Evolution and the Cultures of Science

I

What does the concept of cultures of science mean? A first aspect one should remark on is the preference for the plural. In most cases one will not speak of *the* culture of science but of cultures of science. There may be two cultures, as C.P. Snow proposed fourty years ago.[1] Or one may wish to add a third one, as among others Wolf Lepenies and John Brockman - in very different versions - have recently done.[2] But two, three, four or five, my first point will be that these numbers are by far too small. There are, at least since nineteenth century society, national cultures of science, a phenomenon of quickly receding importance in the presentday globalization of science. And there are - a much more interesting phenomenon - disciplinary and perhaps even subdisciplinary cultures in science, of which one may easily distinguish thirty, fourty or more. One will find this understanding for example in an essay by Clifford Geertz from 1983, called „The Way We Think Now", in which an ethnography of scientific cultures along lines well-established in cultural anthropology is proposed.[3] This program has not yet been realized in science studies. The reason for this probably is that the cognitive focus of laboratory studies, the approach which was somehow dominant in science studies in the last ten to fifteen years, is much more „micro" than a cultural analysis of science would suggest.

Up to now I have only made a quantitative proposal. There are many more cultures in science - and „science" here always means the inclusive German concept of „Wissenschaft" - than normally is reckoned with. This seemingly formal point in my view already has considerable consequences. If there is a sufficient number of cultures in science the commonplace talk on disintegration, fragmentation and cultural disjunctions in science no longer seems to make any sense at all. Instead there are

[1] Snow 1965.
[2] Lepenies 1985; Brockman 1995.
[3] Geertz 1983.

overlapping neighborhoods and integration by intersecting lines of fragmentation, a theoretical hypothesis well-established in differentiation theory since Georg Simmels „Über soziale Differenzierung“ from 1890.[4] Referring to science Donald T. Campbell made the same point in a convincing essay published in 1969.[5] Campbell called this model the „fish scale model of omniscience“, and the metaphor of fish scales for him reproduced the picture of overlapping neighborhoods. If you take this diagnosis serious then there is no common core in science, no centre of universal relevance, but local integration happens everywhere and proves to be sufficient.

Even if we accept this hypothesis of a plurality of cultures in science and its integrative effects, therefrom we do not yet know what is to be understood by a *culture in science*. What is culture? Especially if one is looking for science as culture one point is easily to be seen. The concept of culture can not mean the totality of a social system and it means neither an objective domain of social reality to be distinguished from other objective social domains. Instead it should signify a specific point of view, a way of observing and self-observing a social system. In the next step I want to point out some constitutive features of this way of observing which observes reality as culture.

A first point is *reflexivity*. Culture seems to be a specifically modern concept only emerging in eighteenth century society which has to do with self-analysis, self-observation, and the reintroduction of observations into the domain to which they refer. Culture is a way of knowing something about oneself and acting on the basis of this knowledge. This is closely related to *contingency* as a second constitutive feature. If one observes something as culture one observes it in comparison to alternative possibilities, alternative cultures realized elsewhere.[6] A French culture of *la cuisine* distinguishes itself from other regional cultures of eating. That is in perceiving something as culture one makes the pervasive experience that one could act otherwise, and one then perhaps decides not to do it, to hold to one‘s own culture instead. These first two features are somehow problematically related to a third one: *latency*. Culture is often observed to be latent and latency implies one can not observe

[4] Simmel 1890.
[5] Campbell 1969.

one‘s culture oneself. Even latent culture is normally considered to be a kind of knowledge which is then called *tacit knowledge* or *incorporated culture* in concepts such as Bourdieus *habitus*. Another probable implication of latency is the long-term stability of culture which means that culture changes slower than other aspects of social structure. One can not easily harmonize this conceptual tension of *reflexivity/contingency* versus *latency*. To me the most plausible interpretation would say that cultural analysis means any analysis for which reflexivity/contingency vs. latency functions as the guiding distinction. This is even true for the self-observation of culture which under modern circumstances is always interested in the potential reflexivity of latent structures.

There is one more feature of culture I would like to mention. In a conceptual tradition which derives from Georg Simmel, again, one may say that the concept of culture refers not to properties one shares with every other person neither to properties one shares with only few others. Instead culture is characteristically shared with *some* others[7] and in this respect culture is a phenomenom of intermediate generality which establishes once more why the existence of a plurality of cultures should always be expected.

II

If I take a first resumé at this point the following can be said: There exists a considerable and increasing variety of disciplinary and subdisciplinary cultures in science which may be characterized by the tension or duality of reflexivity/contingency vs. latency characteristic of the phenomenon of culture. Even in describing it so far there is not much similarity to the picture of science debated since C.P. Snow. In the next step I will now introduce transcultural phenomena in science. There are mainly two: *interdisciplinarity* and *transdisciplinarity*.

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[6]Cf. especially Luhmann 1992, 1995.
[7]Cf. Wallerstein 1991, 158.

Interdisciplinarity is a term which means a great number of different phenomena. Among them are the transfer of concepts, methods and instruments between disciplines and the practice which is today an everyday phenomenon of cooperative ventures between scientists from different disciplinary backgrounds. What is more, interdisciplinarity nowadays seems to have become a well-established expectation towards science practiced in a context of research funding by various agencies. If you look at the German context which I know best wherever you are looking for research funding - in the „Sonderforschungsbereiche“ of the DFG or the programs of the great research foundations such as Volkswagen, Thyssen, Bosch and Bertelsmann - there is always the expectation to show that there is a significant interdisciplinary component in your research. You may object that this is only window dressing, that interdisciplinarity is not really practiced in everyday activities. But then I would say that you may not expect from social systems more than expectations. That is the stuff they are made of; expectations are their way of structure formation; and all of them are to police only with great difficulties. The difference interdisciplinarity makes to disciplinary cultures is easily to be surmised: there is a certain blurring of disciplinary boundaries and an internal diversification of disciplinary cultures. What this means to the cultures of science can be understood by a hypothesis which was always central to Talcott Parsons‘ theory of culture.[8] Culture has then to become more general, more abstract, in order to be able to be inclusive of a greater variety in a social system.

What then is transdisciplinarity? This notion points to conceptual structures characterized by a generality which takes them from the conceptual domain of any specific scientific discipline. Cybernetics probably is a good example for this. As can be seen in the case of cybernetics it is an empirical and historical question if a transdisciplinary conceptual domain and its social infrastructures will be differentiated as a scientific discipline in its own right. In the case of cybernetics this seems not to have happened.[9]The distinction of interdisciplinarity and transdisciplinarity obviously is a relative one and implies shifting boundaries. As long as a successful conceptual structure can be attributed to a specific disciplinary domain its interactions and

[8]Parsons 1961, 1973.
[9]Cf. Riedl 1998.

external cognitive effects will be classified as interdisciplinarity. As will be seen in the case of evolution this distinction of interdisciplinarity and transdisciplinarity is not only a classificatory question of limited social import but refers to differences which really can matter. Transdisciplinarity as well as interdisciplinarity are well-established structures of influence processes in science. Both of them are a constitutive part of the culture of twentieth century science, and by the way point to the fact that there are cases in which one may sensibly speak of the culture of modern science in the singular.

III

I will now turn to evolution. Evolution seems to be the conceptual innovation in nineteenth century and twentieth century science which has by far the most extensive inter- and transdisciplinary effects. Of course, there are other cognitive revolutions in science of equal intellectual dignity, say relativity and quantum theory or systems theory and some might think of deconstruction. But whatever one thinks about one of these cases, in each of them the intellectual effects are much more limited to a specific cluster of disciplines. That makes evolution an interesting case for study. And, to add one more introductory argument, the inter- and transdisciplinary effects of evolution obviously do not unify science. It is much more true to say that they still polarize scientific fields.

Evolution was almost from its beginnings in 1859 an inter- and transdisciplinary conceptual success, although one might point out that in this first half century of evolutionary theory the disciplinary structure of science was not yet articulated in an extent comparable to the present situation. What may have resulted from this was a somehow ideological reception of Darwinism which from Haeckel to Spencer was often biased towards evolution as a worldview more than to evolution as a conceptual model for disciplinary research processes. When James M. Baldwin in 1909 reviewed the first fifty years of Darwinian influence in his "Darwin and the Humanites"[10] this

[10]Baldwin 1909.

ideological misappropriation of Darwinism had already happened and was than to prove as an intellectual burden to evolutionary thinking ever since.

But, I will not try to review the history of evolution, here. Instead, I will focus on the interaction of evolutionary thinking and the intellectual cultures of science in the presentday situation. A first point is to note the fact that we have a remarkably complete roster of Darwinisms in the contemporary intellectual disciplines. From evolutionary economics to behavioral ecology in archaeology to theories of mind and brain and synthetic chemistry there is nearly no intellectual discipline in contemporary science in which we will not find theories, models and methodologies based on an import from evolutionary thinking. Often there are competing evolutionary models in one and the same discipline, as for example the conflicting interpretations given by sociobiology and behavioral ecology in archaeology.[11] Referring to this astonishing roster of Darwinisms in many disciplines I am going to discuss in the following three main points:

1. Different conceptual patterns of integrating evolutionary thinking in scientific disciplines;
2. The transfer from interdisciplinary contexts to a transdisciplinary status of evolutionary theory and its implications;
3. Social structural effects on scientific disciplines involved with evolutionary models.

1. There are interesting differences between scientific disciplines in the patterns of integrating evolutionary concepts. They give us a first look on the influence of evolution on the cultures of disciplines. I will distinguish three possibilities: *reductionism, analogies, disanalogies*. Reductionism is the oldest, so to speak classical possibility. It conceives of evolution as a biological theory and subsumes the discipline in question under biological concepts. Natural selection in a biological sense is then the paradigm case. You have this in sociobiology and in the newly emerging field of evolutionary psychology, today.

[11]Boone/Smith 1998.

The thinking in analogies is of more recent origins. This is an interesting test case as the scientific legitimacy of analogies is a contested phenomenon. There are numerous alternatives, again, which represent different understandings of the sense of "evolution". A first understanding bases analogies on trends. Evolution then suggests analogous trends in different domains of reality. Progress, complexity, growth often functioned as plausible candidates for such evolutionary trends. In a remarkable shift this argumentative pattern is today normally reversed. What is instead made plausible by evolutionary analogies is that there are no trends: no progress, no increase of complexity, no growth of systems.

The intellectual successor to evolutionary trends are evolutionary mechanisms or processes in a terminology you find in Donald T. Campbell among others.[12] As such mechanisms function variation or mutation, selection or natural selection, retention or stabilization. One may look for analogues to these in any scientific field whatsoever. And then there are more specialized mechanisms added such as Stephen J. Goulds exaptation which means the cooptation of an old trait which perhaps was adaptive in the past for a new function.[13]

A more reflexive twist is given to this interest in mechanisms of evolution by the comparatively recent theme of evolution of evolution. You find this as a prominent interest in such dissimilar authors as Richard Dawkins and Niklas Luhmann.[14] How do evolutionary mechanisms arise in the first place, how do they separate and do therefrom develop the conditions of their interplay then becomes the guiding question.

So much on *analogies* which are obviously the dominant mode in presentday evolutionary thinking pushing back reductionisms which continue, of course, and have their legitimate fields of application.

A third mode of integrating evolutionary concepts may be called *disanalogies*. I already pointed to a similar strategy in the case of evolutionary trends in which one

[12]Cf. Campbell 1988.
[13]Gould/Vrba 1982.

tries to gain knowledge by the use of negations. Certain trends such as an increase of complexity do not happen and we want to know why. It is nearly the same practice in handling disanalogies. One concentrates on certain *disanalogies* - for example these is no social analogue for the seemingly identical replication of genes - and starting from this, one works out a different but related domain-specific theory.[15] Again, this liberalization of the conceptual space may open the way for a more complex Darwinian vocabulary.

One can easily prolong this list of modes of integrating evolutionary concepts. One important point regards *temporality*. In some cases one primarily imports from evolutionary theory a certain kind of temporal structure. The frequent usage of "punctuated equilibrium" is a case in point. What one means by this is a sequence of first long-lasting stasis and then sudden surges of changes and transformations in a specific domain. Another interesting case is the strange interest in history and archeology which a normally present-minded field such as psychology suddenly acquires when a researcher opts for evolutionary psychology.[16] In evolutionary terms the causally relevant context for any feature of human consciousness one wants to explain is the so-called "environment of evolutionary adaptedness" in which this feature first arose. That may mean that a hard-nosed experimental psychologist unexpectedly begins to become a specialist for hunter-gatherer-societies. That is disciplines acquire a deep structure of evolutionary time to which this was not known before.

I will now turn again to inter- vs. transdisciplinarity. As long as evolutionary biology functions in a self-evident way as the reference context for evolutionary thinking we always have to do with interdisciplinary exchange between two disciplines which may be reciprocal by the way as is easily to be seen in the case of the career of game theory in evolutionary biology. In such bilateral exchange there is then always the

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[14]Dawkins 1995; Luhmann 1997, Ch. 3.

[15]An interesting case in point is the French anthropologist Dan Sperber who denies the possibility of a cultural analogue to replication but believes in the validity of the Darwinian tradition and therefrom derives an original approach of his own which he calls an epidemiology of beliefs. See Sperber 1990, 1996.

aspect of metaphors from a foreign discipline seen either as suggestive and therefore useful or as problematical in their implicit contents.

But this obviously changes when evolutionary theory is no longer seen as primarily a biological knowledge tradition with interdisciplinary exports but ever more as a transdisciplinary conceptual structure for which biology is no longer the privileged context of its use and adaptation. There is a plurality of trends in this direction to be seen. I will mention three: First, there are ever more essays to formulate evolutionary theory as a general selection theory which is based on some elementary presuppositions such as a repertoire of elements in which variations happen, encounters with an independently changing environment which effect internal selection; the differential amplification and reproduction of some elements and so on.[17] In formulations in this vein there is no privileged domain of application specified. A second trend of rather great prominenceis the research on artificial life or evolutionary algorithms, that is the computer simulation of evolution in artificial population of elements.[18] This is a new experimental technique of its own, and its transdisciplinary status is obvious. As a third trend may be mentioned the numerous attempts to reformulate evolutionary theory via self-organization theory which again has the effect to abstract the conceptual structure from the biological domain.[19] This transdisciplinary reformulation of evolution obviously has the advantage to make evolutionary theory more flexible for respecification in different disciplinary directions. On the other hand there is a loss of vividness, of suggestive images, and of ecological thinking which embeds the domain of one's own discipline into other domains of infrastructural relevance. Therefore it is to be supposed that transdisciplinarity always will have to be balanced and supplemented by bilateral exchanges between disciplines who experiment with evolutionary concepts.

I will only make a few concluding remarks on my last subject: effects of evolutionary concepts on the social structure of disciplines: Again various patterns are to be

[16]See Cummins/Allen 1998.
[17]Cf. Darden/Cain 1989; Edelman 1987.
[18]See Koza 1992.
[19]Cf. Depew/Weber 1997.

observed: Often there is still a polarizing effect on disciplines which separates friends and foes of evolutionary thinking. The historical reasons for this are well known and this was intensified or renewed by the sociobiology of the seventies. Cultural anthropology may be a case in point because on the one hand it has a strong tradition of evolutionary theories of its own own, and on the other hand an often hostile, interpretative countercurrent. Other effects besides polarization are the diversification and pluralization of theoretical options in a discipline. In my own discipline, sociology, it is different again. As you know this is a discipline with numerous universal theories from symbolic interactionism to rational choice. Evolution is not present as a theoretical option in its own right, but more as a constraint on all of those theory building ventures. They have to find a place for it, otherwise it is a disadvantage in the competition of theoretical paradigms.

Again a different social structure is the interrelation of orthodoxy and opposition. This is perhaps the case in economics where you find a strong neoclassical orthodoxy and evolutionary economics as one name for the role of the loyal opposition. This hs the consequence that in itself "evolutionary economics" is extremely diversified. I will conclude here: What my arguments may have demonstrated in a first approximation is that there is no longer a small number of homogenous and closed scientific cultures, and that evolution is one core concept in building crosscutting alliances, blurring of clearcut cultural lines and integrating science by intersections, contacts and transfers.

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