigate the governing rationalities of experts' boundary politics. It will be shown that boundary drawing is structured with reference to society's guiding principles and notions of normality. In those problematic cases where the medical frame is unable to deliver sufficient interpretative power, this reference to societal value orientations turns out to be functional for maintaining the experts' professional authority. In the case of prenatally diagnosable disabilities, for example, experts often do not know how to deal with such diagnoses. This ambiguity is for the most part understood as (cognitive) uncertainty amenable to more research, rather than interpreted as non-knowledge with reference to the level of social action which results from the interpretative failure of biomedical frames. Thus, the interpretation of non-knowledge appears to become unambiguous, which undermines any pending politicisation of non-knowledge. The alignment with society's guiding principles turns out to be functional for maintaining the claim to be able to provide adequate and relevant information and terms for decision-making processes; in other words, for maintaining professional authority. On the basis of the observation that experts have to deal with uncertainty and non-knowledge, the article asks in conclusion whether this could point to the possible emergence of a reflexive type of expert.

1 Introduction

Seen from the perspective of sociology, human genetics and reproduction medicine are a dynamic technological field which not only implies a higher degree of control in terms of the circulation of expert knowledge, but above all introduces new uncertainties and design necessities. For example, Giddens (1991) has employed the term 'life politics' as a way of analysing reproductive medicine as a motor for the transformation of identity practices and a new active politics of the physical.

The following discussion does not address these newly emerging design necessities on the level of everyday life and common normalised handling of new technologies. Rather, it is the level of professional action and decision-making that is of interest here. Especially in the field of prenatal testing, technological progress has overextended institutionalised decision-making conventions, resulting in novel requirements for decision-making and design. In connection with the theory of reflexive modernisation, this process is discussed with reference to the concept of boundary blurring ("Entgrenzung").[1] In our case, this term refers to the growing ambiguity of categorical distinctions (Beck/Bonß/Lau 2004: 40-41). Such 'boundary work' performed by experts is acknowledged as an institutional necessity, not merely a legitimisation strategy of a particular profession.

The modern biomedical sciences are a fruitful field for the analysis of phenomena of boundary blurring. In the case of Chorea Huntington, a monogenetic hereditary disease, the basic principle of distinguishing between healthy and sick starts to shift due to the divergence between possible early detection and the late manifestation of symptoms. Is someone who does not yet have symptoms healthy, or sick because he bears the genetic disposition which will inescapably lead to the manifestation of the disease (Scholz 1995: 48)? Breast cancer provides a further illustration. Although this disease is attributed to a genetic component,[2] no strong causality between a specific DNA sequence and phenotype has yet been demonstrated. Consequently, it is only possible to prognosticate the risk of disease, the extent of which remains mostly uncertain (Lemke 2004: 71). The distinction healthy/sick therefore becomes blurred on the level of aetiology. Another example is stem cell research. In the ongoing ethical debate relating to the destruction of embryos as an inevitable consequence of growing embryonic stem cell lines, it has become obvious that a scientific determination of the beginning of life is not possible. Bioethical debates, as a consequence, relate to the pluralisation of the life/death distinction (Viehöver 2005).

Cognition-oriented and decision-relieving boundary constructs in prenatal testing are also being stretched to the limit as a result of increasing scientification and advances in medicine. My interest focuses on the reaction modes of experts, as well as on the consequences of these modes of

[1] "Entgrenzung" means a process of transgressing boundaries or, in a narrower sense, a process in which boundaries become insignificant or irrelevant. Boundary blurring cannot be equated with dedifferentiation ("Entdifferenzierung"), but refers to phenomena below the level of functional subsystems. Boundary blurring is frequently discussed in sociology, in various fields: in connection with flexibilisation and autonomisation ("Eigenarbeit") (Minssen 2000; Kratzer 2003), with the blurring of enterprise boundaries (Powell 1991; Sauer/Döhl 1997), with globalisation and sub-politicisation (Castells 1996; Beck 1986), and in discussions of the complete dissolution of the subject-object differentiation with hybridisation (Latour 1993).

[2] Currently it is assumed that mutations of both genes, BRCA1 and BRCA2 ('breast cancer'), which serve to protect against tumour growth, contribute to the manifestation of breast cancer.

dealing with uncertainty and non-knowledge. In the following I will argue that the ways in which experts draw boundaries are structured with reference to society's guiding principles (like autonomy, self-awareness and individual responsibility) and notions of normality.

In those problematic cases where the medical frame is unable to deliver sufficient interpretative power, this reference to societal value orientations turns out to be functional for maintaining the experts' professional authority. In the case of prenatally diagnosable disabilities, for example, experts in many cases do not know how to deal with such diagnoses. This ambiguity is for the most part understood as (cognitive) uncertainty amenable to more research, rather than interpreted as non-knowledge with reference to the level of social action which results from the interpretative failure of biomedical frames. Thus, the interpretation of non-knowledge appears to become unambiguous, which undermines any pending politicisation of non-knowledge. The alignment with society's guiding principles turns out to be functional for maintaining professional authority.

A challenge for this authority arises from prenatal testing being still ethically controversial. In addition, public debates sustain about whether or not the ideology of eugenics and of human genetics tend to converge. By professional authority I understand human genetics' claims of competence for the explanation of the phenomenon of disability based on the legitimacy to subsume pertinent phenomena within the professional interpretation and relevance framework. In other words, professionals claim to be able to provide adequate and relevant information and terms for decision-making processes. I will develop this argumentation on the basis of two empirical studies conducted within the framework of two research projects.[3]

The concept of non-knowledge serves to highlight the fact that dealing with phenomena such as genetic anomalies in biomedical frames is not trivial but implies certain expert practices. Obviously, non-knowledge is – in contrast to frequently held beliefs – not necessarily functional for science. By differentiating the term, it will be made clear that non-knowledge implies various options for dealing with open questions such as further research or politicisation.

From a theoretical point of view the intention is to combine two completely different sociological discourses, the modernisation theory-oriented debate about boundary politics (Beck/Bonß/Lau 2004) and the constructivist analysis of non-knowledge (Luhmann 1995). My aim is to develop a knowledge-sociological analysis of expert practice in the field of human genetics, critically assessing the competency claims of medicine. In the process I will introduce the German-language sociological debate on non-knowledge, since it has contributed considerably to sharpening this concept (section 2).[4] On the basis of a typology of

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[3] The research project "Life-Politics in the Risk Society" (No. 8885) was supported by the jubilee fund of the Central Bank of the Republic of Austria (Oesterreichische Nationalbank) and carried out at the Institute for Advanced Studies, Vienna. The research project "Life Science in European Society" (QLG7-CT-1999-00286) was supported by the European Commission, DG Research; the Austrian case study was conducted at the Institute of Technology Assessment of the Austrian Academy of Sciences, Vienna.

[4] So far, the topic of non-knowledge has only been discussed in sociological observation of human genetics in the context of the frequently debated right to non-knowledge (Wehling 2003a). Against the background of expanding capabilities of predictive genetic diagnostics and possible discrimination dangers from employers and insurance companies, there has been a discussion since the 1980s of the extent to which an informal or formal right not to

knowledge forms, I will argue that prenatally diagnosable disabilities transcend the defining categories of modern medicine. As a consequence, new differentiations and boundaries have to be found (section 3). The problematique of boundary politics is highlighted in the case of late term abortion. Legal and medical developments are accompanied by the blurring and reconstruction of boundaries by experts, though with a close link to societal guiding principles (section 4). Experts' taking into account of other knowledge forms and alternative rationalities (in counselling and in boundary politics) suggests that a reflexive type of expert could emerge. I argue, however, that these very practices contribute to the legitimisation of a medical genetic interpretation framework for prenatally diagnosable disabilities (section 5).

2 Non-knowledge in the knowledge society

According to the hypothesis that modern societies are becoming increasingly fragile, as put forward by Nico Stehr (2000), it is precisely because of the growing importance of knowledge in all areas of life and institutions that societal uncertainties and non-knowledge are coming to the fore. It would be an over-simplification to treat non-knowledge as a deficit that needs to be overcome. According to Helmut Willke (2002), knowledge in the knowledge society is, in view of uncontrollable systemic risks,[5] constituted by expertise in the treatment of non-knowledge. Non-knowledge here is not characterised by a preliminary lack of knowledge, but by a fundamental uncertainty that cannot be eliminated (ibid.: 11). Willke's notion of 'crisis', therefore, refers to more than mere a loss of credibility or deficiency in knowledge. It signifies the inability to deal with non-knowledge in a competent way, because non-knowledge, being the other, complementary side of the coin of knowledge, has not yet been appropriated and made manageable (ibid.: 18).

The category of non-knowledge has also been systematically introduced into the sociology of science. Taking the example of high energy experimental physics, Karin Knorr Cetina (1999), for instance, describes a change in the epistemology of the natural sciences. After the objects of observation, due to their physical characteristics, have been turned into virtual objects and into products of an experimental machinery, scientists are forced to adopt a new methodological self-reflexivity. Obstacles to cognition, ambiguities, and thus the boundaries of knowledge come into the centre of the analysis. By making the diverse causes of systematic misjudgements part of the reflection, physics "has *forged a coalition* with the evil that bars knowledge, by turning these barriers into a principle of knowledge" (ibid.: 64). The 'simple' generation of knowledge is replaced by a process of specifying non-knowledge. In addition, the door is kept open for the production of positive knowledge.

The knowledge society presents itself as a society which is not just based on 'knowledge', but also – speaking in terms of systems theory – on the 'form' of knowledge, i.e. on a distinction (prior to the indication of anything specific) that equally includes non-

have to know your own genetic predisposition can be founded and legally anchored. This discussion of non-knowledge, however, has taken place on the intentional level of „not-wanting-to-know" rather than on a functional level.

[5] Systemic risks are new forms of risk which cannot be localised, or for which personal responsibility cannot be identified; they emerge from an 'interlinkage of risks' and usually result in a destabilisation of the system. Willke mentions the world financial system and the Internet as instances thereof.

knowledge.[6] Knowledge societies are therefore essentially characterised by the acute increase in the significance of non-knowledge: first, through the systematic production of non-knowledge, and second, through the forced societal management of non-knowledge.[7]

Even though the category of non-knowledge has only recently become a subject of systematic reflection and conceptual work (see Japp 1997; Wehling 2003b), the interest of sociology in this topic can be traced back to the point where controversies over risk and ecological crises indicated the limits of scientific knowledge. Consequently, early conceptualisations were developed with close reference to risk and uncertainty (Collingridge 1980; Wynne 1992; Funtowicz/Ravetz 1993). This aspect is still relevant. To date, conflicts over risk or technologies related to serious ecological and/or health damages have been the main subjects stimulating empirical analyses with a focus on non-knowledge.[8] Although these analyses are grounded in incongruent basic assumptions, they agree that non-knowledge is not necessarily functional for scientific research any more: the basic assumption that non-knowledge would, inevitably, lead to new knowledge is now contested. Thus, non-knowledge is not primarily seen as a precondition for problem solving, a perspective advanced by Robert Merton (1987) with his notion of 'specified ignorance'. Merton argued that in order to generate new knowledge one has to specify non-knowledge, and was the first to emphasise the kind of non-knowledge that was functional for enabling further research. Forms of non-knowledge that could not be tackled were left aside.

The following discussion deals with the conceptualisation of non-knowledge within the two 'grand theories' in which it has become most relevant: the theory of reflexive modernisation of Ulrich Beck, and Niklas Luhmann's constructivist systems theory.

2.1 The modernisation-critical position

Beck (1996) refers to the notion of non-knowledge in order to distinguish his model of reflexive modernisation from alternative perspectives (e.g. Giddens 1990). According to Beck, it is not the mere accumulation and globalisation of knowledge that allows us to characterise modernity as 'reflexive', but rather the recognition of non-knowledge. Risks and dangers which emerge in the course of the process of modernisation must not, for the sake of the preservation of the status quo, become visible as systemically induced consequences of modernisation. Thus the struggle over the conditions of definition becomes vital for political reforms, together with the clarification of the boundary between knowledge and non-knowledge.[9]

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[6] For the notion of 'form', see Luhmann 1991: 23, 59-60.

[7] From this perspective, technology assessment (TA) can be seen as an early attempt to achieve institutionalised anticipation of consequences, though under optimistic assumptions concerning their control. Accordingly, it is the expert who is the only one who knows about the limitations of scientific knowledge and the specification of non-knowledge (van den Daele 1996); boundary-drawing between knowledge and non-knowledge appears as a cognitive process. Against this background, the development of participatory TA (Joss/Bellucci 2002; Abels/Bora 2004) can be understood as an attempt to ensure that experts do not have sole responsibility for boundary-drawing.

[8] For the example of chemical policy see Böschen (2000); for the example of mad cow disease (BSE) see Dressel (2002), Japp (2002a).

[9] Giddens' theory of modernisation offers a somewhat different account; he links the reflexivity of modernity closely to the diffusion and circularity of expert knowledge. It is not non-knowledge that is the engine driving reflexive modernisation, but a conglomeration of different mechanisms which can be subsumed generally under global-

According to Beck, in order to arrive at reflexivity it is necessary to gain knowledge about non-knowledge. Non-knowledge appears to be a confined area that is static and objectively 'given'. The complementary area of non-knowledge shares common features with his notion of risks as apparently objective and 'pre-discursive' threats posed by technology (Beck 1986). In other words, it appears to be *independent* in its existence of any knowledge conflicts (and therefore a priori to them), but *dependent* in its scope on current claims (and articulations) of knowledge.[10] Insuperable and unforeseeable non-knowledge – in Beck's terms (1996: 302) a 'Not-being-able-to-know' ("Nicht-Wissen-Können") – does not have a systematic place in this perspective, and the causes and processes of the constitution of such non-knowledge are, in fact, of secondary interest. Given the assumption of the existence of a certain objectively available ('knowable') area of knowledge, the analysis has to focus on the suppression and omission of non-knowledge ('Not-wanting-to-know'; "Nicht-Wissen-Wollen"). This means that there is a danger of an intentional reduction of the problem of non-knowledge.

In his attempt to differentiate the categories introduced by Beck while avoiding the problems mentioned above, Peter Wehling (2003b: 124-126) distinguishes three dimensions of non-knowledge. First, he distinguishes known from unknown non-knowledge (criterion of knowledge). Here, non-knowledge refers to preliminary knowledge gaps and ambiguities, the deficient character of which is well known. In contrast, phenomena where it is still unclear that something is not known, or rather, what it is that is not known, are referred to as 'unknown non-knowledge'. Second, temporary non-knowledge is distinguished from permanent (enduring) non-knowledge (criterion of time). The question of whether non-knowledge is insuperable or resolvable, i.e. whether it is 'specifiable' in the sense of Merton and therefore open to further analysis, is especially important with regard to the acceptance and funding of research (Wehling 2004: 73). A third dimension of non-knowledge refers to the criterion of intentionality. This distinction between non-knowledge we are either aware or unaware of, with the latter being inevitable, is part of Beck's action-theoretical perspective. Non-knowledge is primarily seen as a consequence of individual action and decision-making (what could the actor have known? what should he have known?); thus, there are significant moral implications.[11]

Wehling's attempt to discuss the concept of non-knowledge, which still has insufficient empirical backing, with the goal of systematising it, is instructive. His comparatively thorough differentiation of the term is directed against the 'thin' typology suggested by systems theory (see below), and strives for the development of a comprehensive research programme. Ultimately, it aims to analyse the processes of emer-

isation and the institutionalisation of knowledge (Giddens 1990). Thus, reflexivity appears as a general feature of modernity. With the development of an 'institutional reflexivity', consequences that are already potentially inherent catch up with modernity. Giddens, unlike Beck, does not postulate a structural rupture within modernity, and he does not need to provide empirical evidence of a transition towards a 'second' modernity. Compared to Beck, his rather linear model of knowledge of reflexive modernisation provides less opportunity for the endogenous precariousness of rationality to become apparent.

[10] In the end, such an epistemological realism assumes the 'accessability' of reality through observation; this is supported by the argument that it is precisely ignorance of, and the denial of knowledge about, the dangers to which industrialisation gives rise that lead to an increase in real dangers (Beck 1996: 311).

[11] For instance, Wehling (2003: 126) refers to non-knowledge sustained in the face of better judgement.

gence, communication and processing of non-knowledge. These concepts allow the reformulation (and an alternative discussion) of controversies about risk, and empirical case studies will indicate their descriptive potential (for a first step see Böschen 2002).

At the same time, Wehling's concept bears a certain resemblance to Beck's approach. Non-knowledge is conceptualised as the result of a process of construction and assignment, and at the same time non-knowledge refers to more or less objectively knowable phenomena, thus existing prior to (any) discourse. This becomes evident in Wehling's description of the hole in the ozone layer (2004: 75-79), where he analyses the transformation of non-knowledge with regard to the process of catching up with the explanations of already manifest consequences (triggered off by CFC). An implicit reference to Beck's realism of hazard runs the risk of, in principle, considering non-knowledge as a deficit that needs to be overcome. For hazards can only be averted with the help of knowledge; they grow without such knowledge. If non-knowledge remains associated – in an ultimately essentialist way – with a knowledge deficit or "knowledge gaps" (Wehling 2004: 69), then we might lose sight of the fact that (non-)knowledge results from contingent processes of construction, which can always take an alternative form – to be precise, in a way that is independent of real progress in knowledge.

2.2 The constructivist position

Although Luhmann's analysis of non-knowledge (1992) has its origin in ecological problems, it does not offer a criticism of institutions. Rather, the radical dimension of this kind of analysis results from its epistemological approach. In order to perform an observation, and hence to generate significance, the observer (in Luhmann's terminology) must focus on one side of the discrimination made which subsequently becomes relevant for any further operation. Concomitantly, an 'unmarked space' is being produced. As this is done, non-knowledge becomes a necessary constituent of any knowledge production. The accumulation of knowledge can, according to Luhmann (1995: 177), only result in a progressive reproduction of non-knowledge; there can be no gradual transformation of non-knowledge into knowledge.[12]

Japp (1997) follows this conceptualisation of non-knowledge. It has systematically developed the 'eigenvalue' of its object of research. Japp distinguishes, in a more pronounced way than Luhmann, between specific and unspecific non-knowledge.[13] Specific non-knowledge corresponds terminologically to Beck's notion of 'Not-yet-knowledge' ("Noch-Nicht-Wissen"). Yet unlike Beck, Japp (2002a: 43-48) places the emphasis on the systematic difference between facts and form of knowledge. Overcoming it is always an accomplishment of construction from the viewpoint of the observer; therefore, the question of connectability ("Anschlussfähigkeit") is paramount. Ambiguities can, on the one hand, be mitigated (with reference to particular value judgements) in such a way that non-knowledge is characterised as a cognitive problem rather than a trigger for political conflict. In this sense, specific non-knowledge is a form of non-knowledge that can be normalised on a medium-term basis and transformed into 'secure' knowledge, even if there is

[12] Apart from the constructivist description of non-knowledge, there are also 'realistic' points of reference in the systems theorists' approach. From this perspective, non-knowledge is seen as a product of complexity and therefore allocated on a factual level; see Willke (2002).

[13] In fact, Luhmann (1995) distinguishes between specified ('marked') and unspecified non-knowledge. However, he does not look into the sociologically relevant questions of the circumstances under which either of the two kinds of non-knowledge is referred to, and what consequences follow from this.

even if there is considerable disagreement amongst experts over the course of such a transformation. On the other hand, specific non-knowledge is a form of knowledge that refers to comparison or probabilities. Hence, it allows us to bring out uncertainties and to ask for risk assessments. In other words: the *specificity* of non-knowledge is emphasised, while *non-knowledge* (as such) is highlighted – depending on the degree to which uncertainty is accepted and science and technology are trusted.

Unspecific non-knowledge is a construction which rejects the validity claims of (expert) knowledge as well as those of specific non-knowledge. It is a form of societal self-description in which uncertainty is labelled as potentially catastrophic. The reaction to such a 'potentiality of illimitable damage' is to demand 'avoidance behaviour', i.e. not to adopt certain available (technical) options. Unspecific non-knowledge, actually a form of not connectable non-knowledge (how should one speak about something that is simply unknown?), can only be asserted in a meaningful way through the communication of the 'catastrophe' as a symbol of what is to be avoided (Japp 2002b: 436). This is the case especially when new and unknown phenomena or developments are regarded as beyond the scope of scientific knowledge. This means that in principle, they transcend the explanatory potential of scientific knowledge, are considered unpredictable and uncontrollable with regard to science, and furthermore become, or are turned into, a potential threat. We can understand this process as a generalisation of non-knowledge.

The political consequences of this generalisation with regard to knowledge and technological conflicts are well known. The assignment of unspecific non-knowledge involves the danger, as Helga Nowotny (2005: 41-42) argues with regard to the loss of authority of experts, that laypersons renounce their loyalty to experts and consider taking the 'exit option'. They could abandon the discourse with scientific experts and 'cross over' to the political system: they could, by means of initiatives or demonstrations, influence science, legislation and the regulation of research.

One of the strengths of the constructivist position is that it helps to understand non-knowledge as a co-produced phenomenon and therefore as a logical necessity. The sociologically relevant questions, then, are how processes of acknowledgement of (non-)knowledge develop, and how claims of (non-)knowledge turn into (non-)knowledge. Following an important trend in science research one can ask, for instance, in which way a representational relationship is established between 'clean', decontextualised laboratory objects and the reality of nature (e.g. Latour 1999: chapter 2). Wehling's differentiated terminology is probably the best way of capturing such processes, if they can be captured at all.

Japp's strict constructivism, on the other hand, could overcome the perspective of a symmetrical relation between knowledge and non-knowledge (i.e. that acquiring knowledge should inevitably be linked to reducing non-knowledge). Due to the absence of a privileged observer position, assigning something to knowledge or non-knowledge is, in the end, a normative decision. Non-knowledge is therefore a construction that leaves open every political option. In some situations, and in the view of those who look sceptically at a plan or project (for whatever reason), the readiness to acknowledge non-knowledge is so low that critics and whistleblowers can easily prevail. In other situations, there is no communication about non-knowledge or rather non-knowledge is communicated as uncertain knowledge or knowledge not yet established, irrespective of any perceived advance in knowledge.

Finally, from such a perspective non-knowledge appears less as a cognitive but rather as a social phenomenon. A certain way of communicating, in the case of unspecific non-knowledge often associated with the (aggressive) claims of persons affected (Japp 1999: 30), is taken as a certain way of assigning non-knowledge. As a result, conflicts not necessarily centred around ecological risks also become accessible to the category of non-knowledge. The following investigation of prenatal testing uses this perspective.

3 Prenatal testing, its development and its relevance

Prenatal testing and genetic counselling span the fields of human genetics and medicine. While prenatal testing in the early 1970s was merely a sideline for human geneticists, it has since differentiated itself from the field of human genetics, become successfully institutionalised, and now, as part of gynaecology, is considered a core aspect of pregnancy care (Nippert 1991).[14] In 1966 the first cultivation of foetal cells suspended in amniotic fluid was successful. This was seen as a decisive step towards the cytogenetic and biochemical detection of foetal anomalies. The first prenatal detection of Morbus Down was performed in 1968.

While prenatal testing is not restricted to DNA analyses (in fact the majority of examinations employ ultrasound), prenatal testing has now become an important field of activity for genetic counselling. Current figures show this. In 1970, when prenatal testing was introduced in Germany, only six amniocenteses were registered.[15] Shortly thereafter prenatal testing was added to the catalogue of services provided by compulsory health insurance and already by the mid-1980s (in the meantime chorionic villus sampling (CVS) had been introduced) over 30,000 amniocenteses and 3,000 CVS were registered.[16] In 1999 alone approximately 70,000 invasive examinations were performed. This means that roughly every tenth pregnancy involved invasive diagnosis (Nippert 1999).

An important factor in this normalisation process was the way in which various court decisions obliged doctors to promote the potential of prenatal testing to women over the age of 35. Hennen et al. (1996: 78) state that prenatal testing has almost become a standard examination in pregnancy care for women over 35. While prenatal testing is still ethically controversial, it is predominantly directed towards the early detection of Down's syndrome, and is currently the only way of preventing the birth of disabled children.

3.1 Transgressing traditional categories

In the case of prenatal testing, the consequences of an ongoing scientification process make it necessary to draw boundaries. Recently, Ronald Hitzler and Michaela Pfadenhauer (1999: 99) have pointed to the fact that

[14] Prenatal testing includes examinations and tests relating to the development of the foetus over the course of pregnancy. Ultrasound is the most common form of non-invasive prenatal testing. In addition there are invasive diagnostics, i.e. surgical interventions which sample cells from the unborn child and test them, mostly for Down's syndrome (amniocentesis, chorionic villus sampling).

[15] Amniocentesis involves removing amniotic fluid in the 16th to 18th week of pregnancy by means of transabdominal puncture of the uterus. Foetal cells from the amniotic fluid are cultured and analysed in the laboratory, mostly for chromosome anomalies such as Down's, Klinefelter, and Turner syndrome.

[16] CVS involves removing chorionic tissue (a preliminary stage of the placenta genetically derived from the foetus) by means of a needle inserted through the abdominal wall or vagina. As with amniocentesis, chromosomes (or DNA) can be analysed.

improved techniques for diagnosis have resulted in precarious data acquired at a very early point in time, which transcend the way of coding (and separating) 'healthy' and 'sick', a constitutive element of modern medicine.[17] Our case supports this notion. With the help of early prenatal testing (e.g. measurement of the nuchal translucency thickness[18]), certain distinctive features considered to be reliable indicators of the Down's syndrome (so-called 'soft-markers') can be diagnosed as early as the tenth week of pregnancy. While Down's syndrome constitutes a chromosomal aberration and as such, with regard to the genetic paradigm (related basic analysis: genetically normal/abnormal), an abnormality, it is difficult or impossible for the prenatal diagnostician to identify its 'clinical implication', in other words its 'meaning', with regard to the medical code (healthy/sick). In practice, it is obviously difficult for the expert to determine medically operationalisable criteria to decide whether an abortion after prenatal testing is legitimate or not. The following interview passage illustrates the practical difficulties involved:

It is ethically unproblematic if my prenatal diagnosis is anencephalus[19]; I spare the woman a pregnancy, including the risks of a pregnancy, and the child anyway has no chance of survival (…) It is more tricky in the case of viable deformations; because here, of course, at some point the question arises, how disabled does a child have to be that I categorise it as ethically justifiable to seriously consider the early diagnosis, so that I can perform an abortion/kill it? (1:17/41:52)

Within the continuum of viable disabilities (quantitatively) accounting for the major part of prenatal testing, it is obviously difficult, on the basis of medical knowledge, to provide 'trigger points' unconditionally linked to certain strategies of action, unless the diagnosed deformations or genetic defects can be reformulated within the traditional categories of medicine so that they become unambiguous. This is the case with anencephalus, because it is described as a kind of deformation not allowing life after birth. In this case it is the distinction alive/dead that, as a distinguishing criterion, provides orientation and relief with regard to the decision taken.

The difficulty of boundary-drawing by means of expert knowledge becomes apparent from the fact that the expert does not pursue, and does not try to operationalise, the question of when it starts to be 'tricky' to perform prenatal testing. The social consequences of such a blurred boundary can be observed on the level of interactions. Last but not least, in view of professional codes regarding genetic counselling, it can be said that for such a decision it

[17] According to the medical code, in Luhmann's (1990) terminology, disease represents the positive side of the distinction as it is operationally connectable and therefore corresponds to the 'goal of action' or the teleology of the system. The fact that human genetics establishes a new dichotomy, so to speak behind the back of medicine, is a development Luhmann was aware of. Health is differentiated by the introduction of the new categories 'genetically burdened/not burdened'. However, Luhmann confined himself to perceiving the interdependency between basic coding and (genetically induced) secondary distinction as a proof of the stable autonomy of the medical system. It remains, however, unclear how this secondary distinction is practically operationalised and what the consequences are. In the end, a reasonably unconflictual interdependency of the two codings has quite a few preconditions; all complexity associated with the diagnosis of 'being genetically burdened' has to be countered by discharge mechanisms ("Entlastungsmöglichkeiten") within the logic of the medical system.

[18] This measurement is an ultrasound evaluation of the thickness of the neck fold of the foetus.

[19] Severe deformations in the central nervous system, caused by a defective closure of the neural tube in the development of the foetus; babies lack the skullcap and substantial parts of the brain.

is obviously no longer sufficient to refer to expert knowledge alone. Accordingly, the norm-setting, goal-oriented, hierarchically structured consultation of an expert is not considered appropriate any more.[20] Against this background, it becomes understandable why the unprejudiced, process-oriented and client-centred ideal of counselling has become so popular, as it is easily reconcilable with the central value of modern medical practice, i.e. the autonomy of the patient.[21]

3.2 A typology of non-knowledge

I shall now relate the blurring of boundaries to some arguments from the sociology of knowledge. On the level of different forms of knowledge, we can essentially distinguish three categories: ignorance, uncertainty, and non-knowledge.

a) Ignorance refers to an inadequate or preliminary form of knowledge that has the potential to be corrected. Practically, it is about mistakes, errors and false statements that can subsequently be clarified, for instance by empirical data or through a critique of science or ideology. From a sociological point of view, this level is of secondary importance.

b) Uncertainty, or uncertain knowledge, is located on a cognitive level. As already mentioned, two forms of uncertainty can be distinguished with regard to human genetics: diagnostic uncertainty (what is the probability of a disease on the basis of genetic disposition?) and prognostic uncertainty (when will a disease appear and how will it develop?).

Uncertainties related to indication and diagnosis play a crucial role with regard to prenatal testing. In the frame of early prenatal testing (e.g. measurement of the nuchal translucency thickness), the woman gets a 'risk figure', an expression of the individual probability of giving birth to a disabled child (for example: 'you have a risk of 1 in 500'), rather than a definitive assessment of the genetic status of the child.[22] A traditional yes/no diagnosis is replaced by a statistical calculation. Not 'healthy' or 'not healthy', but probably healthy, but maybe not healthy. Whether a probability of 1 to 500 means healthy or sick is ideally left to individual interpretation.

These kinds of uncertainty can be associated with the notion of specific non-knowledge, because they have a strong emphasis on cognition. At the moment there are no ways of transforming this uncertainty into knowledge, but there is precise knowledge about the kind of deficient character of this knowledge and thus usually an idea of how non-knowledge can be translated into knowledge on a medium-term basis. This form of knowledge is therefore in principle characterised by connectability ("Anschlussfähigkeit"). In practice, this means that there is confidence in being able to overcome, at least on a medium-term basis, the preliminary character and the ambiguity of knowledge with the help of additional and more extensive information, more precise measurements and tests, better qualified specialists, and so on.[23]

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[20] A corresponding plea for non-directive forms of counselling, which provide extensive medical-genetic information supporting individual decision-making, can be found, for example, in GfH (1996). For a criticism of the ideal of non-directivity in counselling methodically grounded in participant observation of counselling interviews, see Bosk (1992).

[21] From the perspective of human genetic counselling, see Reif/Baitsch (1986). A summary with regard to the changing concepts of counselling from the perspective of discourse analysis is provided by Waldschmidt (1996).

[22] In terms of probability the calculation of risks includes, on the one hand, the statistical basic risk correlated with the age of the woman. The variation, i.e. the individual specification of risk, results from the measurement of the nuchal translucency thickness.

cialists, and so on.[23] However, the people affected may perceive uncertainty as a fundamental and irreducible problem. But even in this case (of ascription of risk) the problem is framed as having the 'right configuration', i.e. it is not perceived as a problem that would transcend the professional frame of interpretation and relevance.

c) Non-knowledge: it is crucial for my argument that the notion of non-knowledge is not defined in a cognitivist way (i.e. as a problem of inadequate knowledge progress), but rather related to the level of social action. The notion of non-knowledge correlates to disabilities that can be discovered by prenatal testing and that are supposed to transcend bio-medical possibilities of interpretation. From this perspective, non-knowledge is characterised by the fact that expert knowledge is unable to 'grasp' the specific phenomena; it cannot really assess their significance. This should not be understood in the sense that prenatal testing would be incapable of understanding what is 'constitutive' of disability. The argument that medicine can no longer claim objectivity as a reference for its practice is not an epistemological one. It is a sociological argument: with regard to certain disabilities, medicine obviously can no longer refer to the kind of objective meaning which would normally result from the close link between expert knowledge (diagnosis) and decision (treatment), and which finds expression in the stable character of the distinctions healthy/sick and normal/abnormal. The practical implications for action described above are the result. In the context of claims of being affected, this problem can entail the radical negation of medical knowledge claims (Japp 2002a: 47).

[23] Against this background, the attempt to isolate foetal cells from the mother's blood in order to get early and reliable evidence about forms of trisomy (Hahn/Holzgreve 2001) implies the perpetuation of a particular research logic.

If we agree with Luhmann that the constitution of knowledge is the result of a successful ascription of necessarily ambivalent information to a supposedly secure knowledge (and non-knowledge is therefore a 'construction defect'), the analytic benefit of the terminology introduced becomes somewhat clearer: due to its ambiguity, disability leaves open several options of ascription. By referring to hegemonic discourses and cultural values it can, for instance, be clarified in a way that identifies non-knowledge as a cognitive problem (consequence: demand for more precise test results, better therapies etc.). In this case, non-knowledge becomes framed as uncertainty. Alternatively, by referring to different discourses and alternative value orientations, the ambiguity attached to disability can also become effective as a tool for the repulsion of scientific claims of cognition. In this case non-knowledge is not connected to the option of continuing scientification, but is opened up to external criticism – with politicisation as a consequence.

Taking the institutionalisation of prenatal testing in to consideration, one can ask which discourses, norms and rules would help to normalise the understanding of professional practice as an appropriate configuration of the problem. In what follows, I will analyse the rationality of concrete boundary-drawings in order to reconstruct these discourses and norms.

4 The politics of boundary-drawing

Modernisation theory sees boundary-drawing as essentially related to the postulate of boundary blurring ("Entgrenzung") of institutions and guiding principles. From this perspective, "Entgrenzungen", i.e. the dissolution or pluralisation of categorical distinctions (Viehöver/Gugutzer/Keller/Lau 2004), are regarded as indicators of the emergence of a 'second' modernity.

According to Beck et al. the epochal rupture consists of the fact "that the *guiding ideas* of western modernity have become questionable because of the dynamics of secondary effects" (2001: 25). The category of boundary-drawing becomes interesting for the theory of modernisation for one main reason: because of its strong hypothesis of an epochal rupture, the theory is highly dependent upon criteria for empirical testing. A central argument is that modernity is reflexive from the moment when, as a consequence of scientific and technical developments, habitual boundaries and patterns of thinking are dissolved by means of risks and dangers released by (and in) the process of modernisation. Such boundaries as the difference between nature/society, life/death, or healthy/sick (Viehöver 2005) are fundamental to the self-understanding of modernity, because they constitute action and decision-making resources as well as mechanisms for assigning responsibilities.

From this point of view, boundary work provided by the experts is therefore regarded as an expression of an institutional dynamic, but not as a form of strategic management of symbolic boundaries such as Gieryn (1983) would propose.[24] His concept of 'boundary work' focuses on the way science appropriates, by means of boundary work, resources related to the privileged position of science, such as credibility, prestige and power (Gieryn 1995). Finally, the scope of the autonomy of science needs to be maintained and science needs to be protected from external control, for example by delimitating it from other functional systems such as policy.

The boundary-drawing discourse of human genetics can therefore be studied from at least two perspectives. On the one hand, boundary construction by experts can – with regard to political and ethnic conflicts – be seen as a strategy designed to legitimise professional authority (see Cunningham-Burley/Kerr 1999; Bogner 2004). Modernisation theory, on the other hand, chiefly considers the way experts deal with the opening up of the scope for decision-making, a field which is subject neither to traditional claims nor to formal regulations.

The boundary work of experts can be illustrated by taking the urgent problem of late term abortion as an example. The reconstruction of the rationality underlying boundary construction in this case can inform us about the discourses and value orientations that enable experts to provide and implement the authoritative notions and concepts for the interpretation of disabilities to be discovered by prenatal testing; the legitimisation of decisions; and, thus, the societal debate about disabilities.

4.1 Late term abortion: the prenatal boundary between life and death

Advances in neonatal medicine have contributed to rendering the prenatal line between life and death more fluid. This has become especially problematic with regard to the recently amended German abortion law. In the course of the 1995 amendment the temporal limitation for an abortion previously set at the 22nd week (orientated towards the boundary of viability) was eliminated. In principle, in case the foetus is classified as a 'hazard' to the physical or mental health of the pregnant woman, the doctor may induce an abortion (if the pregnant woman consents) up until shortly before birth (StGB § 218a, section 2). The situation in Austria is similar with respect to the penal code. According to

[24] Gieryn (1983: 782) characterises the boundary work of scientists as 'ideological efforts'. The way he poses his main question, "What images of science do scientists present to promote their authority over designated domains of knowledge?" (ibid.: 783), indicates that he understands the ideology (of 'scientificality') as an active and strategic process of establishing boundaries.

Austria's abortion law (in force since 1975), an abortion based on eugenic indications may be conducted up until shortly before birth (StBG § 97, section 1, item 2).

The dissolution of a definitive, albeit pragmatic demarcation presents a serious challenge for a gynaecologist. Performing an abortion between the 22nd and the 24th week of pregnancy,[25] at a time when the child is generally considered viable, can get doctors into a difficult situation with serious consequences.[26] Obviously, an absurd and irreconcilable dilemma arises if a (non-punishable) abortion makes necessary to perform an act of active euthanasia in order to pursue the original intention. On the other hand, it is obvious that the need to take such decisions tends to result in a practice which is regulated by experts themselves.

With regard to the exigency of having provisional-moral boundary constructs (Beck/Bonß/Lau 2004: 15), referring to a viability boundary as a criterion of a time limit for late term abortions (as suggested for example by chamber of medical doctors in BÄK 1998) does not help in the individual case. Firstly, this threshold is fluid as a result of advances in neonatal medicine, and of course it varies in individual cases. Finally, the actual week of pregnancy cannot even be determined with absolute accuracy. Hence, boundaries keep dissolving as it is no longer possible to discern, based on medical diagnostic methods, on which side of the border one stands at a concrete point in time. But even if one disregards ambiguities and the need to interpret viability criteria there must be exceptions, either due to medical or eugenic indications or in cases when, for example, the results of an amniocentesis are received very late. Hence prenatal diagnosticians and gynaecologists are faced with the problem of having to redraw the prenatal line between life and death. Ultimately, the boundary construction provides an immediate guideline for professional action and decision-making. For us, as a result, the ensuing question relates to the interpretations and considerations supporting these boundary constructions.

4.2 The pluralisation of the life/death distinction

The prenatal boundary between life and death, prior to its dissolution over the course of the abortion reform, had been drawn by the law - which itself was orientated toward medical 'facts' ('the boundary of viability'). For us this raises a new and interesting question, namely how scientific, judicial or philosophical knowledge plays a role in the reconstruction of this boundary. In any case, the problem of late term abortions is no longer regulated by formal law but rather by the informal boundary politics of experts. It is the experts who are formulating processes for dealing with this problem in publications (e.g. von Kaisenberg/Jonat/Kaatsch 2005), in directives and statements of professional associations (e.g. DGGG 2003), at symposiums and congresses, and also on the level of day-to-day internal cooperation and team meetings in hospitals. This subpoliticisation, however, is not tantamount to an exclusive orientation towards medical genetic expertise. In the following it will be shown that ethical or philosophical knowledge is

[25] A late term abortion in practice essentially means the inducement of labour in anticipation that the child will be stillborn. In some cases a so-called foetocide is performed in order to be sure. Prior to the abortion, the foetus is killed by means of a potassium chloride injection to the heart.

[26] In Germany around 1,500 abortions are performed annually after the 22nd week of pregnancy, according to an article in the German magazine "Der Spiegel" (Friedrichsen/Ludwig 1999). The Federal Agency of Statistics reported 190 abortions in 1997, but the director of the Hospital Doctors' Association of the Marburger Bund, Frank Ulrich Montgomery, estimates approximately 800 late term abortions per year (Sperber 2001).

also of significance for the reformulation of boundaries.

It is possible to reconstruct the logic of boundary-drawing in expert discourse based on its discussion of exceptional cases. Two different argumentation types have been analytically identified in connection with the manner in which experts classify exceptional cases. On the one hand, there is an effort to fall back on medical criteria as a way of drawing a boundary. This means that the legitimisation of late term abortion is founded on a poor survivability prognosis for the foetus. By referring once again to viability in this way the pragmatic boundary of the former abortion law is more than just revived, since this criterion may also now be applied to the period after the 22nd week of pregnancy when decisions are still possible. 'Non viable deformities' or 'untreatable diseases' consequently represent legitimate exceptional cases for late term abortions according to the experts I questioned asked. In an attempt to concretise such terms when they need interpretation, experts tend to draw on the medically most clear-cut cases. A concrete example is anencephalus which, based on a very low survival probability, is characterised by experts as a 'death-like' condition. In such a case the continuation of the pregnancy is usually deemed pointless or an unnecessary risk for the woman. The diagnosis 'anencephalus' is therefore associated with the demarcation dead/alive. Ultimately in this type of argumentation, the distinction between life/death is in a way reintroduced on the side of life (i.e. in the time period open to decision-making, starting with the viability boundary). In view of the interpretational dependency of the exceptional case, this can be viewed as a pluralisation of the demarcation.

The second type of argumentation may also be considered a pluralisation of the demarcation, but in a stronger sense, since a rationality different than that of medicine has a bearing. In this case experts do not legitimise late term abortions according to the life/death distinction set out above. Here, the boundary-drawing which becomes action-orientative for a problematic case beyond the viability boundary, refers to the distinction between personal and non-personal life. Further elaborated, this distinction provides the basis for the bioethical debate which ties granting the right to life to the criterion of personhood (e.g. Tooley 1979; Singer 1979). The following interview passage serves to illustrate this second argumentation type, and sums up the argument in a very reflexive way.

Expert (E): I think Prof. N and I both found a rather sensible solution to the problem of late term abortions here in the department. (...) We have a formulation that we draw a line starting with the 23rd plus 0th week. In other words, the beginning of the 24th week and thereafter – and that is now the formulation of T. from A. – the confidence in prenatal testing on the one hand, and a considerable lack of cognitive development on the other must be very likely. Yes? Well, if you start at the end of the spectrum: anencephalus. There's no gestation age limit for anencephalus.

Interviewer (I): Spina bifida?[27]

E: No. Well, spina bifida must be diagnosed with much care. If associated with a large hydrocephalus, then yes, this is precisely a case in which one has to consider this formulation.

I: So what exactly is considered a severe cognitive defect?

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[27] A congenital deformity of the spine and spinal cord ('cleft spine') which can appear in very different degrees of severity. Disorders accordingly range from slight impairment of the ability to walk to paraplegia with bladder and intestinal dysfunctions. Most of the time spina bifida is associated with hydrocephalus (excessive accumulation of cerebrospinal fluid within the cranium).

E: Well. Yes, I have the formulation of personhood which is used in philosophical writing. Also, someone lacks a consciousness of his own existence, no feeling of past and future and no interaction with others. That would be the criteria of personhood, and there are such children. That can be operationalised up to a certain point.

I: So that can really be operationalised?

E: Yes. Yes, that can be operationalised. So when it's clear that this child will never be able to have interaction with a counterpart, whether from a philosophical or theological point of view, it will not develop a consciousness of its own self, it will not develop a consciousness for the past or future, or for any other perspective, then, well.... (2:113/632:677)

This second argumentation type can be considered reflexive in as much as the fiction of a clear possibility of differentiation is dismissed by means of the viability criterion. Diagnoses come to the fore (e.g. spina bifida) which are ambiguous, and which remain hidden in the first argumentation type and then must be decided ad hoc in practice. The professional orientations to action as observed in the second case are directed toward criteria founded in ethics rather than medicine. In the end an effort is made to solve the problem of drawing the line by referring to ethical rather than medical categories. By means of the term personhood, mankind is divided into purely biological life forms and persons characterised by autonomy, rationality and self-awareness. For the legitimisation of a late term abortion this essentially boils down to the distinction between a dignified and undignified life (although not from a perspective with a eugenically objectified 'worth living' orientation). The terms autonomy and self-awareness thereby entail specific demands for actively shaping the individual's life through anticipation and acts of choice (Rose 1998). As general principles of governing the individual's life in late modernity these terms constitute, in such a perspective, guiding principles of society. In the bioethical concept of personhood, these guiding ideas essentially support a logically consistent convergence on a universal concept for the valuation of life.

The question of the (by no means unproblematic)[28] relationship between bioethical discourse and societal notions of normality becomes important in the light of the general question of the significance of normality concepts for professional actions and decision-making. Beyond the present context, one can ask which framework of action, for example an expert lacking the pertinent training in bioethics, when forced to make a decision. According to the perspective developed here, it will be a framework of action which has been delimited in a logically consistent manner by bioethics and centred on the guiding principle of autonomy. Since – in line with the liberal school of bioethics – moral imperatives are developed from the hegemonic value system of society and the normative is strictly anchored in the empirically observable (Braun 2000: 108-135), the bioethical discourse must be understood as an expression as well as an elaboration and generalisation of societal normality concepts that are crystallised in the fundamental questions: What is a life worth living? What is a human being?

5 Conclusion and outlook: reflexive experts?

Prenatal testing is marked by scientifically technical dynamics which un-

[28] The logically compelling argument of utilitarians for permission to kill newborn babies (since a newborn can never be a person) will meet with resistance from the population. However, it is precisely the stringency of analytical operations which suggests, with the reference to normality, a need to adapt biopolitical norms and regulations in a way that would result in the liberalisation of contra-intuitive practices.

dermine the stability of institutionalised decision-making conventions. Decision and design necessities for experts result from the evolving ambiguities of categorical definitions (healthy/sick, life/death) which require new boundary constructions. Specific professional orientations to action have been reconstructed here by analysis of these constructions. In the process it became clear that concrete professional orientations to action draw their cognitive-oriented and legitimising power from the implicit reference to society's guiding principles and notions of normality. These societal guiding principles operationalise themselves, according to the example of the more or less subpolitical regulation of late term abortions, in the form of a certain ideal of rationality. Categories such as autonomy, interactivity or self-awareness together make up the differentiation between person/non-person, a complement to the blurred life/death distinction. Admission into a social community therefore no longer depends on biological but on cognitive criteria, which require a minimum command over oneself as a precondition for a life worth living.

But the revaluation of an impartial, process-oriented and client-centred counselling ideal, which is centred around the guiding principle of individual decision-making autonomy, also illustrates the close link between professional practice and society's guiding principles. In connection with the problem of boundary drawing, this revaluation can be regarded as an indication that the reference to expert knowledge no longer appears sufficient for the reformulation of prenatally diagnosable disabilities in the medical code, nor for the distinction between legitimate and non-legitimate practice as a consequence. On the level of discourse, the hegemony of a liberal autonomy principle seems to be expressed in the counselling ideal which has become the guiding principle for the regulation and handling of 'life and death questions' in the context of (bio-)medical progress.[29] According to Erwin K. Scheuch (2003), in the light of this close link between professional action orientations and society's guiding principles it would be conceivable to speak of the "meaning of the spirit of the age for medicine".

Far-reaching conclusions follow considering the non-knowledge problem mentioned earlier. The concept of non-knowledge has been linked with prenatally diagnosable disabilities because it can be, and is in practice, associated with transcending in principle the scope of interpretations of medicine. Hence, non-knowledge as a 'phenomenon of assignment' is based on the legitimacy of the scientific interpretational framework. This conception analytically sensitises us to the question of which factors contribute to making 'objects to be dealt with' legitimate objects of research practice.

Regarding the institutionalisation and normalisation of prenatal testing (as described), one can assume that the reference to society's guiding principles is a factor both in boundary politics and in the redesign of the counselling process. This factor is dysfunctional for a broad challenge to knowledge claims or for formulating a general suspicion of irrelevance. Provided experts draw boundaries conforming to norms and their decisions largely correspond to the expectations of society concerning what is acknowledged as their job, what is considered worth knowing and possible to say, and which taboos exist,[30] non-knowledge

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[29] From the range of existing bioethical literature, the following sources can be cited as theoretically elaborated and influential in practice: for a pragmatic perspective Beauchamp/Childress (1994), and for more general accounts Harris (1991) and Charlesworth (1993).

[30] Not only eugenic practices and value-attributing counselling are taboos. An important taboo which cannot be further elaborated here is the application of prena-

is not communicated. Consequently, professional authority (as defined in section 1) does not need to be called into question.[31] Non-knowledge remains a cognitive problem and not a reason for politicisation. Hence, non-knowledge is not necessarily dysfunctional for science; however, it is not per se functional, a point Merton has already captured in his interpretation of a necessary 'specification'.

In view of the self-relativisation of experts in the course of the revaluation of client-oriented counselling or the experimental raising of ethical aspects within the field of prenatal testing, one can now ask whether we can observe a reflexive type of expert emerging in the case of human genetics, as May and Holzinger (2003) have suggested. They argue that, as a special field in medicine, human genetics with its aetiology and improved diagnostic techniques transcends the established paradigms and principles of medical knowledge. Experts are forced to communicate uncertainty, which makes the relevance of human genetic knowledge appear questionable to the client and is therefore dysfunctional for the medical monopoly on interpretation and for expert status (ibid.: 105). The revaluation of a layperson's perspective in genetic counselling, i.e. the tendency to dissolve the traditional dichotomy between experts and laypersons, can be interpreted as reflexivity on an institutional level. The taking into account of the blurring of the distinction healthy/sick in professional practice indicates the cognitive level of the reflexivity criterion.

From a sociology of science perspective which focuses on the underlying rationalities of counselling and the decision-making process, reservations are certainly in order concerning the hypothesis of reflexivity. In today's reality the expert in fact no longer has the power to make decisions and issue directives. However, in the context of the interpretation presented here, the (undoubted) dissolution of asymmetrical interaction relationships in genetic counselling must be read differently than as a reference to the contours of a reflexive modernity. A larger degree of autonomy indeed signifies a loss of professional authority pretending to offer socially binding solutions to problems. This, however, does not amount to a loss of relevance for expert knowledge. The expert who sees himself as an impartial and client-oriented information provider, and whose decisions and demarcations are ultimately structured based on hegemonic concepts of normality, does not seem questionable; if anything, the opposite is the case. His knowledge, his terminology and his profession are instrumental in the prenatal debate about the phenomenon of disability. The problem awareness and reflection of laypersons cannot be separated from the sensitisation by the criteria and categories which are significantly influenced by medical expertise. Hence, the expert has the power to decide who and under what conditions is allowed to participate in the decision-making process and which terms will be used in that process.

From this perspective, reflexivity would require the possibility of dealing with the experts' interpretation schemes and definitions of relevance in a reflexive way to be structurally embedded in the context of pregnancy care, for example in the form of an institutionalisation of alternative forms of knowledge in the counselling process.

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tal testing for sex determination (GfH 1990).

[31] The expert practices mentioned cannot be equated with strategic intentional action. In fact, my analysis was guided by the assumption that certain practices and demarcations can be read ex post as functional for the legitimacy of professional authority.

6 References

Abels, Gabriele/Alfons Bora, 2004: *Demokratische Technikbewertung*. Bielefeld: transcript.

Beauchamp, Tom L./James F. Childress, 1994: *Principles of Biomedical Ethics*. New York: Oxford University Press.

Beck, Ulrich, 1986: *Risikogesellschaft – Auf dem Weg in eine andere Moderne*. Frankfurt/M.: Suhrkamp.

Beck, Ulrich, 1996: Wissen oder Nicht-Wissen? – Zwei Perspektiven "reflexiver Modernisierung". In: Ulrich Beck et al. (eds.), *Reflexive Modernisierung – Eine Kontroverse.* Frankfurt/M.: Suhrkamp, 289-315.

Beck, Ulrich/Wolfgang Bonß/Christoph Lau, 2001: Theorie reflexiver Modernisierung – Fragestellungen, Hypothesen, Forschungsprogramme. In: Ulrich Beck/Wolfgang Bonß (eds.), *Die Modernisierung der Moderne.* Frankfurt am Main: Suhrkamp, 11-59.

Beck, Ulrich/Wolfgang Bonß/Christoph Lau, 2004: Entgrenzung erzwingt Entscheidung: Was ist neu an der Theorie reflexiver Modernisierung? In: Ulrich Beck/Christoph Lau (eds.), *Entgrenzung und Entscheidung: Was ist neu an der Theorie reflexiver Modernisierung?* Frankfurt/M.: Suhrkamp, 13-62.

Böschen, Stefan, 2000: *Risikogenese. Prozesse gesellschaftlicher Gefahrenwahrnehmung: FCKW, Dioxin, DDT und Ökologische Chemie*. Opladen: Leske + Budrich.

Böschen, Stefan, 2002: Risikogenese – Metamorphosen von Wissen und Nichtwissen. In: *Soziale Welt* 53, 67-86.

Bogner, Alexander, 2004: Kritik der Life-Politics – zum Grenzziehungsdiskurs der Humangenetik. In: *Österreichische Zeitschrift für Soziologie* 29, 49-71.

Bosk, Charles L., 1992: *All God's Mistakes. Genetic Counseling in a Pediatric Hospital*. Chicago: The University of Chicago Press.

Braun, Kathrin, 2000: *Menschenwürde und Biomedizin – Zum philosophischen Diskurs der Bioethik*. Frankfurt/M.: Campus.

Bundesärztekammer (BÄK), 1998: Erklärung zum Schwangerschaftsabbruch nach Pränataldiagnostik. In: *Deutsches Ärzteblatt* 95, A-3013-3016.

Castells, Manuel, 1996: *The Rise of the Network Society. The Information Age: Economy, Society and Culture, Vol. I*. Oxford: Blackwell.

Charlesworth, Max, 1993: *Bioethics in a Liberal Society*. Cambridge: Cambridge University Press.

Collingridge, David, 1980: *The Social Control of Technology*. New York: St. Martin's Press.

Cunningham-Burley, Sarah/Anne Kerr, 1999: Defining the „social"– towards an understanding of scientific and medical discourses on the social aspects of the new human genetics. In: Peter Conrad/Jonathan Gabe (eds.), *Sociological Perspectives on the New Genetics.* Oxford: Blackwell, 149-170.

Deutsche Gesellschaft für Gynäkologie und Geburtshilfe (DGGG), 2003: Schwangerschaftsabbruch nach Pränataldiagnostik. München <abrufbar unter: www.dggg.de>.

Dressel, Kerstin, 2002: *BSE – The New Dimension of Uncertainty. The Cultural Politics of Science and Decision-Making*. Berlin: Sigma.

Friedrichsen, Gisela/Udo Ludwig, 1999: Scheußliches Problem. In: *Der Spiegel* Nr. 27, 34-35.

Funtowicz, Silvio/Jerome Ravetz, 1993: Science for the post-normal age. In: *Futures* 25, 739-755.

Gesellschaft für Humangenetik (GfH), 1990: Erklärung zur pränatalen Geschlechtsdiagnostik. In: *Medizinische Genetik* 2, 8.

Gesellschaft für Humangenetik (GfH), 1996: Positionspapier der Gesellschaft für Humangenetik. In: *Medizinische Genetik* 8, 125-131.

Giddens, Anthony, 1990: *The Consequences of Modernity*. Cambridge: Polity Press.

Giddens, Anthony, 1991: *Modernity and Self-Identity – Self and Society in the Late Modern Age*. Stanford/CA: Stanford University Press.

Gieryn, Thomas F., 1983: Boundary-work and the demarcation of science from non-science: Strains and interests in professional ideologies of scientists. In: *American Sociological Review* 48, 781-795.

Gieryn, Thomas F., 1995: Boundaries of Science. In: Sheila Jasanoff et al. (eds.), *Handbook of Science and Technology Studies.* Thousand Oaks: Sage, 393-443.

Harris, John, 1991: *The Value of Life. An Introduction to Medical Ethics*. London: Routledge.

Hennen, Leonhard/Thomas Petermann/Joachim J. Schmitt, 1996: *Genetische Diagnostik – Chancen und Risiken – Der Bericht des Büros für Technikfolgen-Abschätzung zur Genomanalyse*. Berlin: Sigma.

Hitzler, Ronald/Michaela Pfadenhauer, 1999: Reflexive Mediziner? Die Definition professioneller Kompetenz als standespolitisches Problem am Übergang zu einer "anderen" Moderne. In: Christoph Maeder/Claudine Burton-Jeangros/Mary Haour-Knipe (eds.), *Gesundheit, Medizin und Gesellschaft –*

Beiträge zur Soziologie der Gesundheit. Zürich: Seismo, 97-115.

Japp, Klaus P., 1997: Zur Beobachtung von Nichtwissen. In: *Soziale Systeme*, 289-312.

Japp, Klaus P., 1999: Die Unterscheidung von Nichtwissen. In: *TA-Datenbank-Nachrichten* 8, 25-32.

Japp, Klaus P., 2002a: Struktureffekte öffentlicher Risikokommunikation auf Regulierungsregime. Zur Funktion von Nichtwissen im BSE-Konflikt. In: Christoph Engel/Jost Halfmann/ Martin Schulte (eds.), *Wissen – Nichtwissen – Unsicheres Wissen.* Baden-Baden: Nomos, 35-74.

Japp, Klaus P., 2002b: Wie normal ist Nichtwissen? In: *Zeitschrift für Soziologie* 31, 435-439.

Joss, Simon/Sergio Bellucci (eds.), 2002: *Participatory Technology Assessment – European Perspectives*. London: University of Westminster Press.

Knorr Cetina, Karin, 1999: *Epistemic Cultures – How the Sciences Make Knowledge*. Cambridge, MA: Harvard University Press.

Kratzer, Nick, 2003: *Arbeitskraft in Entgrenzung*. Berlin: Sigma.

Latour, Bruno, 1993: *We Have Never Been Modern*. Cambridge, MA: Harvard University Press.

Latour, Bruno, 1999: *Pandora's Hope. Essays on the Reality of Science Studies*. Cambridge, MA: Harvard University Press.

Lemke, Thomas, 2004: *Veranlagung und Verantwortung. Genetische Diagnostik zwischen Selbstbestimmung und Schicksal*. Bielefeld: transcript.

Luhmann, Niklas, 1990: Der medizinische Code. In: Niklas Luhmann (ed.), *Soziologische Aufklärung 5. Konstruktivistische Perspektiven.* Opladen: Westdeutscher Verlag, 183-196.

Luhmann, Niklas, 1991: *Soziologie des Risikos*. Berlin: de Gruyter.

Luhmann, Niklas, 1992: Ökologie des Nichtwissens. In: Niklas Luhmann (ed.), *Beobachtungen der Moderne.* Opladen: Westdeutscher Verlag, 149-220.

Luhmann, Niklas, 1995: Die Soziologie des Wissens: Probleme ihrer theoretischen Konstruktion. In: Niklas Luhmann, *Gesellschaftsstruktur und Semantik – Studien zur Wissenssoziologie der modernen Gesellschaft.* Frankfurt/M.: Suhrkamp, 151-180.

May, Stefan/Markus Holzinger, 2003: *Autonomiekonflikte der Humangenetik – Professionssoziologische und professionsrechtliche Aspekte einer Theorie reflexiver Modernisierung*. Opladen: Leske + Budrich.

Merton, Robert K., 1987: Three Fragments from A Sociologist's Notebook: Establishing the Phenomenon, Specified Ignorance, and Strategic Research Materials. In: *Annual Review of Sociology* 13, 1-28.

Minssen, Heiner (ed.), 2000: *Begrenzte Entgrenzung*. Berlin: Sigma.

Nippert, Irmgard, 1991: History of Prenatal Genetic Diagnosis in the Federal Republic of Germany. In: Margaret Reid (ed.), *The Diffusion of Four Prenatal Screening Tests Across Europe.* London: King's Fund Centre, 49-69.

Nippert, Irmgard, 1999: Entwicklung der pränatalen Diagnostik. In: Gen-Ethisches Netzwerk/Gabriele Pichlhofer (eds.), *Grenzverschiebungen – Politische und ethische Aspekte der Fortpflanzungsmedizin.* Frankfurt/M.: Mabuse, 63-80.

Nowotny, Helga, 2005: Experten, Expertisen und imaginierte Laien. In: Alexander Bogner/Helge Torgersen (eds.), *Wozu Experten? Ambivalenzen der Beziehung von Wissenschaft und Politik.* Wiesbaden: VS, 33-44.

Powell, Walter W., 1991: Neither Market nor Hierarchy: Network Forms of Organization. In: Grahame Thompson/ Jennifer Frances/Rosalind Levacic/ Jeremy Mitchell (eds.), *Markets, Hierarchy and Networks.* London: Sage, 265–278.

Reif, Maria/Helmut Baitsch, 1986: *Genetische Beratung – Hilfestellung für eine selbstverantwortliche Entscheidung?* Berlin: Springer.

Rose, Nikolas (1998): *Inventing Our Selves. Psychology, Power and Personhood.* Cambridge University Press: Cambridge

Sauer, Dieter/Volker Döhl, 1997: Die Auflösung des Unternehmens? – Entwicklungstendenzen der Unternehmensreorganisation in den 90er Jahren. In: IfS/INIFES/ISF/SOFI (ed.), *Jahrbuch sozialwissenschaftliche Technikberichterstattung '96 – Schwerpunkt: Reorganisation.* Berlin: Sigma, 19-76.

Scheuch, Erwin K., 2003: Die Bedeutung des Zeitgeistes für die Medizin. In: *Soziale Welt* 54, 389-404.

Scholz, Christine, 1995: Biographie und molekulargenetische Diagnostik. In: Elisabeth Beck-Gernsheim (ed.), *Welche Gesundheit wollen wir?* Frankfurt/M., 33-72.

Singer, Peter, 1979: *Practical Ethics*. Cambridge: Cambridge University Press.

Sperber, Katharina, 2001: Selektion diesseits des Rubikons. In: *Frankfurter Rundschau* vom 15.6.2001.

Stehr, Nico, 2000: *Die Zerbrechlichkeit moderner Gesellschaften. Die Stagnation der Macht und die Chancen des Individuums*. Weilerswist: Velbrück.

Tooley, Michael, 1979: Decisions to Terminate Life and the Concept of

Person. In: John Ladd (ed.), *Ethical Issues Relating to Life and Death.* New York: Oxford University Press, 62-93.

van den Daele, Wolfgang, 1996: Objektives Wissen als politische Ressource. Experten und Gegenexperten im Diskurs. In: Wolfgang van den Daele/Friedhelm Neidhardt (eds.), *Kommunikation und Entscheidung. WZB Jahrbuch 1996.* Berlin: Sigma, 297-326.

Viehöver, Willy, 2005: Der Experte als Platzhalter und Interpret moderner Mythen: das Beispiel der Stammzelldebatte. In: Alexander Bogner/ Helge Torgersen (eds.), *Wozu Experten? Ambivalenzen der Beziehung von Wissenschaft und Politik.* Wiesbaden: VS, 149-171.

Viehöver, Willy/Robert Gugutzer/Reiner Keller/Christoph Lau, 2004: Vergesellschaftung der Natur – Naturalisierung der Gesellschaft. In: Ulrich Beck/ Christoph Lau (eds.), *Entgrenzung und Entscheidung: Was ist neu an der Theorie reflexiver Modernisierung?* Frankfurt/M.: Suhrkamp, 65-94.

von Kaisenberg, Constantin/Walter Jonat/ Hans-Jürgen Kaatsch, 2005: Spätinterruptio und Fetozid – das Kieler Modell. In: *Deutsches Ärzteblatt* 102, A133-A136.

Waldschmidt, Anne, 1996: *Das Subjekt in der Humangenetik – Expertendiskurse zu Programmatik und Konzeption der genetischen Beratung 1945-1990*. Münster: Westfälisches Dampfboot.

Wehling, Peter, 2003a: Das Recht auf Nichtwissen in der Humangenetik – ein "Irrläufer" in der Wissensgesellschaft? In: Jutta Allmendinger (ed.), *Entstaatlichung und soziale Sicherheit. Verhandlungen des 31. Kongresses der Deutschen Gesellschaft für Soziologie in Leipzig 2002.* Opladen: Leske + Budrich (CD-Rom).

Wehling, Peter, 2003b: Die Schattenseite der Verwissenschaftlichung. Wissenschaftliches Nichtwissen in der Wissensgesellschaft. In: Stefan Böschen/ Ingo Schulz-Schaeffer (eds.), *Wissenschaft in der Wissensgesellschaft.* Wiesbaden: Westdeutscher Verlag, 119-142.

Wehling, Peter, 2004: Weshalb weiß die Wissenschaft nicht, was sie nicht weiß? – Umrisse einer Soziologie des wissenschaftlichen Nichtwissens. In: Stefan Böschen/Peter Wehling (eds.), *Wissenschaft zwischen Folgenverantwortung und Nichtwissen. Aktuelle Perspektiven der Wissenschaftsforschung.* Wiesbaden: VS, 35-105.

Willke, Helmut, 2002: Dystopia – Studien zur Krisis des Wissens in der modernen Gesellschaft. Frankfurt/M.: Suhrkamp.

Wynne, Brian, 1992: Uncertainty and environmental learning. Reconceiving science and policy in the preventive paradigm. In: *Global Environmental Change* 2, 111-127.

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Intellectual Property, Communism and Contextuality

A non-essentialist exploration of German digital copyright and the public domain

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Abstract

This paper explores current changes in German copyright legislation in two fields in which the digitalisation of creative works has changed the relationship between commercial and non-profit activities: the music industry and scientific publishing. For years the music industry has been facing a decreasing demand due to Internet distribution and filesharing networks and a lock-in of traditional business models. Scientific work is confronted with a supply crisis of information. The resources of libraries, which traditionally used to mediate commercial and non-profit activities, are dwindling while the role of commercial databases and meta-information systems for academic reputation is gaining importance.

These processes are well known, but both the current public debate and theoretical analyses suffer from a certain essentialism: The problem of intellectual property is mostly seen as inherent to the characteristics of knowledge *goods* and knowledge production. Thus, the arena appears like a zero-sum game to both commercial actors and promoters of the public domain, in which commodified goods are subtracted from the public domain and vice versa. This paper applies a process-oriented and interactionist sociological perspective to the shifting relationship of markets and public spheres. Knowledge goods and intellectual property institutions thus are mutually constitutive. In establishing them, situated flows of knowledge and meaning are bracketed institutionally and technologically for a time. However, current changes in copyright legislation tend to privilege commercial exploitation and thus may end up establishing the very zero-sum configuration that so far has been challenged theoretically.

1 Introduction

In recent years, issues of intellectual property have moved out of the domain of legal specialists and professional authors and inventors. Teenagers using the Internet, farmers or software developers find themselves confronted with intellectual property claims and possible infringements. Public debates on patents for living organisms or software, on piracy and private copying reach the general press. With and through the regulation of intellectual property, knowledge societies negotiate the boundaries of markets and public spheres and seek ways of handling knowledge, culture and innovation – all of which are supposed to be key resources for economic success and social welfare.

This paper applies a sociological perspective to these processes of negotiation which is not limited to rational interests and property rights. From an interactionist and constructivist view, actors in these fields of negotiation do not just distribute resources but indeed constitute them as such. Neither do they just establish rules and resources (Giddens 1984), but configure entire ensembles out of practices of creating and consuming, roles of authors and audiences, and economic and social exchange relations, in which norms and values play as much a part as interests and strategies.[1] The institutions of intellectual property thus do not simply present an enabling and constraining framework for action. In this field they become a dynamic object of action, discourse, power and influence themselves.

While this view may be almost commonsensical to sociological approaches to knowledge and technology, this paper argues that both public debates and theoretical reflections on intellectual property and the public domain mostly restrict themselves to an essentialist view. The significance of the public domain and the need for copyright protection are ascribed to specific properties of knowledge *goods* and knowledge production. Thus, the intellectual property regime appears like a zero-sum game to companies interested in property rights and to promoters of the public domain, in which either intellectual "property is theft" or freely circulated digital goods are just stolen profit ("piracy").

In the perspective developed here, knowledge goods and intellectual property institutions will be seen as mutually constitutive, temporary results of an institutional/technical bracketing of situated flows of knowledge and meaning. However, the current changes of intellectual property governance with their privileging of markets and property rights, in combination with the likely strategies of commercial actors in the field, may end up implementing the very zero-sum configurations that players in the field evoke – with the added imbalance of a fortified property regime and an impoverished public domain.

This paper does not claim to be more than an exploratory study. It is part of a broader study on the boundaries of economic and organisational sociology in which the author seeks to address the question: how do companies, institutions and social norms and movements draw the boundaries of markets, private and public spheres; shape goods and services; and configure and challenge customer and other non-work roles in relevant arenas of knowledge societies (Holtgrewe 2005)?[2] The present analysis is based

[1] This theoretical outlook shares the perspective on process and the mutual constitution of institutions and actors with Werle's actor-centered institutionalism (Werle 1998). Due to its subject matter it focuses on a wider range of actors including social movements and civil society, and addresses both strategic action and normative and expressive orientations of actors in the field (cf. Döbert/van den Daele 2002).

[2] This paper began as a *Habilitation* talk at the Faculty of Social Science of Duis-

on a review of literature, an analysis of the recent media and public debate on copyright legislation in Germany, an analysis of relevant actors' websites and participation in workshops and conferences on intellectual property and public goods.

The paper first introduces the key concepts of the public domain (1.1) and of copyright (1.2). In the second section it discusses the theoretical concepts relevant to the subject: The economics of information goods (2.1), the modernist sociological concepts of the knowledge society in the Mertonian tradition, and the concept of the contextuality of knowledge (2.2). Section 3 analyses the contexts of music (3.1) and scientific publishing (3.2) through a modified value-added chain concept which includes non-profit activities of knowledge creation and absorption. Section 3.3 analyses recent changes in copyright law which are relevant to these empirical fields. The discussion and conclusion in section 4 first compares the configurations and path-dependencies for relevant actors in the empirical fields (4.1) and then draws conclusions for the politics of intellectual property and the public domain (4.2).

1.1 The public domain

The public domain emerges in the debates about copyright and its limitations as a somewhat diffuse and normative concept which is opposed to the establishment and extension of intellectual property rights. As a legal term, it means the status of a creative work which is not protected by copyright laws (in German: "Gemeinfreiheit")[3] and may be used, reproduced and distributed by anyone either because copyright has expired (e.g. 70 years after the death of the author in German and US copyright law), because it is generally exempt from copyright (e.g. government publications) or because the author has failed to establish copyright (Gasaway 2003, cf. Lessig 2001: 20). "Public domain" or open source/free software thus mostly is not literally in the public domain, but the copyright holder permits such use (or a specific range of possible uses) to anyone through the terms of the licence. In its more general use in debates on knowledge, the Internet and copyright, the public domain means the sphere of freely accessible knowledge and/or cultural goods that may be circulated, used and further developed by anyone. This is possibly put more precisely by terms such as the "creative common property" or, in a good German translation, the "Wissensallmende" (Grassmuck 2000). Behind these programmatic terms is the general idea that this common property is the "seedbed" for any production of creative work and innovation: producers of knowledge and cultural goods inevitably stand "on the shoulders of giants" or at least those of other creative people: "In the digital world, all the stuff protected by copyright law is in one sense the same: It all depends fundamentally upon a rich and diverse public domain." (Lessig 2001: 50)

1.2 Basic concepts of copyright: Institutionalising creativity

The chief institutions of intellectual property that grant property rights to inventors and authors of intellectual creations are

burg/Essen University in 2003. Other versions were presented as contributions to the 4th Austrian Conference of Technology Assessment on June 7th 2004 in Vienna and to the plenary session 1 on "Knowledge, Power and Inequality in Knowledge Society" conference of the German Sociological Association in October 2004 in Munich. I am grateful for the comments and ideas provided by the participants of these conferences and to Jens Aderhold, Virginia Doellgast, Andrea Fried, Christian Kerst, Manfred Moldaschl, Michael Nentwich, Peter Sanders, Karsten Weber and two anonymous reviewers. Of course the author remains responsible for all remaining misconceptions and imprecisions.

[3] http://de.wikipedia.org/wiki/Public_Domain, retrieved February 5th 2005.

- patents,
- copyright,
- copyright contract law,
- trademark protection,
- and trade secrets (Leadbeater 2001).

The following sections will focus on German copyright and after discussing the basic concepts, on copyright in digital spaces. German copyright protects "personal intellectual creations" ("persönliche geistige Schöpfungen", § 2 (2) UrhG), e.g. works in science, arts and literature. Notably, copyright in general does not protect ideas but their instantiation – nobody can claim copyright on the form of a sonnet or the method of narrative interviewing, for example. Copyright addresses both property rights and non-commodified claims. Different from US or British copyright, continental European copyright distinguishes between the author's personality rights and the rights of exploitation. Since authors' personality rights cannot be transferred, the author and her "intellectual and personal relations to the work and its use" (§ 11 UrhG) are not subject to commodification. Personality rights reserve the author's right to decide on publication and communication of the contents and assure her right both to be recognised as the author of the work and to prohibit distortions and impairments. In contrast, the rights of exploitation and use can be transferred, i.e. the rights of reproduction, distribution, exhibition and performance. Such rights can be simple or exclusive and may be limited spatially, temporally or with regard to content.

German copyright has so-called "barriers" ("Schranken") which regulate fair use. They permit the reproduction of works or parts of works for church, school or teaching use, the rendition for non-profit purposes or for the reporting of current events, citation and the making of private copies. Some of these uses are compensated through a fee on photocopiers, audio- and videocassettes. For specific media and technologies there is a range of special regulations.

This brief summary makes it obvious that copyright confers 'thinner' and more relational property rights than property in land, cars, computers etc. (but cf. Strathern 1999 on the culturally specific concepts of property). They cut certain modes of exploitation use and communication out of the general production of culture and knowledge. This point is also made by Bowrey and Rimmer:

"Copyright locates legal rights to cultural production within a system of interdependencies. It is not really the case that copyright creates two competing domains - private and public. There is no private 'domain' in a closed sense. The boundaries that exist are permeable. This is because ownership is determined by overlapping cultural limitations that express the realities of that copyrightable work's genesis, and enable similar relations with other cultural producers to the benefit of cultural production generally. For example, fair use, taking of insubstantial parts, taking ideas but not the expression, and limits to the duration of protection all interrupt the owner's 'domain'. There are no 'walls' around the copyrightable work in that property sense." (Bowrey/Rimmer 2002)

The barriers of copyright thus address such practices of use that are institutionally situated outside the market. With their focus on educational uses they support especially the production of new or future knowledge and the socialisation of future producers – an area in which markets tend to fail. Intellectual property and knowledge as a public good thus are interrelated rather than complementary.

Currently both copyright and patent law are being changed on the level of legislation, jurisdiction and practical implementation. The majority of these changes aim at

- a stronger protection of intellectual property,
- an extension into previously exempt areas,
- shifts between the domains of trademark, copyright and patent law,
- and a redistribution of functions between the state, the respective industries and technology.

They are triggered by

- international agreements (WIPO, TRIPS; GATT);
- EU directives harmonising intellectual property;
- and US-American law (cf. Kuhlen 2004).

The structural reasons for these changes can be found in changing modes of innovation: On the technological side, science, technology and even previously basic research are moving closer to actual and potential markets, and they are increasingly evaluated in terms of their commercial potential. In the cultural industries, a long process of mergers and acquisitions has continued. Media and distribution modes have multiplied, and the Internet has become a cheap but hard to control way of distributing and using digital goods.

In Germany, copyright law is being adapted to meet the requirements of the EU Copyright Directive 2001/29/EC on the "Harmonisation of certain aspects of copyright and related rights in the information society" in two steps. The first amendment became effective on September 13th, 2003, the second is currently under legislation. The new regulations will be discussed in section 3.3.

2 Economy and sociology of knowledge

2.1 The economic view of information goods

From an economic point of view, the current problem of intellectual property rights is tied to the characteristics of digital goods (Stehr 1994; 2001; Kuhlen 1995; Quah 1996, 2003; Cortright 2001; Hutter 2000, 2002). They are immaterial and non-rival – my enjoyment of a Nick Cave song or a lecture by Lawrence Lessig is not affected by others listening to the same song or lecture. The cost of producing digital goods is concentrated on the first instantiation. If cultural or knowledge goods become digital, the cost of reproduction and distribution gets very small. Cultural and knowledge goods are also generative (Moldaschl/ Diefenbach 2003) or recombinant (Quah 2003): Their use enhances their value since it is accompanied by communication. Knowledge generates new and emergent knowledge, and cultural production draws on previous cultural products and practices.

For all these reasons, markets for digital goods are likely to fail or to have severe limitations and 'leaks'. Traditionally, markets in knowledge goods have been based on the materialisations of these goods, and intellectual property rights regulate the rights to produce and distribute these materialisations: Books, vinyl records and CDs, journals or videocassettes are of course rival and material – but they still can be copied at low cost. Yet even such pre-digital markets have been complemented by other, non-profit modes of distributing knowledge and cultural goods: By public libraries, mass media, institutions of education and training, 'alternative' and communal cultural centres, and by interpersonal networks of friends taping audio cassettes or lending books. Notably all these distribution modes do not simply replace the market. They inform and

educate audiences and shape their competencies and tastes.

The establishment of intellectual property rights over knowledge and cultural products gives potential creators (or distributors) of knowledge goods an incentive to produce by assigning them a temporary monopoly over the reproduction and distribution of these goods – provided that it is chances of material gain which motivate producers. However, intellectual property governance is dilemmatic since on the other hand it limits the circulation of and the access to knowledge and cultural goods – which do not just provide education and entertainment but also form the basis for further creation of knowledge. If the knowledge good has been produced already, its maximal (free) distribution may maximise social welfare and enjoyment. On the other hand, if prices drop to zero, the risk of not making a profit or even recuperating the cost of creating a new knowledge good may be a disincentive for potential creators (Quah 2002: 8). As Richard A. Posner, former chief judge of the US court of appeals, phrased it: "Granting property rights in intellectual property increases the incentives to create such property, but the downside is that those rights can interfere with the creation of subsequent intellectual property." (Posner 2002: 12)

Intellectual property rights thus mediate the interests not just of producers, distributors and consumers of knowledge and cultural goods, but they also implicitly articulate past and future, actual and potential knowledge creation and circulation.

Digitalisation now de-materialises and de-spatialises knowledge and cultural goods thoroughly. Hence, the dilemma of intellectual property rights is widened. Access to cultural and knowledge goods is potentially global, given Internet access. The limitations or 'barriers' ("Schranken") of intellectual property rights that permit the non-profit and educational use ("fair use") of cultural goods no longer tie in with the previous temporal/spatial boundaries of these uses: Music may be distributed beyond circles of friends to millions of fellow enthusiasts, libraries may make and distribute digital copies of books and journals.

From a Marxist point of view, this is an instance of the capitalist contradiction between forces and relations of production. Brödner et al. pointed out this contradiction in 1981: the use of databases under capitalist conditions would lead to a monopolisation and commodification of information which in turn requires a strict regimentation of information exchange in order to maintain the value of these goods (Brödner et al. 1981: 148; cf. Boyle 2000). On the other hand, the expansion of human knowledge and socialisation of production increase the need for general access to information and render this monopolisation socially counterproductive (Brödner et al. 1981: 150).

2.2 Knowledge communism and contextuality

Sociological approaches address the subject of intellectual property in terms of the knowledge society. Approaches within modernisation theory emphasise the aspect of unfolding forces of production. Mertonian communism (Merton 1973) in science is expected to expand to other spheres of knowledge production. Stehr for example (1994; 2001) argues in this vein that the central character of knowledge as a force of production challenges the institutions of property and the economics of scarcity. He regards knowledge as a "capacity for action" so that in knowledge societies these capacities are redistributed, empowering small groups of actors.

In current debates on intellectual property and the public domain, left wing and libertarian views are more or less explicitly based on these modernist and Marxist concepts. In Germany

they are pursued for example by the Heinrich-Böll-Stiftung (2000, 2002, 2002a), the Green Party's think tank (cf. also Hofmann 2002; Kuhlen 2002 and other contributions in prokla 126; Lutterbeck 2002). In this view, the increasing relevance of knowledge is seen as a dialectical process between forces and relations of production, e.g. an empowerment of labour power versus the dominant institutions of property and power. André Gorz writes: "Transforming capital opens up the perspective towards a society of knowledge and culture but resists its development in order to retain its power." (Gorz 2002: 28, translation UH)

Currently among the authors representing digital neo-Marxism we find optimistic and pessimistic positions. Optimists (such as Gorz 2002; Maurizio Lazzarato 1998; or Paul Adler 2002, 2003) emphasise the possibilities of knowledge production beyond the market and its inherently free and cooperative logics. Pessimists describe an ongoing capitalist expansion and exploitation (Rifkin 2000) leading to observable social polarisation.

At this point, the perspective of the sociology of knowledge brings in a contrasting view. It emphasises the contextual, processual, potential and generative character of knowledge. Here the focus is on the practical and embedded utilisation of knowledge. Knowledge may be tacit or explicit (Polanyi 1985); individual or collective (Lam 2002); and all these forms and aspects of knowledge are articulated in its utilisation (e.g. Håkanson 2002; Malhotra 2003). Knowledge thus consists of heterogeneous ensembles of knowledge goods, of "knowledge machines" (Rammert 1999, 2003) of expertise embodied in human brains, of intersubjective sensemaking processes requiring attention, selection and understanding (Weick 1995), of communities and networks of practice (Lave/Wenger 1991) and so on.

This complexity, fluidity and heterogeneity of knowledge lead Michel Callon to argue against the Mertonian tradition, that even science does not produce essentially public goods. The very contextuality of knowledge makes it exclusive. Scientific statements by themselves are useless and only their utilisation and re-contextualisation render them effective and valuable: "Knowledge cannot be applied without being transformed." (Callon 1994: 405)

These transformations are costly: they require not just time and attention, but also the use and maintenance of complementary goods, i.e. they require information work (Kuhlen 1995). In this view, the appropriability and (non-)rivalry of knowledge goods are gradual: "Degrees of appropriability and of rivalry are the outcome of the strategic configurations of the relevant actors, of the investments they have already made or are thinking of making." (Callon 1994: 407)

Contrary to the view of knowledge economics which abstains from these processes, in order to become a knowledge good, knowledge needs to be explicated, decontextualised and packaged, and in order to be used, these goods need to be recontextualised, unpacked, and absorbed.

It is the explicated and materialised bodies of knowledge and culture, i.e. knowledge goods, that are the objects of intellectual property rights. Their (possible) market value may consist in their innovativeness, since new and innovative knowledge is scarce (Stehr 2001), but innovativeness is of course relational and needs to be compatible with existing knowledge. With regard to cultural goods, originality and distinctiveness may confer market value – but so may the conformity to current tastes and fashions.

Taking the sociology of knowledge perspective into account, both intellectual property and the public domain thus are not static institutions framing strategic action but are instantiated

and contextualised in and through processes of production, distribution and use of digital goods. Their legal regulation enables and restricts particular modes of production and use, but it does not determine them. Regulation becomes even less deterministic if boundaries between public goods and markets become permeable and if actors' options and perspectives multiply.

3 Producing, exploiting and using digital goods: popular music and scientific publishing

In the following sections we shall explore the connections between markets, non-profit distribution and use, economies and norms in two fields, music and scientific publishing. While music is one of the classical domains of cultural industries, science just as classically is thought to constitute a public domain – but in both cases the emerging picture is rather more patchworked.

3.1 Failing from previous successes: the music industry

The music industry, like the film industry, represents the traditionally commercial distribution of cultural goods. However, the anti-commercial critique of artistic avant-gardes and subcultures is just as traditionally connected to 'alternative' ideas of creatively connecting producers and audiences.

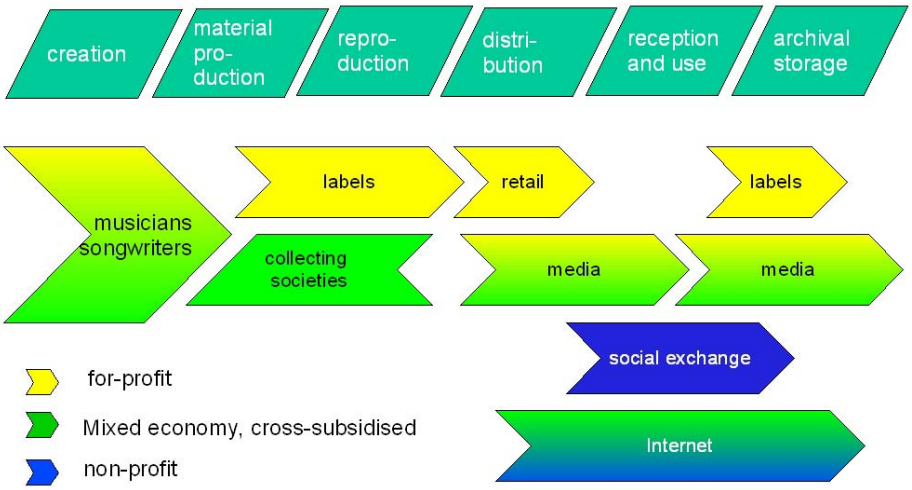
The industry is highly concentrated. After a long history of mergers and acquisitions, the last of which was Bertelsmann Music Group's merger with Sony Music in 2004, four major labels share roughly 80% of business volume and dominate the industry associations accordingly. Yet the global market is stagnating at about 40 billion US-$ since 1995, and turnover has decreased in recent years. Notably, this stagnation began before MP3.comz, Napster and other filesharing systems enabled the free distribution of digital music.

Traditionally, the music industry's business models have been tied to material cultural goods, such as vinyl records, CDs or DVDs. Other modes of distribution and consumption represent mixed economies: collecting societies (e.g. the German Verwertungsgemeinschaft Wort) control and licence certain performance rights and distribute the fees on copying machines and media. This involves certain redistributions and consolidations into lump sums which reduce transaction costs and sometimes privilege smaller producers over larger ones (Kretschmer 2005). Mass media distribute music without separate fees and generate and distribute audiences' attention. Users have their own ways of distributing and exchanging music: In school playgrounds and friendship networks people exchange copies and compilations and evaluate musicians.

The mixed-economic value-and-use-chain thus can be described as follows (see fig. 1): the creation of music, the writing, composing and performing happens mostly in relations which are not purely for-profit. Indeed, the majority of musicians subsidise their music from teaching or performing (Kretschmer 2005). The production and distribution of music are commercial activities – though they may be cross-financed as in media broadcasting. Users buy music, but a large share of distribution and consumption takes place outside of the economy and in social exchange (Haug/Weber 2002). The archiving of music is a mixed economy as well: broadcasting companies' archives are publicly subsidised, record companies' archives are private, and the Internet as a music archive is non-profit or cross-subsidised.

The technological possibilities of the Internet and the diffusion of advanced copying, data compression and distribution technologies to private households now endanger the music industry's business model as soon as music can be distributed digitally and users

Fig. 1: creation, exploitation and use of music



themselves are able to store it on diverse media. Users can thus multiply and globalise their practices of exchanging and listening to music. Creators also have gained options: the traditional countercultural scenario of "eliminating the middle man" and bringing audiences and artists into direct interaction has gained plausibility again (Dolfsma 2000; Kasaras 2002). However, beyond free distribution there is still a lack of models for business and culture which allow for the fair and viable compensation of artists.

Another question is how the actual functions of intermediaries such as the music industry and media are going to change: they provide capital and attract and distribute attention and reputation. It is conceivable that beside the grassroots activities of music enthusiasts, clubs and music magazines or radio stations will take over more or less commercial distributive activities. The question is whether this will take place with or without the traditional music industry.

In a study of the music industry based on interviews with experts from the major labels, collecting societies and industry associations between 1996 and 1999, these actors were still quite confident facing digitalisation and Internet distribution (Kretschmer et al. 1999; 2001). They felt safe in their central position and expected to be able to develop digital distribution slowly. They wanted to avoid a 'cannibalisation' of the music market with its comfortable profits, to maintain their control over 'content' and its distribution and to build platforms in co-operation with large Internet service providers (ISP). The Internet was seen as a "promotion medium and mail order machine" (managers quoted from Kretschmer et al. 2001: 427) – and this view has been dominant until today.

However, the advantages of a cheap distribution medium, in which the central investments in bandwidth and storage technologies were made by users and ISPs, were attractive to the industry as well. When Bertelsmann's Thomas Middelhoff bought up Napster, for example, the strategy was to turn the 37 million Napster users into paying customers for unspecified services – a vision which may have been overoptimistic in the new economy boom but must have looked commercially irresistible to a company like Bertelsmann whose global success had traditionally been based on exclusive distribution channels. The conversion of Napster failed due to the other major labels' risk aversion and to Napster's limited development capacities (cf. Röttgers 2003).

After Napster, the music industry chiefly reacted defensively to the new technological challenges along the lines of their 1990s strategies: file-sharing networks such as Napster and MP3.com were bought up, copyright claims are legally enforced against ISPs and recently also against individuals, legislation is intensively and successfully lobbied to expand copyright, media campaigns are launched and CDs are technically protected against copying. Digital rights management (DRM) is gaining significance, i.e. the development of copying protection for potentially all digital information goods. DRM makes it possible to differentiate the ways of using digital goods such as listening, transferring files to different devices, and storing files on a CD, and to separately account for these uses (see Lessig 2001; Halderman 2002). Beyond the technical-legal limitation of distribution, new business models develop rather slowly: in the US, Apple's iTunes presents a quite successful combination of hardware and music subscription. In Europe the existing download websites so far are suffering from high prices, small assortments and a lack of agreements with collecting societies. Record companies but also radio stations and specialists distributing sounds for mobile phones set their future hopes in subscription models and mobile services.[4]

All these models no longer try to succeed in existing markets. In order to achieve market success, companies try to strategically configure new ensembles of organisations, products, pricing arrangements, regulations and customers. However, these strategies are countered by users' distributed and hedonistic practices, and increasingly users, communication scientists, artists and new social movements are developing some public voice in copyright issues. They assert the right to "private copying" (www.privatkopie.net), demand access to a public domain of freely available music that should be funded through a "cultural flat fee" for unlimited copying (www.fairsharing.de), and develop new licencing models (www.creativecommons.org). In these debates about the boundaries of intellectual property and the public domain, not just innovation models but also norms of creativity, public spheres and the free circulation of knowledge come to the fore – although there is often some confusion between public goods and consumerism.

In this context it appears that the industry strategy that aims to fortify the traditional business model legally and technologically is likely to generate its own innovation blockade. Market actors dealing in licences, reputation or cultural images necessarily depend on cultural and institutional norms beyond the market. Although they seek to influence these and to increase their strategic options in the process, continuing strategies of the past and adapting the institutional environment to these strategies may lead to counterproductive lock-ins of technologically enforced property rights that are contrary to cultural innovation.

3.2 Scientific publishing

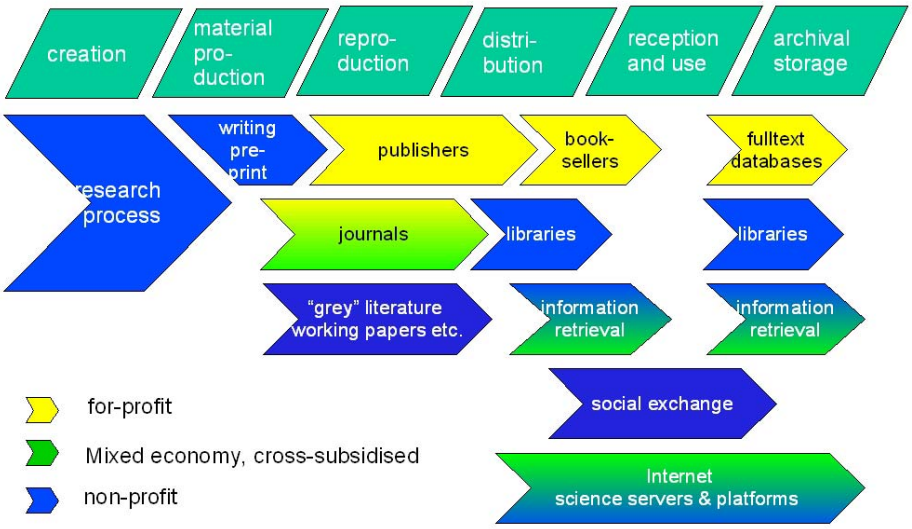
In contrast to the market-based music industry, science traditionally represents the ideal-typical public domain that Merton has described as "communist": "The substantive findings of science are a product of social collaboration and are assigned to the community. ... The scientist's claim to 'his' intellectual 'property' is limited to that of recognition and esteem." (Merton 1973: 273)

The roles and functions of performer and audience[5] within the social system

[4] www.heise.de/newsticker/meldung/55442

[5] In the wide sense of Stichweh's "Leistungs- und Publikumsrollen" (Stichweh 1988).

Fig. 2: creation, exploitation and use of scientific publications



of science are fluid and the close interaction desired by cultural avant-gardes is potentially real here. The exchange currency is academic reputation.

While theoretically scientific publishing thus creates and maintains a public domain, practically this domain is rather more patch-worked (Willinsky 2002). The creation of academic publications as knowledge goods is part of the research process, which is funded publicly to a large extent (fig. 2). The physical production of scientific publications is a commercial activity, although academics and their assistants have taken over the pre-press work. Distribution through booksellers is commercial, while distribution through public libraries is publicly funded, and libraries also take over archiving. Archiving is, however, complemented by the information retrieval that libraries and both commercial and publicly funded data bases provide.

The exploitation of digital content and meta-information, such as databases and the just-in-time access to full text, is the domain of commercial services (Becker/Bickel 1992), i.e. scientific publishers who have become comprehensive information providers. Libraries offer access to the databases they subscribe to, and their networks and document delivery services come to resemble commercial providers in their business models (Kuhlen 2001). On the other hand, commercial publishers often offer abstracts and tables of contents for free through the Internet in such a way that, again, free distribution of limited information generates attention and demand for digital goods.

Considering the scarce public funds for libraries, the business models of publishers and data base providers, and the sheer volume of scientific publications, the ensemble of non-profit production and information provision through libraries on the one hand, and commercial duplication, distribution and value-added services on the other, has fallen into the so-called 'journal crisis'. In Germany, from 1991 to 1997 the funds of university libraries have increased by 1.3% per year while the prices for journals in the humanities have been raised by 27% and in the sciences by 77% (Nentwich 2001: 24).

The sustainability of this institutional arrangement becomes more questionable considering that the actual authors of scientific publications have hardly any share in the profits that accrue from the commodification of their production. They confer copyright to publishers, invest work into pre-press preparation, and may even subsidise publication (in the case of books in Germany). In return, "universities

need to devote ever larger shares of their library budgets to buying back their faculty's material previously given to the publishers" (Nentwich 2001: 22). For these, especially the large ones, this business is rather profitable: Elsevier Science&Medical in 2003 reported 2002 million € of business volume and 677 million € operating profit.[6]

For these reasons, the division between commercial and non-profit activities is likely to change. Print or print-and-digital publishing of traditional journals are supplemented by document servers and disciplinary internet platforms. Academics and research institutions use the Internet in combination with search engines to make working papers or published articles globally accessible in ways that bring formalised scientific communication closer to the informal one of conferences and talk. These practices differ along the lines of the communication and publishing habits of disciplines and communities. The contextuality and half-life periods of scientific results and the relative significance of conferences versus journals play a part here (Nentwich 2003).

Currently, a range of library networks, professional associations and grassroots initiatives are working on open archives,[7] standards for electronic publishing and on rules for bringing published work back into the public domain (Sietmann 2002). In Germany, the DFG (German Research Foundation) and the BMBF (Federal Ministry for Education and Research) fund the development of public science platforms, pre-print-servers and decentralised forums (Wissenschaftsrat 2001; BMBF 2002). The DFG-funded project GAP (German Academic Publishers) is developing a platform for electronic journals and book publication. Krause and Schmiede (2004) give an overview of German developments in the social sciences.

For these reasons, Michael Nentwich (2003) already sees the variety of initiatives and projects as indicative of a phase 3 of re-de-commodified scientific publishing after the phase of the public domain and the phase of commodification. I suppose that, at least in some disciplines, the path-dependency of the traditional structures may be rather stronger. There is no reason why the mechanisms of peer-review should not be transferable to electronic and openly accessible media. Yet, currently the distribution of academic reputation is tied to established journals and hence, commodified distribution. The generation of strategically important meta-information such as the measuring of impact factors and ranking of these journals is largely dominated by commercial companies. Even an increase of this path-dependency is likely if academic evaluation mechanisms and indicators (Hornbostel 1997) diffuse in such ways that they give additional weight to the "old" agencies of reputation.

3.3 Market and technology in the information society – recent changes in copyright

The current amendments to copyright law in Germany as elsewhere aim at a fortification and extension of intellectual property rights, and they tend to assimilate new technology to established forms of distribution. The central regulations for the fields analysed here are private copying, technical copying protection and the so-called "science barrier", i.e. the rules of fair scientific use.

In general, in spite of all the negotiations and compromises in the process

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[6] www.reedelsevier.com/media/powerpoint/m/1/FINALpresentationforwebsite.pdf

[7] For physics, mathematics and computer science, there is the pre-print server www.arxiv.org in Los Alamos (Grötschel 2002). www.openarchives.org has developed a standard for open archives, the Budapest open Access Initiative (www.soros.org/openaccess) promotes free access to academic publications on the Internet.

of legislation, the amendments follow mostly the interest and strategies of large commercial actors and thus prescribe the predominance of markets and property rights as opposed to an expansion of the public domain. However, some formulations leave a range of ambiguities to jurisdiction and to everyday practice.

The regulation of private copying allows limited numbers of reproductions for non-commercial purposes. Such reproductions are generally legal, but with a view to file-sharing networks one exception has been introduced: copies are legal "unless an obviously illegally produced master copy is used for reproduction"[8] (§ 53 (1), sentence 1 UrhG). Even for legal copies, "effective" (§ 95a) technological protection measures must not be circumvented. Devices to avoid or circumvent copy protection are outlawed, i.e. they may neither be used nor distributed.

Here, the technological defense against copyright infringements or more generally, against uses that are contrary to the will of the copyright holder, gains legal protection. This means that law is not simply replaced by code, as Lawrence Lessig stated (1999), but the law protects technological copy protection. Intentionally or unintentionally, it privileges those future business models that enhance the logic of increased monopolisation and control of consumers as described by Brödner et al. (1981) or Boyle (2000). For example, Digital Rights Management systems enable a division of uses which may be paid for differentially ("pay-per-use", with different fees for listening to music, recording it, or transferring it to other devices), and in order to implement this, they need to control users tightly. On the other hand, the law's formulations of "obviously" illegal copies and "effective" protection measures are legally diffuse and leave the actual evaluation of up- and downloading or copying to users and the courts. Consequently, users' actual obligations to check the legality of master copies are controversial. Well aware of these imprecisions, both associations of culture industries and the Ministry of Justice seek to influence users' interpretations through public media campaigns. The code and the law (Lessig) are surrounded and in fact socially implemented through public discourses and images that are shaped by the actors in the field. The film industry (www.hartabergerecht.de) symbolically presents downloading as a criminal activity (and in fact overstates the legal sanctions), while the ministry (www.kopien-brauchen-originale.de) draws on everyday transpositions of icons of popular culture to claim that copies require originals.

In the field of science, a new fair-use rule has been established in § 52a UrhG, which, however, is set to expire by the end of 2006. It permits making small parts of a published work, small works or single newspaper articles available for teaching and recently also for research purposes. The public to whom such material is made available is, however, restricted to a delimited circle of researchers or students, i.e. a technologically circumscribed user group, and fees need to be paid to collecting societies.

In the second legislative package (BMJ 2004) this is made more concrete and the previous copyright barriers are drawn tighter. Here, a range of the technological possibilities of digital distribution is reserved for commercial distributors. If a library has digital works, these may only be read electronically inside the respective library, and not in more copies than the library has paid for. Electronic document delivery services may only deliver journal articles or parts of works by mail, fax or as a graphic file, i.e. not as a text file which can easily be processed further. Such delivery is permitted only if "the articles or small parts of works cannot

[8] "sofern nicht zur Vervielfältigung eine offensichtlich rechtswidrig hergestellte Vorlage verwendet wird"

be acquired by members of the public at times and locations of their choice by a contractual arrangement" (BMJ 2004: § 53a (1), sentence 2, translation UH). This privileges the document supply by commercial databases over the supply through libraries.

Academic associations have voiced their concern over drastic cost increases and increasing inequality in the provision of scientific information.[9] For libraries, this implies that their function in the provision and archival storage of information tends to be restricted to a basic supply, which legally transfers the physical limitations of paper copies to electronic information. In the use of new technology, the market is privileged over the public sector – while on the other hand, the state funds electronic public domains, open archives and electronic publishing.

4 Discussion and conclusions

4.1 Digital music and digital science

If we compare the relationship between markets and non-market distribution in the fields of music and science, the technological possibilities have been used in the contrary directions of commodification and decommodification. In the field of music, users in alliance with the IT industry have quickly integrated the options of digitally obtaining, distributing and playing music into cultural everyday practices. For a long time the music industry has had little success in attempting to integrate possible value added into their business models, and is now trying to legally enforce and technologically fortify their intellectual property rights. Other players such as IT companies (e.g. Apple) or specialist start-ups that distribute, for example, music for mobile phones (Jamba) have been more successful in innovating products and services and in shaping consumers' practices of music reception. For the music industry, however, the empirical relationship of intellectual property and the public domain and the perception of that relationship by relevant actors takes the shape of a zero-sum game: Gnutella *or* DRM, free distribution *or* commodification.

In science, large commercial publishers have been able to realise digital value-added from an early point in time, and scientific databases have been developed rather earlier than the Internet. Actors from the fields of science and public libraries have only recently begun to re-emphasise the norms and self-descriptions of a public domain, and to develop its technological foundations. Here we find mixed and heterogeneous economies and practices of use.

The uses of digital goods and the institutions of intellectual property thus are developing in contradictory ways and in close interaction with the norms, practices, strategies and path-dependencies in their respective fields. Consequently, the music industry faces a crisis of demand and science a crisis of supply in their respective digital goods.

But why is it that large and global academic publishers have been able to position themselves so much more successfully in their market of digital goods than the major music industry labels? Or: why have computer users, teenagers and students been able to implement faster and more economical modes of distributing digital goods in their cultural everyday practices than professional knowledge workers, who are also normatively committed to the public domain?

From different theoretical points of view, there are different reasons: looking at users' incentives, the music market with its fairly expensive CDs gave consumers a considerable incentive to shift to free music distribution, while in publicly-funded science users do not pay the full price for their in-

[9] www.heise.de/newsticker/meldung/51961.

formation supply. On the demand side, the information work and attention required to absorb music are considerably less than for reading scientific publications. Culturally and technologically, the omnipresence of music has been extended from public spaces to individual media devices, while scientific work is mostly situated in professional research contexts, though these tend to de-spatialise. In terms of innovation theory, timing is significant: the music industry appears to be suffering from its previous successes in digitalising music and realising high CD prices. Scientific publishers were able to establish value-added services on proprietary networks before the Internet offered an alternative.

This comparison of widely contrasting fields looks temptingly deconstructive with regard to academic self-images. Indeed, in science, path-dependencies and possible lock-ins are found in the non-profit sphere. When the academic distribution of reputation became tied to commercial patterns of distribution, academics relied on libraries as mediators between both sides, which could be expected to maintain a Mertonian public domain. With the journal and library crisis, this public domain turns into an *illusio* in the sense of Bourdieu (1998: 110): by relying on the institutionalised self-description of science as a public domain, the economic and social prerequisites of this domain and its maintenance moved out of focus as well as the existing exclusionary mechanisms. Academics disinterestedly took access to their own means of production for granted. In the author's view, the development of open access mechanisms and platforms could also do with some more institutional imagination. While a transfer of peer-review mechanisms will be indispensable in an era of wide-ranging performance appraisal, its limitations (cf. Hirschauer 2004) suggest that there is room for experimentation with diverse, more transparent and open forms of evaluation.

However, this comparative analysis gives merely a momentary picture. Considering the wide variety of digital initiatives in the sciences and humanities, it is quite possible that academic publishers still will be "napsterised" (Kuhlen 2002; cf. Nentwich 2003). At any rate, we have to expect the emergence of mixed economies and technologically/socially/culturally hybrid modes of use and practice.

Actors intending to profit from digital goods would be well advised not to concentrate on the legal and technological enforcement of intellectual property rights. More auspicious strategies would be to learn to cope with fluid boundaries and leaks between markets and public domains, to think about intelligent hybrids and modes of adding value and supporting creative practice and use.

4.2 Conclusions for copyright and public domain politics

These analyses of institutional fields have made clear that knowledge bases, digital goods, public domains and commodification processes are so heterogeneous that they cannot be described as either a one-way process of commodification or as an unfolding of the productive forces of the knowledge society. As Stehr argues, an expansion of individuals' and small groups' capacity for creative action has been observed: it is possible to extend the social exchange of cultural goods and knowledge, as well as the enjoyment of music and professional communication. This has turned out to be temporarily easier for everyday consumption cultures than for scientific communities. The development of copyright, however, does not move in the direction of an extension of free and context-unspecific access to digital goods.

Although copyright does not draw simple boundaries between property rights and the public domain but governs their interrelation, it tends to enclose property rights and contexts of use rather than opening them up. This

is obvious with the legal privilege for copy protection and commercial document delivery. With the fair scientific use rule ("Wissenschaftsschranke") a not-quite-public domain is recognised in a field where economically relevant contributions to innovation are expected, in universities and research institutions. Users in this domain are to be technically configured as members of these organisations. If, however, the boundaries of the science system become more permeable to other social systems or contexts, if sciences and their applications move closer together, and if such processes and arenas are not to be reduced to markets, a legal delimitation of scientific audiences and discourses appears counterproductive.

While technically, the new copyright law requires libraries to restrict their information supply to paper-analogous forms of distribution, scientific communities are required organizationally to restrict their audiences to formalized membership roles.

With the expansion and legal-technical fortification of intellectual property rights in the heterogeneous fields of knowledge and cultural production, specific modes of digital goods production and specific powerful actors' strategies are privileged over others: commercial production that tends to address existing expectations and reception modes of its market, small-scale control of customers and users, passive consumption, secondary and multiple exploitation, and the concentration of those content providers that are able to implement such strategies. These actors may expect increasing returns, which lead to monopolisation, path-dependency and lock-in, i.e. to an overdetermined convergence, homogenisation and ultra-stabilisation of existing technologies, contents and cultures (Callon 1994; Boyle 2000; Lessig 2001). Powerful actors who are further empowered in this way are quite capable of driving these processes by themselves, to increase favourable path-dependencies and extend their monopolies into the future.

The changing copyright regime thus fails to support and even endangers avant-gardist, hybrid and everyday practices of producing and using cultural and knowledge goods. These practices depend upon social exchanges beyond the market and are situated in between the delimited social spheres of science, culture and technology. Through the strategies pursued by commercial producers and exploiters of digital goods and through the short-termism, side-effects and unintended consequences of these strategies, the expansion of intellectual property rights may thus end up creating the very zero-sum situations between intellectual property and the public domain that we have challenged theoretically.

On the other hand, when copyright issues first emerged, a network of NGO and social movement actors, academics and technologists has developed, which we might term a digital civil society (cf. Kuhlen 2004) defending *the* public domain. For these, the public domain in its very non-specificity presents a useful normative focus to address the non-market prerequisites of knowledge and culture: their creation and circulation. It also presents a *Leitbild t*o develop and implement institutional and social innovations: licences and models for distribution and use of digital goods that seek to balance and ally authors' and audiences' interests and norms in new ways. From an evolutionary perspective on innovation, cultivating public spaces beyond markets means maintaining higher social variability and seedbeds of potential and alternative innovations (cf. Rammert 1997).

However, the experience of digital science based on the Mertonian view contains a warning lesson for promoters of the public domain: a normative over-commitment to the public domain as a generally good idea may end

up underrating the heterogeneous and also unequal practices and contexts in which digital goods are created and used.[10] Attention to context-specific passions and interests and to the dynamics of inclusion and exclusion in the respective arenas of action will be conducive to a view that understands the public domain as a token for variability, open access and reflexive creativity.

5 References[11]

Adler, Paul, 2002: Critical in the Name of Whom and What? In: *Organization* 9, 387 - 395.

Adler, Paul, 2003: Beyond "Hacker Idiocy": The Socialization of Software Development. Paper contributed to Critical Management Studies Conference, Lancaster, July 7-9. Lancaster.

Becker, Jörg/Susanne Bickel, 1992: *Datenbanken und Macht.* Opladen: Westdeutscher Verlag.

BMBF, 2002: Information vernetzen – Wissen aktivieren. Strategisches Positionspapier. Berlin (BMBF)

BMJ, 2004: Referentenentwurf für ein Zweites Gesetz zur Regelung des Urheberrechts in der Informationsgesellschaft. Fassung vom 27. 09. 2004. <www.bmj.bund.de/media/archive/760.pdf>

Bourdieu, Pierre, 1998: *Homo academicus*. Frankfurt/Main: Suhrkamp.

Bowrey, Kathy/Matthew Rimmer, 2002: Rip,mix, burn: The politics of peer to peer and copright law. In: *First Monday* 7, No 8. <www.firstmonday.org/issues/issue7_8/bowrey/index.html>

Boyle, James, 2000: Cruel, Mean or Lavish? Economic Analysis, Price Discrimination and Digital Intellectual Property. In: *Vanderbilt Law Review* 534, 2007 – 2039. <law.vanderbilt.edu/lawreview/vol536/boyle.pdf>

Brödner, Peter/Detlef Krüger/Bernd Senf, 1981: *Der programmierte Kopf. Eine Sozialgeschichte der Datenverarbeitung*. Berlin: Wagenbach.

Callon, Michel, 1994: Is Science a Public Good? In: *Science, Technology and Human Values* 19, 395 – 424.

Cortright, Joseph, 2001: *New growth theory, technology and learning: A practitioner's guide.* Reviews of economic development literature and practice No. 4. Portland (Impresa). <www.impresaconsulting.com/cortright_ngt.pdf>

Döbert, Rainer/Wolfgang van den Daele, 2002: Wessen Gemeinwohl ist mit wie viel Matthäus-Effekt vereinbar? Zur globalen Neuordnung der "Rechte des geistigen Eigentums". In: Schuppert, Gunnar Folke/Friedhelm Neidhardt (eds.), *Gemeinwohl – auf der. Suche nach Substanz. WZB-Jahrbuch 2002.* Berlin: sigma, 199 – 218.

Dolfsma, Wilfred, 2000: How will the music industry weather the globalization storm? In: *First Monday* 5, No 5. www.firstmonday.org/issues/issue5_5/dolfsma/index.html.

Gasaway, Lolly, 2003: When U. S. works pass into the public domain. University of Noth Carolina Task Force on Intellectual Property. <www.unc.edu/~unclng/public-.htm>

Giddens, Anthony, 1984: *The Constitution of Society*. Cambridge: Polity

Gorz, André, 2002: Welches Wissen? Welche Gesellschaft? In: Heinrich-Böll-Stiftung (ed.), *Gut zu wissen. Links zur Wissensgesellschaft.* Münster: Westfälisches Dampfboot, 14 – 35.

Grassmuck, Volker, 2000: *Die Wissensallmende.* <mikro.org/Events/OS/interface5/wissens-almende.html>

Grötschel, Martin, 2002: Die Offene Bibliothek: Mathematiker und das Urheberrecht. In: Heinrich-Böll-Stiftung (ed.), *Digitales Urheberrecht. Zwischen ‚Information Sharing' und ‚Information Control' – Spielräume für das öffentliche Interesse an Wissen?* Dokumentation einer Tagung der Heinrich-Böll-Stiftung am 26. April 2002 in Berlin. Berlin: Heinrich-Böll-Stiftung, 31 – 33.

Håkanson, Lars, 2002: *Creating Knowledge - The Power and Logic of Articulation. (What the Fuss is All About).* Paper prepared for the 2002 LINK Conference, November, 1-2, 2002. <www.cbs.dk/departments/int/link2002/papers/Hakanson.doc>

Halderman, J. A., 2002: *Evaluating New Copy-Prevention Techniques for Audio CDs.* Paper presented to DRM 2002/2002 ACM Workshop on Digital Rights Management. <http://crypto.stanford.edu/DRM2002/halderman_drm2002_pp.ps>

[10] The author has raised an analogous argument regarding open source/free software, cf. Holtgrewe 2004.

[11] A reference list with active links can be found at www.sti-studies.de.

Haug, Sonja/Karsten Weber, 2002: *Kaufen, Tauschen, Teilen : Musik im Internet*. Frankfurt/Main: Peter Lang

Heinrich-Böll-Stiftung (ed.), 2000: *Wem gehört das Wissen? Geistiges Eigentum in Zeiten des Internet.* Dokumentation einer Tagung der Heinrich-Böll-Stiftung am 20./21. Oktober 2000 in Berlin. Berlin: Heinrich-Böll-Stiftung.

Heinrich-Böll-Stiftung (ed.), 2002: *Gut zu wissen. Links zur Wissensgesellschaft.* Münster: Westfälisches Dampfboot.

Heinrich-Böll-Stiftung (ed.), 2002a: *Digitales Urheberrecht. Zwischen ‚Information Sharing' und ‚Information Control' – Spielräume für das öffentliche Interesse an Wissen?* Dokumentation einer Tagung der Heinrich-Böll-Stiftung am 26. April 2002 in Berlin. Berlin: Heinrich-Böll-Stiftung.

Hirschauer, Stefan 2004: Peer Review Verfahren auf dem Prüfstand: Zum Soziologiedefizit der Wissenschaftsevaluation. In: *Zeitschrift für Soziologie* 33, 62-83.

Hofmann, Jeannette, 2002: "Weisheit, Wahrheit und Witz". Über die Personalisierung eines Allgemeinguts. In: *Prokla 126*, 126 – 148.

Holtgrewe, Ursula, 2004: Heterogene Ingenieure – Open Source und Freie Software zwischen technischer und sozialer Innovation. In: Gehring, Robert A./Bernd Lutterbeck (eds.), *Open Source Jahrbuch 2004. Zwischen Softwareentwicklung und Gesellschaftsmodell*. Berlin: Lehmanns Media, 339-351. <www.think-ahead.org>

Holtgrewe, Ursula, 2005: Kunden und Dienstleistungsorganisationen – ein Blick in die organisationssoziologische Werkzeugkiste. In: Jacobsen, Heike/ Stephan Voswinkel (eds.), *Der Kunde in der Dienstleistung*. Wiesbaden: VS.

Hornbostel, Stefan, 1997: *Wissenschaftsindikatoren. Bewertungen in der Wissenschaft.* Opladen: Westdeutscher Verlag.

Hutter, Michael, 2000: The Commercialization of the Internet. A Progress Report. In: Engel, Christoph/Ken Keller (eds.), *Understanding the Impact of Global Networks on Local, Social, Political and Cultural Values.* Baden-Baden: Nomos, 73 – 92.

Huttter, Michael, 2002: *The impact of digitization and internet on the culture sector.* Wittener Diskussionspapiere Nr. 105. Witten-Herdecke: Fakultät für Wirtschaftswissenschaften.

Kasaras, Kostas, 2002: Music in the age of free distribution: MP3 and society. In: *First Monday* 7, No 1. <www.firstmonday.org/issues/issue7_1/kasaras/index.html>

Krause, Jürgen/Rudi Schmiede, 2004: Auf dem Weg zu einem Fachportal Sozialwissenschaften. In: *Soziologie* 33: 22-38.

Kretschmer, Martin, 2005: Artists' earnings and copyright: A review of British and German music industry data in the context of digital technologies. In: *First Monday* 10, No 1. <www.firstmonday.org/issues/issue10_1/kretschmer/index.html>

Kretschmer, Martin/George Michael Klimis/Roger Wallis, 1999: The Changing Location of Intellectual Property Right in Music: A Study of Music Publishers, Collecting Societies and Media Conglomerates. In: *Prometheus* 17, 163 – 186.

Kretschmer, Martin/George Michael Klimis/ Roger Wallis, 2001: Music in electronic markets. In: *new media & society* 3, 417 – 441.

Kuhlen, Rainer, 1995: *Informationsmarkt. Chancen und Risiken der Kommerzialisierung von Wissen.* Konstanz: UVK.

Kuhlen, Rainer, 2001: *Wie viel Virtualität soll es denn sein? Zu einigen Umschichtungen auf den Wissensmärkten mit Konsequenzen für die Informationsversorgung und Wissensbereitstellung durch Bibliotheken*. 3rd Symposium of the ICICOM, Frankfurt Book Fair 7. – 8. Oktober 2001. Konstanz: unpublished.

Kuhlen, Rainer, 2002: Napsterisierung und Venterisierung. Bausteine zu einer politischen Ökonomie des Wissens. In: *Prokla* 126, 57 – 88.

Kuhlen, Rainer, 2004: *Wem gehören Wissen und Information? Gedanken zu einer politischen Ökonomie (und Ökologie) des Wissens.* Beitrag zum Semesterkolloquium der Fakultät für Informatik an der TU Karlsruhe am 9. Februar 2004. <www.inf-wiss.uni-konstanz.de/People/RK/Vortraege04-Web/vortrag_informatik090204.pdf>

Lam, Alice, 2002: Alternative Societal Models of Learning and Innovation in the Knowledge Economy. In: *International Social Science Journal* 171, 67-82.

Lave, Jean/Etienne Wenger, 1991: *Situated learning - Legitimate Peripheral Participation.* Cambridge: Cambridge UP.

Lazzarato, Maurizio, 1998: Immaterielle Arbeit. Gesellschaftliche Tätigkeit unter den Bedingungen des Postfordismus. In: Negri, Toni/Maurizio Lazzarato/ Paolo Virno (eds.), *Umherschweifende Produzenten. Immaterielle Arbeit und Subversion*. Berlin: id-Verlag, 39 - 52.

Leadbeater, Charles, 2001: How should knowledge be owned? In: Nonaka, Ikujiro/David Teece (eds.), *Managing Industrial Knowledge. Creation, Transfer*

and Utilization. London: Sage, 170 – 181.

Lessig, Lawrence, 1999: *Code and other laws of cyberspace.* New York: Basic Books.

Lessig, Lawrence, 2001: *The future of ideas. The fate of the commons in a connected world.* New York : Random House.

Lutterbeck, Bernd, 2002: Die Wissensgesellschaft bauen! In: Bizer, Johann/ Bernd Lutterbeck/Joachim Rieß (eds.), *Umbruch von Regelungssystemen in der Informationsgesellschaft. Freundesgabe für Alfred Büllesbach*, 23 – 38. <www.alfred-buellesbach.de/PDF/ Freundesgabe.pdf>

Malhotra, Namrata, 2003: The Nature of Knowledge and the Entry Mode Decision. In: *Organization Studies* 24, 935-959.

Merton, Robert K., 1973: The Normative Structure of Science. In: Storer, N.W. (ed.), *The Sociology of Science*. Chicago: University of Chicago Press, 267-278.

Moldaschl, Manfred/Thomas Diefenbach, 2003: Regeln und Ressourcen. Zum Verhältnis von Institutionen- und Ressourcentheorien. In: Maurer, Andrea/Michael Schmid/Martin Held (eds.), Ökonomischer und sozialer Insttutionalismus – Chancen einer interdisziplinären Annäherung? Marburg : Metropolis, 139-162.

Nentwich, Michael, 2001: (Re-)(De-)Commidification in Academic Knowledge Distribuion? In: *Science Studies* 14, 21 – 42.

Nentwich, Michael, 2003: *Cyberscience. Research in the Age of the Internet.* Vienna: Austrian Academy of Sciences Press.

Polanyi, Michael, 1985: *Implizites Wissen.* Frankfurt/Main : suhrkamp.

Posner, Richard A., 2002: The law and economics of intellectual property. In: *Daedalus* Spring 2002, 5 – 12. <www.daedalus.amacd.org/issues/spring200/posner.pdf>

Quah, Danny, 1996: *The Invisible Hand and the Weightless Economy.* CEP occasional paper no. 12. London: Centre for Economic Performance. <http://cep.lse.ac.uk/pubs/download/occasional/OP012.pdf>

Quah, Danny, 2002: *Matching Demand and Supply in a Weightless Economy: Market-Driven Creativity With and Without IPRs.* CEP discussion paper CEPDP0534. London: Centre for Economic Performance. <http://cep.lse.ac.uk/pubs/download/DP0534.pdf>

Quah, Danny, 2003: *Digital Goods and the New Economy*. CEP discussion paper CEPDP0563. London: Centre for Economic Performance. <http://cep.lse.ac.uk/pubs/download/dp0563.pdf>

Rammert, Werner, 1997: Innovation im Netz. Neue Zeiten für technische Innovationen: heterogen verteilt und interaktiv vernetzt. In: *Soziale Welt* 48, 397 – 416.

Rammert, Werner, 1999: *Produktion von und mit "Wissensmaschinen". Situationen sozialen Wandels hin zur "Wissensgesellschaft"*. In: Konrad, Wildfried/ Wilhelm Schumm (eds.), Wissen und Arbeit. Neue Konturen von Wissensarbeit. Münster:Westfälisches Dampfboot, 40 - 57.

Rammert, Werner, 2003: Zwei Paradoxien einer innovationsorientierten Wissenspolitik: die Verknüpfung heterogenen und die Verwertung impliziten Wissens. In: *Soziale Welt* 54, 483-508.

Rifkin, Jeremy, 2000: *Access. Das Verschwinden des Eigentums.* Frankfurt/ Main: Campus.

Röttgers, Janko, 2003: *Mix, Burn & R.I.P. - Das Ende der Musikindustrie.* Heidelberg: dpunkt.

Sietmann, Richard, 2002: Ein Netz im Netz der Netze. Wissenschaftlicher Informationsaustausch im Zeitalter des Internet. In: *c't* 18/2002, 80-84.

Stehr, Nico, 1994: *Knowledge Societies. The Transformation of Labour, Property and Knowledge in Contemporary Society.* London: Sage.

Stehr, Nico, 2001: *Wissen und Wirtschaften. Die gesellschaftlichen Grundlagen der modernen Ökonomie.* Frankfurt/Main: Suhrkamp.

Stichweh, Rudolf, 1988: Inklusion in Funktionssysteme der modernen Gesellschaft. In: Mayntz, Renate (ed.), *Differenzierung und Verselbständigung : zur Entwicklung gesellschaftlicher Teilsysteme.* Frankfurt/Main: Campus, 261-293.

Strathern, Marilyn, 1999: What is intellectual property after? In: Law, John/John Hassard, (eds.), *Actor Network Theory and After.* Oxford: Blackwell, 156 – 180.

Weick, Karl E., 1995: *Sensemaking in organizations.* Thousand Oaks, Calif.: Sage.

Werle, Raymund, 1998: An institutional approach to technology. In: *Science Studies* 11, 3-18.

Willinsky, John, 2002: Copyright Contradictions in Scholarly Publishing. In: *First Monday* 7, No 11. <www.firstmonday.org/issues/issue7_11/willinsky/>

Wissenschaftsrat, 2001: *Empfehlungen zur digitalen Informationsversorgung durch Hochschulbibliotheken.* Bonn: Wissenschaftsrat.<www.wissenschaftsrat.de/texte/4935-01.pdf>

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Reflexive Stimulation or Disjointed Incrementalism?

Readjustments of National Technology and Innovation Policy

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Abstract

Are national technology and innovation policies becoming obsolete under the conditions of an increasing internationalization of science, technologies and industry? The paper supports the argument that despite globalization and Europeanization, national technology and innovation policies remain the most important and effective level of governance in this area of policy. The argument will be elaborated in four steps: firstly, the paper presents a brief overview of the discussions and controversy concerning the future governance of technology and innovation policies. Secondly, the effects of changing general conditions on national policies are discussed, especially the policy implications of the development of new technologies, of the internationalization of industry and of the growing importance of public discourses. Thirdly, the relations between the national and the European level of governance are analyzed and an answer is given to the question why there has not been a significant shift of competencies and resources from the national to the European level until now. Against this background and with a special view regarding the German case, the paper finally analyses strategic reorientations, new elements and instruments of the national technology and innovation policy and discusses their impact on science, industry, and society.

1 Discussions and controversies: Globalization, multi-level governance and the remaining role of national policies

For a long time major objectives of national technology and innovation policies have included strengthening technological competitiveness, supporting technologies and promoting innovation activities on the territory that is controlled. And they are still at work. In Germany as well as in other leading countries, national policy efforts are strongly focused on the aim "to enable Germany to hold its own against the competition of other leading technology regions of the world." (BMBF 2000: 14-15) However, are national policies still able to call the tune? What remains of national political capabilities to stimulate or shape technologies, innovation activities, infrastructures and institutions under conditions of an increasing internationalization of knowledge, technologies and industries?

In Germany, since the early 1990s these questions have been discussed mainly in the field of political science (see Grimmer et al. 1992; Martinsen/Simonis 1995; Gerybadze et al. 1997; Grimmer et al. 1999; Simonis et al. 2001; Grande 2001). The debate began with a paradigm shift. The conception of a coherent and intervening state with regard to economy and society and with this the idea that the state could shape or steer technological progress (Hauff/Scharpf 1975) was empirically proven wrong (Simonis 1992; Meyer-Krahmer 1999). Instead since then three different arguments have been widely acknowledged:

Firstly, it has been recognized that the state is only one player in the technology and innovation process among other relevant actors. Moreover, it has been shown that political decision-making systematically depends on external expertise and negotiations with powerful private actors especially from industry and science. Therefore the idea of an autonomous and directing state was replaced by various concepts of a cooperative, interactive, learning or negotiating state.

Secondly, it has been emphasized that political authorities are not able to plan or steer technologies or innovation activities but instead at best are able to provide general conditions and 'soft' incentives for multiple self-organized and self-interested groups of actors. Therefore the idea of an active and intervening technology and innovation policy was rejected in favor of new modes and instruments concerning a more indirect stimulation of innovation activities, infrastructural and institutional change.

Thirdly, it has been stressed that the complexity of policy-making itself has increased significantly over the past two decades. Because of Europeanization (and regionalization too) national technology and innovation policies have lost their exclusiveness in the policy-making system in favor of an emerging multi-level system of governance. Therefore the focus of analysis has shifted from national policies to the patterns of Europeanization and the multi-layer structure of this policy field.

However, behind these stylized facts there are still controversial points. This concerns especially the two related questions which will be discussed in this paper.

The first one deals with the distribution of resources and competencies within the scope of the multi-level system of governance. Is the gradual Europeanization of innovation and regulatory policy activities undermining or replacing policies carried out at the national level? Or does the nation state remain the indispensable and dominant arena of policy activities? (see the discussions in Kuhlmann 2001; Edler et al. 2003; Edler/Kuhlmann 2005) Or, to put it into a normative question: is a "much stronger, more focused and

integrated policy for industry and technology" in the European Union necessary to fulfill the conditions of globalization and to consolidate Europe's competitiveness in the global technology race? (Chesnais et al. 2000: 249; see also EU-Commission 2000) Or is the technological competitiveness of Europe even today mainly based on the national capabilities, infrastructures and institutions of their leading countries?

If this last question is answered in the affirmative a second tier of questions arises concerning the remaining leeways and capabilities of policy-making at the national level itself. Does the internationalization of knowledge, technologies, markets and industrial activities lead to a convergence or dissolution of national innovation systems and to a substantial decline or erosion of nation states' capacities in technology and innovation policy? (Willke 2001; Grande 1994, 2001b; Ohmae 1990; Cairncross 1997) Or do there remain variations across countries in innovation, production and political systems as well as in national innovation policies indispensable in providing opportunities, infrastructures and institutions rendering the country attractive for science and industry? (Porter 1989; Nelson 1993; Mowery/Nelson 1999, Archibugi/Iammarino 1999)

The main argument of this paper is that national technology and innovation policy is not becoming obsolete. National systems of innovation with significant differences in technological specialization, markets, infrastructures and institutions remain the most important level of innovation activities even in the era of globalization. Moreover, national policies especially of the large European member states (and the US as well) aim at strengthening their own technological and economic competitiveness in rivalry with other countries. This sets limits both to the emergence of a European system of innovation and the European integration process in this area. Of course, to face the challenges of internationalization and to remain functioning, new adjustments of national technology and innovation policies are necessary. They have to open up, learn from and adapt to other countries and develop new systemic concepts and instruments of policy-making.

The paper argues along these lines in three steps. The following chapter discusses the effects of changing general conditions on the leeways and capabilities of national policies, especially the policy implications of the development of a new set of core technologies, of the internationalization of industry and of the growing importance of a watchful and headstrong public. In the third chapter the division of competencies between the national and the European level of governance will be analyzed and the question will be answered, whether there is a significant shift of competencies and resources from the national to the European level or not. Against this background and with a special look at the German case, the paper will finally sketch strategic reorientations, new concepts and instruments of national technology and innovation policy and discuss their capability to influence and stimulate innovation activities as well as infrastructural and institutional change.

2 Contexts: Fluid technologies, international economy, watchful public and changing governance

To get an impression of the challenges technology and innovation policies are being faced with, it seems above all necessary to work out major changes in technology, economy, public perception and governance during the last two decades and to sketch their repercussions on policy-making.

2.1 Fluid technologies

The portfolio of core technologies has changed fundamentally. Since the

1980s new information and communication technologies have transformed the entire economy and ultimately the rest of society as well. Moreover, genetic engineering, life sciences and nanotechnologies are gaining in importance.

The characteristics of these new cross-sectoral core technologies, which at present dominate the dynamics of innovation and sociotechnical change, differ from those of established large technologies or large technological systems (such as nuclear energy, aircraft and space technologies, and electricity systems) in many respects. Typical features of these technologies are (Dolata 1992, 2003)

- their dynamic and fluid state: they develop fast, have wide-ranging and cross-sectoral potential applications but are often extremely uncertain concerning the direction they are going;
- their often decentralized and fragmentary character: different from large technologies they emerge in countless areas and places, are promoted by a large number of different actors and can be used in numerous contexts;
- their science-based and multidisciplinary profile: they are often knowledge-based and interdisciplinary and call for intensive collaborations both within industry and between industry and academia;
- the absence of state intervention: they are promoted mainly by enterprises, scientific institutions, industrial networks and through cooperations between industry and academia – self-organized patterns of development without direct participation of state authorities are the rule;
- their international performance: the patterns of innovation, cooperation and competition are internationally interwoven.

These characteristics of new core technologies have considerable consequences for policy-making. The direct influence of the state on the dizzy dynamics and further pathways of these complex and small-sized new technologies is low. They are different from large technologies, because the state is not necessary as an indispensable investor, guarantor or customer. Moreover, the state is no longer only faced with a small number of well-known industrial or scientific actors. Instead it has to deal with multiple heterogeneous actors and numerous self-organized and -governed networks of innovators (Freeman 1991; Rammert 1997).

Under these conditions of private self-organization and uncertainty all kinds of innovation policy activities – ranging from public research programs, institutional restructuring of public research and incentives to support the innovation efforts of firms to regional initiatives and regulatory policy – cannot be developed by an autonomous and implemented by a directing state. Instead, policy-making of state authorities is more than ever systematically dependent on the external expertise and competencies of private actors which are at the head of the innovation process. A major new challenge in this respect is how the competencies and resources of new actors (e.g. start-up companies) can be integrated into the already existing patterns of private-public consultation and corporatist decision-making between state authorities, industry and science.

2.2 International economy

Moreover, technology and innovation policies are faced with considerable changes in the patterns of industrial innovation activities. In monetary terms, an average of 70% of the overall research and development in the OECD countries is carried out by industry (BMBF 2004: 489). Three new trends are particularly remarkable and have significant repercussions on pol-

icy-making: the step-by-step internationalization of industrial innovation activities, the growing importance of technology-based cooperations and the rise of new start-up companies as catalysts of the innovation process.

Above all the internationalization of companies' innovation activities has significantly increased during the past two decades. This trend is most remarkable in new high-technologies (like biotechnology and pharmacy, computer, semiconductor and information technologies). By now, German companies, for instance, spend more than a fourth of their overall research and development (R&D) budgets abroad. Actually, the exceptionally internationalized German chemicals and pharmaceuticals industry invests nearly half of their R&D-budget in foreign countries. Other large-scale enterprises like Siemens or Daimler Chrysler do so too (Belitz 2004: 18-25; BMBF 2002a: 123-138) What is typical of these companies is that they no longer carry out only subordinate development activities in foreign countries. Instead they have begun to realize leading-edge research in company-owned R&D-centers abroad – research activities that formerly were highly concentrated in their home country (Gerybadze et al. 1997; Hack 1998; Dolata 1996). However, internationalization doesn't mean indiscriminate globalization, as Ohmae (1990), Cairncross (1997) or Willke (2001) have suggested. Companies don't allocate their R&D-activities evenly and everywhere but concentrate them worldwide in a few leading regions or districts which are close to scientific excellence and (future) lead markets (Feldman 1994; Patel 1995; Heng/Schaaf 2002; Carlsson/Mudambi 2003). Instead of a locationless globalization very selective and a regionally concentrated patterns of internationalization are characteristic of industrial R&D and innovation activities.

A second remarkable trend of the 1990s is the rapid increase of collaborations both within industry and between industry and academia – especially in new high technologies. At the top of the trend is the pharmaceuticals industry. Today the large companies of this industrial sector spend between 25 and 30% of their research budgets on the support of external cooperations, whereas until the 1980s the same companies realized their research activities nearly exclusively in-house (Dolata 2003: 175-243). The systematic constraint towards cooperation results from the extraordinary dynamics of the generation of knowledge, the fast rate of technological change and the multidisciplinarity of research and development projects. These complex patterns of innovation are, even in large enterprises, impossible to handle purely by in-house capacities (Hagedoorn 1996; Hagedoorn et al. 2000; OECD 2000). Besides the expansion of company-owned capacities and capabilities (Pavitt/Patel 1999), they require the simultaneous recourse to company-external knowledge, know-how and competencies. Therefore today "the locus of innovation will be found in networks of learning, rather than in individual firms." (Powell et al. 1996: 116; also Freeman 1991)

A third new trend has to be added. Besides large enterprises small and research-intensive start-up companies have been established as pioneers, brain trusts and driving forces of the innovation process and the early commercialization of new technologies – not only in the U.S., but during the 1990s also in Western Europe. The personal computer and its operating systems, the early commercialization of genetic engineering, and the internet, for instance, all got under way not by saturated large enterprises but by new entrants (Ichbiah/Knepper 1991; Dolata 1996; Mowery/Nelson 1999; BRIE-IGCC E-conomy Project 2001). As venturesome, research-intensive and unconventional operating units they stimulate not only the innovation process itself, but at the same time

have become important external resources and cooperators for big industry, even though the bulk of the entire industrial R&D expenses still falls to large enterprises – in Germany approximately 80% (Legler et al. 2004: 15-24) – and only very few start-up companies conduct leading-edge research and turn out to be commercially successful innovators (Parker 1999).

Altogether these trends – internationalization, collaboration and the emergence of new industrial actors – have considerable impact on the outline of technology and innovation policies.

The formerly close connection between domestic enterprises, the national development of technologies and national policies has opened up. The addressees of national policy initiatives are no longer exclusively the well-known national champions and the medium-sized enterprises at home. Instead the state has to provide general conditions and incentives that are attractive for increasingly internationally operating domestic companies as well as for foreign enterprises which intend to invest in the respective country. Moreover, it has to develop new incentives that aim at supporting the emergence and stabilization of new start-up firms. And finally, it has to recognize that today the locus of innovation will be found "in the interstices between firms, universities, research laboratories, suppliers, and customers" (Powell et al. 1996: 118) and therefore has to promote initiatives designed to stimulate cooperative arrangements and networking as well as technology transfer from academia to industry.

The pattern of a highly selective and regionally clustered internationalization of companies' research and innovation activities not only interweaves national (and regional) locations closer than ever before but at the same time places them into fierce competition and rivalry. Under these conditions, nation states are under pressure to compete with each other and struggle for locational decisions and investments of both domestic and foreign enterprises and scientists, too (Jessop 2002). For this purpose above all, they have to offer excellent research conditions, sophisticated innovation infrastructures and prosperous lead markets to companies.

2.3 Sensitive public

During the last two decades the public perception and use of new technologies has changed too. Starting with the fierce protest against nuclear energy, almost every new technology has been perceived ambivalently and has been widely discussed in public. Moreover, the end user make use of the opportunities of new technologies often in a headstrong and unexpected way (Bauer 1995; Bauer/Gaskell 2002).

In contrast to the 1970s and 1980s, today public unease concerning new technologies is not only spurred on by well-organized protest movements, non-governmental organizations and environmental and consumer associations but is increasingly expressed by collective actors which are non-organized and hardly ever institutionalized, such as citizens, voters and consumers. They remain unimportant as long as they do not develop shared user preferences or problem perceptions concerning new technologies. But if so, they are no longer only passive addressees of new technological supplies but instead can exercise considerable influence on the design and portfolio of new products as well as on public policy (Dolata 2003: 31-33).

On the one hand collective actors do appear as headstrong users and selective consumers. This is the case with many new everyday applications of media, information and communication technologies. Often final customers and users exert an influence on new technological supplies by using them very selectively or contrary to all expectations. This can lead both to

failure or (sometimes unexpected) success of new products (Kubicek 1997).

On the other hand, collective actors can also be skeptical, watchful citizens and discerning consumers, the majority of which may not accept new technologies or specific applications. This is for instance partially the case with genetic engineering, especially with new applications in agriculture and the food industry (Hampel/Renn 1999).

These opportunities of public intervention do not only have repercussions on the strategies of certain industries, they can also put political authorities under pressure. Public policy is not only forced to create initiatives and incentives which aim at strengthening countries' economic and technological competitiveness, it is at the same time faced with an enlightened public which no longer accepts technological progress in general but discusses and sometimes refuses new technologies. Therefore, policy has also to develop new modes of mediation of social controversies concerning new technologies. It has to ensure transparency, safety, consumer protection and participation as well.

2.4 Multi-level governance

Finally, the architecture of innovation policy-making itself has also changed. Since the early 1980s the most remarkable new development in this respect has been the gradual formation of an original European technology, innovation and regulatory policy. Since then, national policy initiatives have been increasingly supplemented by and partly intertwined with corresponding activities of the European Union. The formerly unchallenged dominance and exclusiveness of national authorities and policies has been restricted in favor of a co-evolution and co-existence of different levels of innovation policy making.

What does co-evolution and co-existence mean? Are we witnessing an intensified European integration and a significant shift of governance and policy-making from the national to the European level? Or can we observe only loose combinations of fragmented levels of governance in which national policies and arenas still play the dominant role? To answer this first tier of questions I will now analyze the dynamics, scope and breadth of European integration in the field of innovation and regulatory policy and give reasons for the argument that the national level of policy-making still remains the most important one.

3 Architectures: European Integration, National Systems of Innovation and International Rivalries

3.1 European Integration?

Without doubt the European Community has reached a new level of governance and the Commission of the European Communities has been established as a new and important actor in technology, innovation and regulatory policy during the past two decades. This has happened mainly in two areas: in the development of legal frameworks for research, production and commercialization of new technologies, and in the implementation of European programs for research and technological development. Moreover, with the recent approach "Towards a European research area" launched in 2000, the Commission started a new attempt to coordinate European, national and regional innovation policies in a better way (European Commission 2000).

Responsibilities for the set up of legal frameworks and regulations of technologies have shifted heavily from the national to the European level since the late 1980s. Meanwhile, the decisions concerning legal and regulatory aspects take place mainly at the European level – and are reflected in a whole string of relevant initiatives, guidelines and directives that are un-

der way or have been enacted by the European Union (for instance in biotechnology and chemicals regulation or in patent protection). As a result, the negotiations dealing with legal and regulation aspects have also shifted from the national to the European governance level – with the European Commission and the European Parliament, the governments and responsible ministries of the Member states as well as the relevant pressure groups of the European lobbying process as influential negotiating parties. However, this significant Europeanization of legal activities and regulations has not led to a dramatic loss of influence of national authorities, actors and controversies up to now. As for instance the development of regulations for biotechnological research, production and marketing or the discussions about a renewed European chemicals regulation show, national actors and interests are closely involved in European negotiations, are often able to set the tone, to initiate and to speed up as well as to protract or to block the European decision-making process (Dolata 2003a; Hampel 2005; Jacob/Volkery 2005).

Table 1: Budget of the EU Framework Programs for research and technological development (FPs) in comparison with the public R&D funds of the Member states

		Budget FPs (billion Euro)	Share of FPs on total EU budget (in %)	Public R&D funds of the EU Member states (billion Euro)	Share of RP-budget on public R&D funds of the Member states (in %)
1. FP	1984 – 1987	3.75	2.41	110.5	3.4
2. FP	1987 – 1990	5.37	3.15	128.1	4.2
3. FP	1990 – 1994	6.60	4.04	198.9	3.3
4. FP	1994 – 1998	12.30	4.02	220.1	5.6
5. FP	1998 – 2002	14.96	4.15	251.7	5.9
6. FP	2002 - 2006	17.50	-	-	-

Source: Rammer et al. 2004: 170

However, in the field of European technology and innovation policy such a comprehensive shift is scarcely to be identified up to the present – not even as an outcome of the recent European research area initiative.

Of course, the European Union has become a serious player in technology and innovation policy, too. Since the early 1980s the EU has established ever increasing Framework Programs (FPs) for research and technological development that are targeted at a number of advanced technologies, particularly including sectoral programs to support research in information and communication technologies and the life sciences. Furthermore, FPs are aiming to stimulate scientific cooperation within Europe and to strengthen the transnational networking between the actors, institutions and regions involved (Peterson/Sharp 1998; Borrás 2003; Prange 2003).

Even though the total amount of the European Union's spending on research and technological development has increased substantially through to the present, it cannot keep up with the public funds for research and development (R&D) in the Member states: as table 1 shows, the 17.5 billion Euro budget of the latest framework program meets with only approximately

6% of the total public funds for R&D in the Member states, of which about 75% are spent in Germany, France, the UK and Italy (BMBF 2002: 338). The European funds have gained in importance in supporting research and infrastructures in the smaller and weaker Member states, but have only a minor impact on the national innovation systems of the leading ones (Pavitt 1998).

More important is the fact that European policy has not yet been able to integrate the fragmented national research infrastructures, to coordinate the various regional, national and European policy activities effectively and to develop a coherent European technology and innovation policy which would be mandatory on the Member states (Kuhlmann 2001; Grande 2001a). In 2000 the European Commission itself stressed this negative record by stating that "it cannot be said that there is today a European policy on research. National research policies and Union policy overlap without forming a coherent whole." Furthermore: "Above the European research effort as it stands today is no more than the simple addition of the efforts of the 15 Member States and the Union." (EU-Commission 2000: 7)

It seems that the European research area initiative launched in 2000 will not be able to change this situation fundamentally. The suggestions made with this new approach were not far-reaching. Although the Commission was aware of the lack of coherence and coordination of national and European technology and innovation policies, the only suggestions made in this respect were to develop a benchmarking system of national research policies, to improve science and technology foresight, statistics and indicators, and to strengthen and intensify the European networking of existing national research centers as well as public-private partnerships. In contrast to the past, the Commission did not claim once again far-reaching new competencies in technology policy but instead emphasized its role as a catalyst and soft coordinator of activities which (should) take place mainly on the national and sub-national level (EU-Commission 2000, 2002, 2003; see also Edler et al. 2003; Edler/Kuhlmann 2005). This is an remarkable restraint which recognizes the persistent dominance of national resources within the EU as well as the fact that even though the industrial innovation activities are highly internationalized, the national and sub-national innovation infrastructures remain the most important ones concerning the production of new knowledge and technologies.

To sum up, the future role of the European Union as a player in technology and innovation policy seems to be confined to the forecasting of technological developments and the benchmarking of national policies as well as to the stimulation of European networking in science and technological development. Paradoxically, concentrating on this restrained scope of duties may turn out to be a successful strategy for further European integration – not only because it takes into account national self-centeredness but particularly because it acknowledges the necessity of distinct national and sub-national policies. Therefore one can hardly expect the emergence of a European technology and innovation policy which could replace or compete with the national policies at eye level. It seems that the recent initiatives undertaken will not remove the existing balance between the European and national responsibilities and competencies in this policy field.

3.2 National systems of innovation and international rivalries

There are two complementary explanations for this restrained scope of European integration and the persisting dominance of national policies in this arena.

Firstly, international as well as regional patterns of innovation are chiefly structured and formatively in-

fluenced by the distinct peculiarities of national systems of production, innovation and policy-making. Despite increasing interweaving and penetration there is little empirical evidence for a strong convergence of national systems or for the emergence of a coherent European system of innovation.

Secondly, the leading countries – among others especially the U.S., Germany, France, the U.K and Japan – clearly compete with each other. Against the background of a very selective and regionally concentrated internationalization of industries' innovation activities, national policies are forced to compete for technological leadership as well as for the most excellent and attractive innovation-oriented infrastructures as major prerequisites for their competitive advantage.

Especially the research on national systems of innovation (Nelson 1993; Edquist 1997; Mowery/Nelson 1999; Balzat/Hanusch 2004) and the varieties of capitalism (Soskice 1999; Hollingsworth 2000; Hage/Hollingsworth 2002) has shown convincingly, that major differences still exist between national systems of production, innovation and policy-making. These differences range from distinct national research and education systems, unique structures of industry and inter-firm collaborations through to the financial systems, the demand and market structures or the patterns of negotiation, public perception and political moderation of controversies about new technologies. Of course, the national systems are closely intertwined in the age of internationalization and national policies try to learn form and adapt to each other. But they do so in their own unique way and against the background of very different national innovation cultures, patterns of technological specialization, institutional contexts and political systems. And they try to sharpen unmistakably national or rather regional innovation profiles and strengths which enable the country to stand the test of international rivalry and competition (Diederen et al. 1999; Kuhlmann 1999, 2001; Borrás 2004; Senker/van Zwanenberg 2001).

All in all there is little evidence so far of advanced tendencies towards a uniformity of national systems or towards the emergence of a coherent European system of innovation. Instead, the territories of the great nation states remain the most relevant areas of innovation with diverse and unique profiles. Otherwise the highly selective and regionally concentrated locational decisions and investments of industry would make no sense: enterprises do not go anywhere but instead put out feelers and make very specific locational choices.

Against this background it should be comprehensible why core elements of technology and innovation policies still remain nationally-based – even within the European Union. If national areas of innovation with distinct infrastructures, patterns of specialization, institutions and cultures are still the most important ones, their modernization and readjustment right at the front has to be pushed forward by national political authorities. And if the internationalization of industrial research, development and innovation activities is not viewed as a process of locationless globalization but instead is identified as a highly selective process restricted to a few top regions and lead markets worldwide, the great Member states of the European Union are not only competing with their non-European rivals (like the U.S. or Japan) but also with their European ones – and therefore pay careful attention not to reduce the remaining leeways of national policies by delegating core competencies to the European Union (Banchoff 2002).[1]

[1] In two interim balance sheets of the European Research Area Initiative the EU-Commission had to admit that „the initiative in its current form seems to be hampered, however, by insufficient participa-

4 National leeways and profiles: Readjustments of technology and innovation policy in Germany

If strategies and policies that aim at getting competitive advantage are still the domain of national initiatives, negotiations and decisions, the second tier of questions concerning the remaining leeways and capabilities of national technology and innovation policies has to be answered. Are the competencies and capacities of national policies being eroded, regarding the background of the indisputable internationalization of markets, firms and technologies? Or do national policies remain a relevant factor in stimulating and shaping technologies, infrastructures and institutions?

4.1 Limits and new challenges of innovation policy-making

The findings so far should have supported to idea that the capacities of innovation policy-making are limited to the provision of general conditions for strongly self-organized actors and private contexts of research, development, production and use of new technologies. In contrast to this, political authorities cannot steer or influence the dynamics of technological development itself, of industrial innovation activities or of scientific research in a formative way. Moreover, the regionally clustered internationalization of the innovation activities of industry has strong repercussions on the leeways and the focus of national policies: above all they have to develop new concepts and instruments which aim at providing infrastructural, institutional and regulatory conditions that are attractive for both domestic and foreign enterprises.

Therefore, the former alignment of national research and technology policies on the funding of specific technology programs, the support of national champions and the concentration on large technologies (Meyer-Krahmer/Kuntze 1992) has become too limited in several respects.

The rise of new core technologies such as information and communication technologies, biotechnology or nanotechnologies has qualified the importance of large technologies as cornerstones of national technological competitiveness and as major forces of technological change. Accordingly, policy is not only forced to readjust the portfolio of supported technologies but also has to develop new concepts and instruments to support this new set of core technologies which are developing in a more decentralized way and are being encouraged by numerous private actors and fluid networks of innovators (Rammer et al. 2004).

However, today the attractiveness and competitive advantage of a country no longer depends mainly on the direct public support of new technologies. Unmistakable national innovation landscapes with competitive regional and sectoral technology clusters, excellent research conditions, effective systems of technology transfer and future lead markets have become crucial factors for the competitiveness of countries as well as for locational decisions and investments of industry (Meyer-Krahmer 2005). Accordingly, technology and innovation policy activities have to open up and to concentrate their efforts more strongly on the stimulation and restructuring of technology-related infrastructures and institutions.

The former concentration of policies on the support and protection of national champions has also become too limited. Against the background of the described patterns of internationaliza-

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tion of the Member States. This is reducing the impact of the activities being undertaken, thereby jeopardizing the chances of the project achieving its objectives: the creation of a genuine ‚Internal market in research' and the establishment of genuine coordination of national research policies." (EU-Commission 2002: 3; see also EU-Commission 2003)

tion, national policy has also to woo foreign enterprises which intend to reinforce their own position through investments in the host country. Moreover, besides the support of large enterprises, national policy is forced to develop specific initiatives and incentives to support the emergence of technology-based start-up firms which are gaining in importance as locational factors. And finally, the strong state-protection of national champions or industries in the past has widely proved to be counterproductive in stimulating innovations as well as in strengthening the national economic and technological competitiveness of industry. This applies especially to new core technologies which are best developed in the environment of fierce competition. "Successful national industries tend to be ones where intensely competitive domestic rivalries push each other to excel." (Lawton 1999: 42; see also Monopolkommission 2004).[2]

4.2 New adjustments of national technology and innovation policy

Since the mid 1990s, the governments of the leading states have reacted to these limits and new challenges with remarkable readjustments of their technology and innovation policies. Despite all variability in the points of departure, featured concepts and instruments, they aim at strengthening unmistakable national and regional innovation landscapes by stimulating competition as well as networking between the actors involved and by restructuring the infrastructures and institutions relevant for innovation (Larédo/Mustar 2001; Rammer et al. 2004).

In Germany this new set up of priorities in technology and innovation policy can be observed in particular in four related areas.[3]

Firstly, the political support of structural change in the national patterns of technological specialization towards new research- and knowledge-intensive technologies and branches of industry has been strengthened. However, the featured initiatives and instruments are not new or spectacular. They concentrate on the implementation of research programs which feature new core technologies, especially information and communication technologies, biotechnology and life sciences, nanotechnologies, new materials and environmental technologies. In 2004 in Germany 20.1% (in 1993: 17.1%) of the total (civil and military) federal funding on science, research and technology was spent to support these new clusters of technology. In contrast the federal funding of large technologies (especially nuclear energy and nuclear fusion, aviation and space technologies, military projects) has gradually decreased (from 29% in 1993 to 20.1% in 2004), even though these sectors are still of importance in the profiles of federal support (data calculated on the basis of BMBF 2004: 616-621 [table 8a]).

Secondly, the public support of research, development and innovation in industry has changed significantly. In general, the federal state has withdrawn from financing industrial R&D

[2] Timothy Bresnahan and Franco Malerba argue similarly with respect to the protectionist policy of individual European governments concerning the computer industry in the 1970s and 1980s: „The effect of protection by individual European governments was to keep an uncompetitive European computer industry alive and sheltered from destruction by IBM. These barriers to exit, however, did not lead European firms to launch major policies and investments able to increase their innovativeness and competitiveness internationally." (1999: 102)

[3] For more detailed empirical findings and statistics see the annual reports on the technological specialization and competitive advantage of Germany: BMBF 2000a, BMBF 2003; BMBF 2004 and Grupp et al. 2004. A comparative analysis of recent trends in technology and innovation policy including Germany, the U.S., the U.K., France, Japan and Finland can be found in Rammer et al. 2004.

directly in a remarkable way. While at the end of the 1970s the public share of total industrial R&D expenses amounted to 14%, at the beginning of the new millennium in Germany the federal state financed not more than 3.5% of the total R&D-expenses of industry (Legler et al. 2004: 32f.). Moreover, compared with the public support of large enterprises, the public support and stimulation of small and medium sized enterprises, especially of new technology-based start-up firms, has gained in importance. Although even today with approximately 80% the bulk of the remaining public support of industrial R&D falls to large enterprises, especially to the aviation and space industry, in relative terms since the mid 1990s small enterprises have benefited more and more from public financial support. At present, public money amounts to 8.5% of the total R&D-expenses of small firms, whereas on average only 2.5% of the R&D of large enterprises (i.e. companies with more than 5000 employees) is financed by the state (Legler 2004: 32f.). This is completed by specific programs of gaining importance which support the founding and financing of new start-up firms (BMBF 2002b: 16f.; BMBF 2004: 200-2003). All things considered, innovation policy initiatives have realized that small enterprises and especially technology-based start-up firms play an important part as catalysts of innovation, as locational factors and as potential external resources and partners for big industry.

Thirdly, since the mid 1990s, national policy has begun to take regions as important elements of national innovation systems seriously and therefore has developed new concepts and instruments of a region-oriented technology and innovation policy which makes use of the regional level in order to pursue national goals. It focuses on three targets: generating new regional high-technology clusters, stimulating inter-regional competition for science, technology and innovation, and improving regional networks of innovators as well as the functioning of regional innovation systems (Braczyk et al. 1998; Dohse 2003, 2005). In Germany, the successful prototype of this new area of technology and innovation policy was the so-called BioRegio Contest which started in the mid 1990s and was as subsequent initiatives, too, designed to transform a dormant sector into one intended to be globally competitive by stimulating biotech firm start-ups, the growth of existing companies, the provision of venture capital and the networking of regional actors and institutions. The instrument, which was then new but is meanwhile widely applied, was the invitation to a contest which aimed at stimulating new high-technology clusters and regional centers of excellence by putting the participating regions in an inter-regional competition for additional federal funding.

Finally, since the late 1990s political measures have been initiated to stimulate structural changes of the public science and research infrastructures and institutions. They aim at a stronger competition within the public research system and between their institutions as well as at a faster rate and more efficient system of knowledge and technology transfer from science to industry (Etzkowitz 2003). Among the public initiatives are the introduction of periodical evaluations and the hierarchical reorganization of universities and other public research institutions as well as the intensification of competition for financial resources. Moreover, especially the new instrument of public competitions is widely used to stimulate the clustering of first-class research in a few national lead projects (so-called "Leitprojekte") and centers of excellence (so-called "Kompetenzzentren"). Additionally, the public support of research projects has been strongly focused on applied research and on the intensification of collaborations between public re-

search institutions and enterprises (BMBF 2004: V-XVI). As a result the pressures on universities and other public research institutions to compete with each other, to bundle their resources in lead projects and centers of excellence, to legitimate scientific research by their economic relevance and to contribute to economic development have increased significantly (Rammer et al. 2004: 132-142).

4.3 Reflexive stimulation or disjointed incrementalism?

These new adjustments of national technology and innovation policy are towering above the former concentration on the political shaping of technologies and national industries, the financing of large technologies and the protection of national champions. Instead, the renewed approach appears to be more indirect and context-oriented: above all, it aims at restructuring national (and regional) infrastructures, institutions and innovation landscapes which are attractive both for scientists and enterprises from wherever. The featured new instruments for that purpose are contests which stimulate competition between research institutions or regions as well as initiatives which support the clustering of research in national (or regional) centers of excellence and the networking between scientific and industrial actors. The addressees of these initiatives are no longer mainly domestic large enterprises but also their foreign counterparts, new start-up firms and (regional, industrial or academic-industrial) networks of innovators which often develop only after the implementation of corresponding public initiatives.

Within the inevitable limits of innovation policy-making described above, the readjusted policy is definitely able to cause structural effects. In Germany (as well as in other European countries) it has stimulated the emergence of visible sectors of start-up firms (Dolata 2003). Moreover, it has formatively contributed to the emergence of new regional high-technology clusters and the regional networking of actors (Dohse 2003). And finally, it has forged a far-reaching restructuring of the public research and science system towards increasing competition and clustering, academic-industrial cooperation and technology transfer (BMBF 2004: 473-525). What at first sight appears as a decline of policy-making capacities turns out to be a truly indirect but none the less active and effective contribution to the readjustment of general conditions concerning the technology and innovation process. Therefore, instead of an erosion we are facing a transformation of state capacities in technology and innovation policy.

However, in the end one has to roughen up this far too pretty picture in at least two respects.

The new concepts and instruments cannot be analyzed as a radical new beginning or a clear break with former patterns of research and technology policy but instead are incrementally and sometimes inconsistently fit into existing and persisting ones. The persistence of classical patterns of innovation policy-making is blatant especially in the case of large technologies (in Germany for instance this is seen in the public support of Transrapid, space technologies or traffic telematics) which still remain an important focal point of technology policy. Johannes Weyer has rightly stressed that in these cases even today the state operates "with the classical repertoire of direct intervention, direct project promotion, market foreclosure, promotion of public champions and the exercise of buyers' and buying power (2004: 293; 2005)".

Moreover, the new adjustments of technology and innovation policy can cause new problems, that might arise as a result thereof. A regional-oriented technology policy which aims at picking winners may foster the develop-

ment of some selected regions but at the same time suppresses the development of other regions or innovative enterprises that are located outside the target region (Dohse 2005). The currently strong orientations of technology and innovation programs and public initiatives to restructure the public research and science system by intensifying networking between academia and industry, stimulating technology transfer and the short-term benefits of scientific research for economic development, may cause similar problems. They tend to underestimate that the further development – especially of new science-based and knowledge-intensive technologies – will depend exceedingly on the contributions of pure basic research for a long period (Meyer-Krahmer 2000). Finally, all the readjustments of technology and innovation policy so far have hardly made a contribution to really integrating and institutionalizing the resources and actors of public protest and controversy regarding new technologies into the patterns of political negotiations and decision-making. Of course, policymakers are strongly dependent on external expertise and consultations with private actors. However, at the top the negotiating state still remains a corporatist state. Decisions of general importance are usually negotiated with large enterprises, the federations of industries and the federations of science in closed sessions (Saretzki 1997; Dolata 2003: 265-303).

5 References

Archibugi, Daniele/Simona, Iammarino, 1999: The policy implications of the globalisation of innovation, In: *Research Policy* 28, 317-336.

Banchoff, Thomas, 2002: Institutions, Inertia and European Union Research Policy, In: *Journal of Common Market Studies* 1, 1-21.

Balzat, Markus; Hanusch, Horst, 2004: Recent trends in the research on national innovation systems, In: *Journal of Ecolutionary Economics* 14, 197-210.

Bauer, Martin (ed.), 1995: Resistance to new technology, Cambridge.

Bauer, Martin W./ George Gaskell (eds.), 2002: Biotechnology – the Making of a Global Controversy, Cambridge (UK).

Belitz, Heike, 2004: *Forschung und Entwicklung in multinationalen Unternehmen*, Berlin (Deutsches Institut für Wirtschaftsforschung: Studien zum deutschen Innovationssystem 8-2004).

BMBF (ed.), 2000: Bundesbericht Forschung 2000, Bonn.

BMBF (ed.), 2002: Faktenbericht Forschung 2002, Bonn.

BMBF (ed.), 2002a: Zur technologischen Leistungsfähigkeit Deutschlands 2001, Bonn .

BMBF (ed.), 2002b: im Detail. Bundesministerium für Bildung und Forschung 1998-2002, Bonn.

BMBF (ed.), 2003: Zur technologischen Leistungsfähigkeit Deutschlands 2002, Bonn.

BMBF (ed.), 2004: Bundesbericht Forschung 2004, Bonn.

Borras, Susana, 2003: *The Innovation Policy of the European Union*, Cheltenham.

Borrás, Susana, 2004: System of innovation theory and the European Union, In: *Science and Public Policy* 6, 425-433.

Braczyk, Hans-Joachim/Philip Cooke; Martin Heidenreich (eds.), 1998: Regional Innovation Systems, London.

Bresnahan, Timothy F./ Franco Malerba, 1999: Industrial Dynamics and the Evolution of Firms' and Nations' Competitive Capabilities in the World Computer Industry, In: David C. Mowery/Richard R. Nelson, (eds.) 1999: *Sources of Industrial Leadership. Studies of Seven Industries*, Cambridge, 79-132.

BRIE-IGCC E-conomy Project (eds.), 2001: *Tracking a Transformation. E-commerce and the Terms of Competition in Industries*, Washington D.C.

Cairncross, Frances, 1997: The Death of Distance – how the communications revolution will change our lives, Cambridge.

Carlsson, Bo/Ram Mudambi, 2003: Globalization, Entrepreneurship, and Public Policy: A Systems View, In: *Industry and Innovation* 1, 103-116.

Chesnais, Francois/ Grazia Ietto-Gillies, 2000: Developing a European policy framework in the face of globalization, In: Chesnais, Francois/Grazia Ietto-Gillies; Roberto Simonetti (eds.), *European Integration and Global Corporate Strategies*, London / New York, 238-253.

Diederen, Paul/Paul Stoneman; Otto Toivanen; Arjan Wolters (eds.), 1999:

Innovation and Research Policies. An International Comparative Analysis, Cheltenham.

Dohse, Dirk, 2003: Taking Regions Seriously: Recent Innovations in German Technology Policy, In: Johannes Bröcker/Dirk Dohse/Rüdiger Soltwedel, (eds.), *Innovation Clusters and Interregional Competition*, Berlin, 372-394.

Dohse, Dirk, 2005: Clusterorientierte Technologiepolitik in Deutschland: Konzepte und Erfahrungen, In: *Technikfolgenabschätzung – Theorie und Praxis* 1, 33-41.

Dolata, Ulrich, 1992: *Weltmarktorientierte Modernisierung. Die ökonomische Regulierung des wissenschaftlich-technischen Umbruchs in der Bundesrepublik*, Frankfurt / New York.

Dolata, Ulrich, 1996: *Politische Ökonomie der Gentechnik. Konzernstrategien, Forschungsprogramme, Technologiewettläufe*, Berlin.

Dolata, Ulrich, 2003: *Unternehmen Technik. Akteure, Interaktionsmuster und strukturelle Kontexte der Technikentwicklung: Ein Theorierahmen*, Berlin.

Dolata, Ulrich, 2003a: International Innovative Activities, National Technology Competition and European Integration Efforts, In: Jakob Edler/ Stefan Kuhlmann/Maria Behrens (eds.) 2003: *Changing Governance of European Research and Technology Policy*. The European Research Area, 271-289.

Edler, Jakob/ Stefan Kuhlmann 2005: Towards One System? The European Research Area Initiative, the Integration of Research Systems and the Changing Leeway of National Policies, In: *Technikfolgenabschätzung – Theorie und Praxis* 1, 59-68.

Edler, Jakob/ Stefan Kuhlmann/Maria Behrens (eds.) 2003: *Changing Governance of European Research and Technology Policy. The European Research Area*, Cheltenham.

Edquist, Charles (ed.) 1997: *Systems of Innovation. Technologies, Institutions and Organizations*, London/Washington.

Etzkowitz, Henry 2003: Research groups as ‚quasi-firms': the invention of the entrepreneurial university, In: *Research Policy* 32, 109-121.

EU-Commission (ed.) 2000: *Towards a European research area*, Brussels (COM [2000]6).

EU-Commission (ed.) 2002: *The European research area: Providing new momentum. Strenghtening – Reorienting – Opening up new perspectives*, Brussels (KOM[2002]565).

EU-Commission (ed.) 2003: *In die Forschung investieren: Aktionsplan für Europa*, Brüssel (KOM[2003]226).

Feldman, Maryann P., 1994: *The Geography of Innovation*, Dordrecht.

Freeman, Christopher 1991: Networks of innovators: A synthesis of research issues, In: *Research Policy* 20, 499-514.

Gerybadze, Alexander/Frieder Meyer-Krahmer/Guido Reger 1997: *Globales Management von Forschung und Innovation*, Stuttgart.

Grande, Edgar 1994: Die Erosion des staatlichen Steuerungspotentials in der Forschungs- und Technologiepolitik, In: Fricke, Werner (Ed.), *Jahrbuch Arbeit und Technik* 1994, Bonn, 243-253.

Grande, Edgar 2001: Politik und Technik, In: Ropohl, Günter (Ed.), *Erträge der Interdisziplinären Technikforschung. Eine Bilanz nach 20 Jahren*, Berlin, 181-194.

Grande, Edgar 2001a: Von der Technologie- zur Innovationspolitik – Europäische Forschungs- und Technologiepolitik im Zeitalter der Globalisierung, In: Georg Simonis/ Renate Martinsen/Thomas Saretzki (ed.) 2001: *Politik und Technik. Analysen zum Verhältnis von technologischem und staatlichem Wandel am Anfang des 21. Jahrhunderts*, 368-387 (Politische Vierteljahresschrift: Sonderheft 31/2000), Opladen.

Grande, Edgar 2001b: The erosion of state capacity and the European innovation policy dilemma. A comparison of German and EU information technology policies, In: *Research Policy* 30, 905-921.

Grimmer, Klaus/Jürgen Häusler/ Stefan Kuhlmann/Georg Simonis (ed.) 1992: *Politische Techniksteuerung*, Opladen.

Grimmer, Klaus/Stefan Kuhlmann/Frieder Meyer-Krahmer (ed.) 1999: *Innovationspolitik in globalisierten Arenen*, Opladen .

Grupp, Hariolf/Harald Legler/Georg Licht 2004: *Technologie und Qualifikation für neue Märkte. Ergänzender Bericht zur technologischen Leistungsfähigkeit Deutschlands 2003-2004*, Bonn.

Hack, Lothar 1998: *Technologietransfer und Wissenstransformation. Zur Globalisierung der Forschungsorganisation von Siemens*, Münster.

Hage, Jerald/J. Rogers Hollingsworth 2002: Institutional Pathways, Networks, and the Differentiation of National Economies, In: J. Rogers Hollingsworth/ Karl H. Müller/ Ellen Jane Hollingsworth (eds.), *Advancing Socio-Economics. An Institutionalist Perspective*, Lanham / Boulder / New York/Oxford, 381-398.

Hagedoorn, John 1996: The Economics of Cooperation among High-Tech-Firms –

Trends and Patterns in Strategic Technology Partnering since the Early Seventies, In: Georg Koopmann/ Hans-Eckart Scharrer (eds.), *The Economics of High-Technology Competition and Cooperation in Global Markets*, Baden-Baden, 173-198.

Hagedoorn, John/Albert N. Link/Nicholas S. Vonortas, 2000: Research partnerships, In: *Research Policy* 29, 567-586.

Hampel, Jürgen 2005: Technik-, Akzeptanz- und Risikodiskurse: Europäisierung der Debatten oder nationale Signaturen?, In: *Technikfolgenabschätzung – Theorie und Praxis* 1, 78-85.

Hampel, Jürgen/Ortwin Renn (ed.) 1999: *Gentechnik in der Öffentlichkeit. Wahrnehmung und Bewertung einer umstrittenen Technologie*, Frankfurt / New York.

Hauff, Volker/ Fritz W. Scharpf, 1975: *Modernisierung der Volkswirtschaft. Technologiepolitik als Strukturpolitik*, Köln.

Heng, Stefan/ Jürgen Schaaf, 2002: Standortwahl in der vernetzten Welt: Kein Ende der Distanz, In: *Deutsche Bank Research* (ed.), *E-conomics* 30, 1-11.

Hollingsworth, J. Rogers, 2000: Doing Institutional Analysis: Implications for the Study of Innovations, In: *Review of International Political Economy* 7, 595-644.

Ichbiah, Daniel/ Susan L. Knepper, 1991: *The Making of Microsoft*, Rockland.

Jacob, Klaus/Axel Volkery, 2005: Europäische Rechtsetzung: Die Auseinandersetzungen zur Europäischen Chemikalienpolitik REACH und die Rolle nationaler Regierungen und Akteure im Policy-Prozess, In: *Technikfolgenabschätzung – Theorie und Praxis* 1, 69-77.

Jessop, Bob, 2002: *The Future of the Capitalist State*, Cambridge.

Kubicek, Herbert, 1997: Das Internet auf dem Weg zum Massenmedium? Ein Versuch, Lehren aus der Geschichte alter und anderer neuer Medien zu ziehen, In: Raymund Werle/Christa Lang (ed.), *Modell Internet? Entwicklungsperspektiven neuer Kommunikationsnetze*, Frankfurt/New York, 213-239.

Kuhlmann, Stefan, 1999: Politisches System und Innovationssystem in „postnationalen" Arenen, In: Klaus Grimmer/Stefan Kuhlmann/Frieder Meyer-Krahmer (ed.) 1999: *Innovationspolitik in globalisierten Arenen*, Opladen, 111-139.

Kuhlmann, Stefan, 2001: Future Governance of innovation policy in Europe – three scenarios, In: *Research Policy* 20, 953-976.

Larédo, Philippe/Philippe Mustar, 2001: *Research and Innovation Policies in the New Global Economy. An International Comparative Analysis*, Cheltenham.

Lawton, Thomas C., 1999: Fostering Invention and Innovation: Europe's collaborative R&TD initiatives, In: Thomas C. Lawton (ed.), *European Industrial Policy and Competitiveness. Concepts and Instruments*, Basingstoke, 23-48.

Legler, Harald/Birgit Gehrke/Ulrich Schasse et al. 2004: *Forschungs- und Entwicklungsaktivitäten der deutschen Wirtschaft*, Hannover (Studien zum deutschen Innovationssystem 10-2004).

Martinsen, Renate/Georg Simonis (ed.), 1995: *Paradigmenwechsel in der Technologiepolitik?*, Opladen.

Meyer-Krahmer, Frieder, 1999: Was bedeutet Globalisierung für Aufgaben und Handlungsspielräume nationaler Innovationspolitiken?, In: Klaus Grimmer/Stefan Kuhlmann/Frieder Meyer-Krahmer (ed.) 1999: *Innovationspolitik in globalisierten Arenen*, Opladen, 43-73.

Meyer-Krahmer, Frieder, 2000: Forschungs- und Innovationsförderung in der Bundesrepublik Deutschland: Stärken und Schwächen im europäischen und internationalen Vergleich, In: *Innovation als Schlüsselfaktor eines erfolgreichen Wirtschaftsstandortes*, Institut für Weltwirtschaft und Internationales Management (ed.), Münster, 113-136.

Meyer-Krahmer, Frieder, 2005: Handlungsspielräume und Modernisierungserfordernisse nationaler Technologie- und Innovationspolitik, In: *Technikfolgenabschätzung – Theorie und Praxis* 1, 12-17.

Meyer-Krahmer, Frieder/Uwe Kuntze, 1992: Bestandsaufnahme der Forschungs- und Technologiepolitik, In: Grimmer et al. 1992, 95-118.

Monopolkommission, 2004: *Wettbewerbspolitik im Schatten „Nationaler Champions". Fünfzehntes Hauptgutachten der Monopolkommission* 2002/2003, Berlin: BT-Drucksache 15/3610 v. 14.7.2004.

Mowery, David C./ Richard R. Nelson (eds.), 1999: *Sources of Industrial Leadership. Studies of Seven Industries*, Cambridge.

Nelson, Richard R. (ed.), 1993: *National Innovation Systems. A Comparative Analysis*, New York / Oxford.

OECD (ed.), 2000: *Science, Technology and Industry Outlook 2000*, Paris.

Ohmae, Kenichi, 1990: *The Borderless World: Management Lessons in the New Logic of the Global Market Place*, London.

Parker, Rachel, 1999: From National Champions to Small and Medium Sized Enterprises: Changing Policy Emphasis in France, Germany and Sweden, In: *Journal of Public Policy* 1, 63-89.

Patel, Parimal, 1995: Localised production of technology for global markets, In: *Cambridge Journal of Economics* 1, 141-153.

Pavitt, Keith, 1998: The inevitable limits of EU R&D funding, In: *Research Policy* 27, 559-568.

Pavitt, Keith/Pari Patel, 1999: Large firms in Europe's innovative activity, In: Gambardella/Malerba 1999, 24-41.

Peterson, John/Margaret Sharp, 1998: *Technology Policy in the European Union*, London.

Porter, Michael E., 1989: *The Competitive Advantage of Nations*, New York.

Powell, Walter W./Kenneth W. Koput/Laurel Smith-Doerr, 1996: Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology, In: *Administrative Science Quarterly*, March, 116-145.

Prange, Heiko, 2003: Technologie- und Innovationspolitik in Europa: Handlungsspielräume im Mehrebenensystem, In: *Technikfolgenabschätzung – Theorie und Praxis* 2, 11-20.

Rammer, Christian/ Wolfgang Polt/ Jürgen Engeln/Georg Licht/Andreas Schibany, 2004: *Internationale Trends der Forschungs- und Innovationspolitik. Fällt Deutschland zurück?*, Baden-Baden.

Rammert, Werner, 1997: Auf dem Weg zu einer post-schumpeterianischen Innovationsweise. Institutionelle Differenzierung, reflexive Modernisierung und interaktive Vernetzung im Bereich der Technikentwicklung, In: Bieber, Daniel (ed.), *Technikentwicklung und Industriearbeit. Industrielle Produktionstechnik zwischen Eigendynamik und Nutzerinteressen*, Frankfurt/New York, 45-71.

Saretzki, Thomas, 1997: Demokratisierung von Expertise? Zur politischen Dynamik der Wissensgesellschaft, In: Ansgar Klein/Rainer Schmalz-Bruns (ed.), *Politische Beteiligung und Bürgerengagement in Deutschland. Möglichkeiten und Grenzen*, Baden-Baden, 277-313.

Senker, J./P. van Zwanenberg et al., 2001: *European Biotechnology Innovation Systems. Final Report* (TSER Project No. SOE1-CT98-117, Oct. 2001).

Simonis, Georg, 1992: Forschungsstrategische Überlegungen zur politischen Techniksteuerung, In: Grimmer et al. 1992, 13-50.

Simonis, Georg/Renate Martinsen/Thomas Saretzki (ed.), 2001: *Politik und Technik. Analysen zum Verhältnis von technologischem und staatlichem Wandel am Anfang des 21. Jahrhunderts* (Politische Vierteljahresschrift: Sonderheft 31/2000), Opladen.

Soskice, David, 1999: Divergent Production Regimes: Coordinated and Uncoordinated Market Economies in the 1980s and 1990s, In: Kitschelt, Herbert et al. (eds.), *Continuity and Change in Contemporary Capitalism*, Cambridge, 101-134.

Weyer, Johannes, 2004: Innovationen fördern - aber wie? Zur Rolle des Staates in der Innovationspolitik, In: M. Rasch/ D. Bleidick (ed.): *Technikgeschichte im Ruhrgebiet – Technikgeschichte für das Ruhrgebiet*. Essen: Klartext Verlag; 278-294.

Weyer, Johannes, 2005: Staatliche Förderung von Großtechnikprojekten. Ein dysfunktionaler Anachronismus im Zeitalter der Globalisierung?, In: *Technikfolgenabschätzung – Theorie und Praxis* 1, 18-25.

Willke, Helmut, 2001: Atopia. *Studien zur atopischen Gesellschaft*, Frankfurt.