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Habitus and Utopia in Science:

Bourdieu, Mannheim, and the Role of Specialties in the Scientific Field

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Abstract: Pierre Bourdieu has claimed that his concept of the habitus resolves the objectivism/constructivism debate in the sociology of science. While institutional norms require that scientists maintain a disinterested attitude, studies have revealed that scientists often fail to live up to the normative standard of disinterestedness, sometimes becoming highly tendentious to promote their own work. Bourdieu resolves the interested/disinterested paradox by claiming that scientists promote their own personal interests through objective science. This is supposed to be the consequence of the scientific habitus, which ensures that the biases of the scientific field remain invisible to scientists who operate within it. The concept of the habitus is central to Bourdieu's theory of science. However, it has suffered from two major shortcomings: 1) the scientific field is made up of clusters of specializations which are shaped by interactions with each other, and the habitus does not account for these mesolevel interactions; 2) it can only account for *reproduction* of the scientific field and therefore ignores the mechanisms which produce change. I argue that Karl Mannheim's sociology of knowledge may be employed to better understand how the properties of scientific specialties both reproduce interested and disinterested behavior among scientists and facilitate change in particular specialty areas.
Key words: Pierre Bourdieu; Karl Mannheim; Habitus; Utopia; Field Theory; Specialization; Constructivism; Objectivism; Scientific Change

Pierre Bourdieu (1975, 2004) has claimed that his concept of the scientific habitus resolves the objectivism/constructivism debate in the sociology of science. While institutional norms require that scientists maintain a disinterested attitude (Merton, 1968), empirical work in the sociology of sciencehas revealed that scientists often fail to live up to the normative standard of disinterestedness, sometimes becoming highly tendentious to promote their own work (Arthur, 2009; Frickel, 2004; Frickel & Gross, 2005; Fuchs & Plass, 1999; Griffith & Mullins, 1972). Bourdieu contends accepting the legitimacy of scientific knowledge at face value, and conceptualizing it as politics by other means, are two unsatisfactory options. Clearly, the production of scientific knowledge is shaped more by political forces than positivistic accounts have acknowledged (e.g., Collins & Pinch, 1998). Yet Bourdieu warns against throwing the baby out with the bathwater; it is equally misleading to overlook the role the disinterested scientific attitude plays in how scientists produce knowledge (Bourdieu, 1990).The commitment to disinterested, objective science, and the demonstrated role that interests play in the

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construction of scientific facts (Latour & Woolgar, 1979; Latour, 1987) result in a paradox of motivation.Bourdieu resolves the interested/disinterested paradox by claiming that because disinterestedness is a regulatory norm, scientists promote their own personal interests through objective science. Bourdieu points out that, in the scientific field, consumers of scientific products are also the producer's rivals, and this rivalry is played out by constantly pushing one's self, and one's opponents, to better conform to scientific rationality (2004). In this way scientists exhibit interested behavior while simultaneously adhering to the norm of disinterestedness. The theoretical advancement that is supposed to explain simultaneous interested and disinterested behavior is the scientific habitus, which ensures that the biases of the scientific field remain invisible to scientists who operate within it. The habitus is a social-psychological framework for scientists to appraise new scientific developments that is based on communally agreed upon standards. Because the habitus is a consequence of existing norms, it reproduces the scientific field by providing a template for behavior that is based on preexisting expectations (Bourdieu, 2004).

Scientists pursue their own interests by subjecting their rivals to exacting standards of scientific rationality imposed by the habitus (Bourdieu, 2004). Each new piece of information that is relevant to a scientist's own career can be interpreted as corroborating or contradicting his or her own research program, and Bourdieu proposes that scientific rationality is a weapon used by scientists to neutralize scientists who make contradicting claims, and assimilate scientists who make corroborating claims. But scientists involved may not necessarily be aware that they are using rationality in a partisan way; because disinterestedness is an integral element of scientific rationality, scientists can use it to pursue their own interests while simultaneously being committed to disinterestedness. Bourdieu thus claims that a kind of positivistic scientific rationality plays a role in the accumulation of scientific knowledge, but also acknowledges that the scientific field is stratified by non-scientific factors (i.e., personal interests). The chasm between scholarship which assumes scientists engage in disinterestedness and that which characterizes science as politics by other meanshas traditionally been wide and that Bourdieu has been able to reconcile these views is a major achievement.

The concept of the habitus is central to Bourdieu's theory of science, but it suffers from some major shortcomings: Firstly, Bourdieu fails to account for an integral element of the structure of the scientific field: specializations. Scientific specialties are clusters of scientists who share common interests and who work toward common goals. Specialties are one of the most salient elements of intellectual and professional identity among scientists (e.g., Griffith &Mullins, 1972; Mullins, 1972, 1973; Lermaine, MacLeod, Mulkay & Wiengart, 1976;Hargens, Mullins & Hecht,1980; Glaser, 2001; Frickel & Gross, 2005), and so an account of the scientific habitus cannot overlook the effect participating in a specialty has on establishing the scientists' interests. Moreover, the habitus associated with a specialty is in part shaped by that specialty's interaction with other specialties and other parties outside of the scientific field. Individual scientists do not compete for scientific capital as individuals alone; they do it in the context of the particular specializations in which they participate, and these specializations have a logic which shapes the scientific habitus at a higher level of analysis than practices involved with developing and carrying out individual research projects. Bourdieu's field theory of science would explain more if it could account for the properties of specialties and the way they interact with other groups.

Another shortcoming of the habitus as applied to science is that it can only account for *reproduction* of the scientific field and therefore ignores the mechanisms that produce change. Bourdieu has often been accused of focusing too much on social reproduction and not enough on social change. This criticism is especially relevant when applied to the scientific field, which has mechanisms designed to facilitate change built into its logic (i.e., organized skepticism; Merton, 1968). If the habitus is to retain explanatory power in the field of science, it must account for changes in the scientific field.

I will argue that Karl Mannheim's sociology of knowledge may be employed to better understand the relationship between scientific specialties and the scientific habitus. I will also argue that Mannheim's conceptualization of utopianism can help explain how the scientific habitus both reproduces the scientific field and simultaneously facilitates its evolution. Mannheim's structural perspective and his analysis of the relationship between thought structures and group positions provide theoretical insights into Bourdieu's field theory of science. The key insights which Mannheim offers to Bourdieu's field theory are that utopian thought is critical, ideological, and based on group positions. From this

Mannheimian perspective, the scientific habitus is shaped by the collective experiences of scientists within their own specialties, including interactions with other groups, both inside and outside of science. Moreover, the progressive orientation of scientific utopias ensures a scientific field which is not just reproduced, but in constant flux. These insights will be applied to a well-known case study in the sociology of scientific specializations, Scott Frickel's *Chemical Consequences* (2004). In this book Frickel shows how genetic toxicologists came to define and redefine their own scientific field, and it serves as an example of how Mannheimian insights can be applied to Bourdieuian field theory.[2]

BOURDIEU, FIELD THEORY, AND THE SOCIOLOGY OF SCIENCE

Bourdieu's field theory is a general theory that has been used to explain myriad social phenomena. The three core concepts in Bourdieu's field theory are "field", "habitus", and "symbolic capital" (Bourdieu, 1977). The field represents all individuals within a more or less autonomous social world who have interests and compete for resources, in particular symbolic capital. Each field has its own logic (what Bourdieu calls "specificity") that is determined by the regularities of behaviors of the individuals who participate in the field. Conditions for entry into a field are *competence* (the ability recognize, react to, and ultimately internalize the regularities of the field) and *belief* (basic properties of the field will not be questioned; this secures the autonomy of the field) (Bourdieu, 2004). The idea of a "field", a metaphor taken form physics, is that diffuse "forces" surrounding an object have the capability of changing that object. A field is "the local social world in which actors are embedded and toward which they orient their actions" (Sallaz and Zavisca, 2007: 24). In his review of field theory, Martin explains, "In the social sciences, the field serves as some sort of representation for those overarching social regularities that may also be visualized (by competing theoretical orientations) as quasi-organisms, systems, or structures" (2003: 8). Individuals in a field share a relationship to each other through a shared logic, goals, and recognized forms of legitimate compensation and reward. Fields have "rules for how to play, stakes or forms of value (i.e., capital), and strategies for playing the game. In the process of playing, participants become invested in and absorbed by the game itself" (Martin, 2003:24). While the struggle for resources is a "game" with "rules", the concept of "rules" in a field refers to the patterned behaviors of the actors within it who choose the behaviors which bring the most rewards, not formal decrees. A field is comprised of"a set of assumptions always vulnerable to deliberate upset via surprise" (Martin, 2003: 32); that is, the rules can be broken. More technically, when the field changes in such a way that the old patterns of behavior are no longer profitable, actors will adjust their behavior accordingly and the patterns will change, bringing about new "rules of the game".

The most important reward at stake in a field is symbolic capital. Symbolic capital is a universally agreed upon reward or item of value relevant to a field. Anything can serve as symbolic capital if people recognize its unequal distribution as legitimate (Bourdieu, 1991: 118). In the labor market symbolic capital may refer dirtiness/cleanliness of a job or the flexibility of the work schedule; in science symbolic capital may refer to publications in elite journals or access to elite methods or equipment. By emphasizing the importance of symbolic capital Bourdieu does not deny the importance of material conditions, but argues that all rewards, including material, will flow to those who have the symbolic authority to possess them.

In Bourdieu's field theory the regularities that constitute a field become internalized by the individuals, and the structure of thought is shaped by these external forces. This internalization of social structure is termed the habitus. The habitus is defined by Bourdieu as a set of "durable, transposable dispositions" (1991: 53). It "is less a set of conscious strategies and preferences than an embodied sense of the world and one's place within it—a tacit 'feel for the game'" (Sallaz and Zavisca, 2007: 25). The habitus is theoretically useful because it is a social-psychological concept which accounts for the reproduction of

[2] Scott Frickel did not draw upon Pierre Bourdieu or Karl Mannheim in his analysis of chemical mutagenesis in *Chemical Consequences*. My own thesis is based entirely on my own use of their ideas to interpret Frickel's empirical findings.

social structure. The habitus is best thought of as a kind of coupling connecting the individual to the logic of the field. It determines the structure of an individual's consciousness in such a way that resources required from the individual to maintain social structure, and the rewards the social structure delivers to the individual for cooperation, may be exchanged with the least amount of disruption, to the point that an individual's habitus goes largely unnoticed by the individual until the field's autonomy is threatened by external powers (Bourdieu, 1977). Consequently, the habitus enables the social structure of the field to be reproduced, at the same time that the field determines the shape of the habitus.

Bourdieu applied his brand of field theory to many areas of social life, including the scientific field. In the field of science, symbolic capital derives from access to and skill in the most prestigious objects, methods, theories, and equipment. The "rules of the game" are shaped by the strategies scientists need to have to secure this scientific capital (including securing the right mentors and colleagues, learning the right methods, using a specific kind of technical language, etc.), and the scientific habitus determines which kinds of scientific problems are the most important, and what will be taken for granted. The scientific habitus is supposed to reproduce structures of power within the scientific field by setting priorities which benefit those who already have disproportionate access to scientific capital (Bourdieu, 1975, 1988, 2004).

Bourdieu claims that his concept of the habitus resolves the objectivism/constructivism debate in the sociology of science. He points out that, in the scientific field, "producers tend to have as their clients only their most rigorous and vigorous competitors, the most competent and the most critical, those therefore most inclined and most able to give their critique full force" (2004: 54), and this rivalry is played out by constantly pushing one's self, and one's opponents, to better conform to scientific rationality. In this way scientists exhibit interested behavior while simultaneously adhering to the norm of disinterestedness. The solution he offers is, essentially, that being "objective" is part of the "rules of the game" in the scientific field, and so scientists actively try to play the disinterested part, though because of their habitus that "objectivity" is biased in a direction which reflects their interests. Therefore, scientists can be objective while simultaneously being biased; their strategies are inseparably social and scientific."It follows", Bourdieu argues, "from a rigorous definition of the scientific field as the objective space defined by the play of opposing forces in a struggle for scientific stakes, that it is pointless to distinguish between strictly scientific determinations and strictly social determinations of practices that are essentially *overdetermined*" (1975: 21).That is, the logic of the scientific fieldengenders a habitus which motivates scientists to adopt norms of scientific objectivity, but at the same time biases standards of objectivity toward the individual interests stemming from participating in a certain place in the field. Scientists are committed to a particular way of doing science, and attempt to produce objective, scientific results within the limits of their habitus.

Despite the utility of the concept of the habitus in science, Bourdieu's discussion of how the habitus is constructed from experiences in the field is limited. The scientific habitus is treated as a universal construct governing the relationship between the logic of the scientific field and individual scientists, but little attention is given to how scientific expectations dictated by specific research specialties produce the habitus. Bourdieu's major empirical research on scientific capital, published as *Home Academicus* (1988), compares only broad disciplinary orientations (law, medicine, science, and the arts) within academia, and fails to examine specific research programs and how they shape the positions and dispositions of the scientists who work within them. The scientific habitus is supposed to reflect a relationship between individual scientists (the habitus is essentially a social-psychological concept) and the organization of the scientific field as a whole, but Bourdieu pays little attention to the mesolevel aspects of scientific organization which play a major role in shaping scientists' professional experiences and identities. Scientists form groups which are at a lower level of analysis than the field as a whole, but which play a part in what they will consider to be important, and what they will be likely to overlook.

Furthermore, Bourdieu's field theory has been attacked on the grounds that the habitus only accounts for reproduction of the field and cannot account for change (e.g., Gartman, 1991, Alexander, 1995, Griswold. 1998). Critics argue that" the interlocking concepts of field, capital, and habitus depict an airtight system in which structures produce individuals who in turn reproduce structures" (Sallaz and Zavisca, 2007: 25). Bourdieu has responded by citing changes in particular fields, such as revolutionary Algeria, where the everyday world can no longer be taken for granted. Situations such as these create

"space for symbolic strategies aimed at exploiting the discrepancies between the nominal and the real" (Bourdieu, 1984: 481). But events such as the drastic reorganization of society are rare, and do not account for changes in fields outside of such contexts. In cases such as political revolutions, Bourdieu's field theory does not so much explain changes in the field as is does excuse itself from extraneous circumstances.

The remainder of this paper will be given over to addressing these shortcomings in Bourdieu's field theory of science. Although it is seldom acknowledged, Karl Mannheim and Pierre Bourdieu share fundamental views on the relation between social position and knowledge, and I will argue that Bourdieu's field theory can be enriched when a Mannheimian analysis of group positions is taken.

MANNHEIM, IDEOLOGY, AND UTOPIA

With the publication of the original German edition of *Ideology and Utopia* in 1929, Karl Mannheim grew to be an influential social theorist within the German speaking world. Mannheim's contribution was to redefine how thinking and knowledge were to be considered in reference to social structure. Mannheim's sociology of knowledge argues that styles of thought are a consequence of lived conditions, that lived conditions are organized according to sociological categories, and that each sociological category's style of thought is shaped by interactions with others (1936). Knowledge, he argues, "is from the very beginning a co-operative process of group life, in which everyone unfolds his knowledge within the framework of a common fate, a common activity, and the overcoming of common difficulties (in which, however, each has a different share)" (1936: 29). The Mannheimian sociology of knowledge specifies that the "individual is born into a world where political and social ideas are already preformed into patterns and have a structure which is independent of the individual" (Turner, 1995: 721), and thus the individual takes on the characteristics of thought which are a consequence of the group outlook within which he is situated. From this perspective, the unique experiences of particular groups give rise to corresponding modes of thinking.

These modes of thought simultaneously exist among other modes of thought stemming from other social groups. One characteristic feature of Mannheim's sociology of knowledge is its reliance on structural analysis: the style of thought corresponding to a particular group cannot be understood without reference to the ideas of other social groups with which it interacts. Groups "do not confront the objects of the world . . . as solitary beings. On the contrary they act with and against one other in diversely organized groups, and while doing so they think with and against one another" (Mannheim, 1936: 4). This structural relationship between modes of thought stemming from the concrete experiences of different social groups results in competition over what Mannheim calls "the correct social diagnosis" (1952: 196); different groups compete for control over what counts as the proper perspective on the social condition.

These modes of thought, however, do not arise arbitrarily from social conditions but tend to reflect the various interests of the groups from which they spring. The ideas flowing from a particular group tend to justify the interests of that group, and so contain an element of incongruence with the structure of the intellectual field as a whole. In this sense, ideas become ideologies which imperfectly reflect reality. Mannheim builds on Marx's critique of bourgeois ideology, in which Marx had identified political liberalism as a justification for capitalist relations of production. He acknowledges the significance of Marx's insight, crediting him as the first to give systematic attention to how ideas are a reflection of lived conditions (Mannheim, 1936: 72-5). However, Mannheim faults Marx for claiming to attack liberalism from a politically neutral position. Marxism, Mannheim argues, is no less an ideology than liberalism, even if it represents the conditions of a different class of people. To Mannheim, ideologies cannot be avoided because they are the intellectual dimension of lived experience.

Mannheim's theory of ideology considers several levels of ideological consciousness. An awareness of a *particular* ideology corresponds to the realization that an individual opponent is making use of biased ideas to justify interests. *Total* ideology shifts the focus to the collective, exposing the biases of thought in the ideas of whole social groups. Those who make use of the *special form of the total conception of ideology* only expose as ideological those ideas which correspond to groups other than

one's own; Mannheim locates orthodox Marxism here. Finally, the g*eneral form of the total conception of ideology* subjects all points of view, including the analyst's, to sociological analysis (see Mannheim, 1936:Ch.2). According to Mannheim, the general form of the total conception of ideology is the proper domain of the sociology of knowledge because it treats all ideas as emerging from concrete existence, and so it gives special privilege to none. From the Mannheimian perspective, ideology loses its negative connotation and becomes a constitutive element of social life, a necessary consequence of existence. Because each particular group is situated in a unique position relative to the entire intellectual landscape it can only formulate ideas consistent with that position, and so ideology is merely a way of making sense of the world within the limits imposed by social structure. This is what Rayner has referred to as the "neutral" conception of ideology which "dispenses with the idea that ideology is parasitic upon existing disciplines such as history or science and can be understood negatively as a simple falling-away from well-understood standards of truth or rationality" (1989: 375). Ideology, then, is incongruence, but one which cannot be separated from concrete existence.

In defining ideology as incongruence between ideas and reality, Mannheim includes utopianism as a special kind of ideology that is directed at social change. Ricoeur has recognized the significance of this synthesis, noting that Mannheim "was perhaps the initial person to link ideology and utopia together under the general problematic of noncongruence [*sic*]" (1986:159). The difference between ideology and utopia, however, may be found in their differing political aims: ideologies justify and perpetuate extant social arrangements, while utopias "tend to shatter, either partially or wholly, the order of things prevailing at the time" (Mannheim, 1936: 192). Both ideologies and utopias are incomplete interpretations groups make of a larger intellectual landscape of which they have only a partial view. The difference is thatideologies function to maintain social stability while utopias press for social change. Mannheim executes a slight redefinition of the term which was coined by Thomas More in 1516. To Mannheim, utopian thought is not confined to stories of places that are "no place" but encompasses all forms of thought which intend to alter social relationships as they stand.[3] He "goes out of his way to reject the popular meaning of utopia as wish fulfillment, or a hope or dream that is in principle unrealizable" (Kumar,2006: 173). Instead of utopias being defined as unrealizable, Mannheim insists that they are the vehicles of social change, the modes of thought which work to discredit the ideologies which legitimate the status quo. Utopias are "those ideas and values in which are contained in condensed form the unrealized and the unfulfilled tendencies which represent the needs of each age. These intellectual elements then become the explosive material for bursting the limits of the existing order" (Mannheim, 1936: 199). Because utopian thought is defined by Mannheim as a program for altering existing conditions, utopianism is inseparable from purposeful change; it is the very embodiment of it. As such, it is a primary component of a dynamic society. Ricoeur summarizes Mannheim's position:

> If we could imagine a society where everything is realized, there congruence would exist. The society, however, would also be dead, because there would be no distance, no ideals, no project at all. Mannheim fights against those who claim – and herald – that we are now living in the time of the death of ideology and utopia. The suppression of noncongruence, the suppression of the disconnection between ideals and reality, would be the death of society (1986: 180).

However, as a form of incongruence, utopias suffer the same shortcomings as ideologies. Because, like all ideologies, they are espoused by social groups who may only think within the bounds which their social structural position permits them to, utopias fail to grasp the total social landscape, and are always responses to perspectives which only partially grasp reality. Mannheim argues that utopian groups "are intellectually so strongly interested in the destruction and transformation of a given society that they unwittingly see only those elements in the situation which tend to negate it. Their thinking is incapable of correctly diagnosing an existing condition of society" (1936: 40). And so utopian modes of thought *tend to treat as factual only those elements of reality that are congruous with its own perspective*. This is what Roy Jacques has called "crypto-utopia," or a brand of utopianism which fails to acknowledge the situatedness of its claims; it is "a form of idealized vision of the world that pretends not to be a vision at

[3] Thomas More's original coinage of the term "utopia" was a play on the Greek words "outopia" and "eutopia", the former meaning "the place that is nowhere" and the latter meaning "the good place".

all" (Jacques, 2002: 31).

As Mannheim repeatedly emphasizes, the incongruence between ideas and reality need not take the form of a conscious deception. At the heart of Mannheim's structural analysis of group positions lies his conviction that any particular group cannot develop a worldview which incorporates the perspectives of all other groups. This is because modes of thought are informed by concrete existence, and different groups are existentially disparate. While purposeful deception may of course be employed to further interests, Mannheim's sociology of knowledge states that chicanery is only incidental to ideologies. It is the disparate experiences of different social groups which ensure that a comprehensive view of reality is not attainable, and so members of such groups may act in accordance with their particular ideologies and all the while respond to nothing more than the facts as they see them.

Mannheim views political utopias as evolving as the prevailing social cleavages shift throughout history. In his particular historical schema outlined in *Ideology and Utopia* (1936; the page numbers cited below refer to this book) there have been four major political utopias: orgiastic chiliam, liberal humanitarianism, conservatism, and socialism/communism. Orgiastic chiliasm, an Anabaptist tradition founded by the early Reformation-era theologian Thomas Munzer, is characterized by absolute presentness. "For the real Chiliast, the present becomes the breach through which what was previously inward bursts out suddenly, takes hold of the outer world and transforms it" (p.215). As an aspatial, atemporal utopia, in which the here-and-now is elevated to ecstasy through spiritual means, it anticipates absolute bliss to break from the situation at any moment. This type of untopianism, Mannheim argues, stems from the conditions of the medieval peasant, who is unfamiliar with organized political revolution and therefore cannot envision a utopian world, but can merely wish for a miraculous alleviation of suffering at any moment.

Liberal humanitarianism's utopia, however, is characterized by the "idea", or an idealized set of circumstances (generally organized around political and economic freedom) which political action must always strive toward. In this sense, liberal humanitarianism takes a much more temporal orientation to utopia, in that it can only be totally achieved sometime in the distant future. The liberal humanitarian utopia is associated by Mannheim with the ascending bourgeoisie during the Enlightenment, who took an evolving view of the improvement of political relations as a justification for abolition of the *Ancién Régime* of both monarchy and religion, and for capitalism's nascent but undeniable advance, which posed an obvious threat to the old order and was tightly bound up with the idea of progress.

Conservatism is argued to be a reaction to threats to the existing order made by utopian movements. As a reaction, conservatives construct counter-utopias, in which extant social relations are glorified, magnified, and made into a set of ideal standards by which to judge the extent of their actual application. Like liberal humanitarians, conservatives maintain a temporal orientation to utopianism, but also make use of the past and not the future. If what "is" is right, then there develops an appreciation for how things developed into the state that they are in, and the past and present are thus united and naturalized into an unassailable front against social change. Conservatism is supposed to be a characteristic of the *Ancién Régime*, which maintained an interest in preserving the status quo.

The last utopia Mannheim considers, the socialist/communist, is an invention of the modern proletariat and, unlike the liberal humanitarians who celebrated the "idea", see the determinants of the ideal society in its material conditions. Consequently, socialist/communists (Mannheim declares that for his purposes there is no reason to distinguish between the two) see the installation of their ideals, not in an infinite future, but "at a much more specifically determined point in time, namely the period of the breakdown of capitalist culture" (p.240). In common with liberal humanitarianism, socialist/communists are temporally oriented toward the future, but Mannheim observes that the latter make use of a distinction between the near and distant future, as a means of justifying short-term tactics that are only indirectly related to their lofty long-term goals.

There is much to quarrel with in Mannheim's analysis of utopian thought.[4] (Are these really the dominant trends in utopian thought? Are they merely caricatures of much more complicated

[4] For critiques of Mannheim's sociology of knowledge see Merton ,1968; Kettler & Meja, 1994; Kettler, Meja & Stehr 1990.

worldviews?) I will not digress into a discussion of the strengths and weaknesses of Mannheim's account of the aforementioned groups of utopists. The important points are these: Mannheim identified differing structures of thought corresponding to differing positions in the social structure; the group position determined the content of the utopia; these structures of thought were to some extent incommensurable, in that the group position defined what counted as a reasonable worldview; each stream of utopian thought must interact and compete with the others in the overall intellectual field.

MUNDANE UTOPIANISM

The utility of Mannheim's conception of utopianism is that it shows how group life determines the way in which people view the world, and how it motivates people to change the world in the interests of their own group. While utopias had previously been restricted to literary fictions, Mannheim recognized the significance of utopias for social structure in real life. Mannheim's concept of real utopias has drawn attention to the ways in which utopianism informs social life. Utopianism has been defined as "The conceptualization and the visualization of change . . . [it] is the precondition of actualized social change" (Polack, 1965: 282). It is "the sober, rational, and realistic evaluation of . . . an alternative, credibly better, and historically possible (but far from certain) future" (Wallerstein1998: 1-2).

The idea of utopian ideology can be extended to other fields than the political. While Mannheim's concern with creating an historical sociology caused him to focus primarily on big problems of politics and culture in history, Mannheimian utopianism is a portable idea and can be applied more narrowly if required. Utopianism which falls short of radical restructuring of social relations we might call "mundane" utopianism. Knights and Willmott (2002) argue that the key to understanding the social functions of utopianism is the study of mundane utopias. Because grandiose utopias restructure social relations so extensively, utopias and dystopias "are often difficult to distinguish, as one person's vision of virtue is another's view of vice. Instead . . . it is relevant to give attention to practical, mundane utopian efforts – efforts that are so often taken for granted as to be almost unrecognizable as utopian in inspiration" (Knights and Willmott, 2002: 59). Mundane utopias reveal the deep potency of Mannheim's insights. His claims about the nature of ideologies and utopias reflect more than the major intellectual fault lines in a historical period; they speak to the very actions of thinking and planning in any situation.

UTOPIANISM IN THE SCIENTIFIC FIELD

Like the social world in general, the field of scientific activity is clustered into discernable groups. These groups specialize in different lines of research, and through the various mechanisms of institutionalization (e.g., specialty journals, conferences, professional societies, and university departments) the scientists in each specialty reach more or less a consensus about appropriate methods, problems, and objects of study. This consensus concerning appropriate professional activities ensures that members of a specialty share a set of concrete experiences, both physical and intellectual. Sharing these experiences, members of a specialty develop a particular worldview about the work they do. This worldview includes perspectives on what counts as good science and how that science will be used to direct the specialty as it progresses into the future. Böhme (1975: 220) observes that the acknowledgement of methodological rules and paradigms in a specialty generates solidarity among scientists. The solidarity and sense of community which are a natural consequence of the great number of scientific specialty areas mean that science, as a whole, is characterized by an array of locally specific worldviews, many of which share a great deal of overlap, and many of which are practically incommensurable.

Scholarship – including but not limited to empirical science – is unique among social institutions because of the emphasis placed on making use of the past and the future in an explicit and formal way. For a scientific contribution to be relevant, it must build upon research already carried out in the past, and simultaneously make a contribution to popularly held ideas about where research in a specialty area should be going in the future. What are the next steps towards understanding a problem? What are the

next questions that need to be asked? How should we go about answering them? What other groups should be listening to us and why? Questions such as these are an integral element of any vital specialty, and they call for scientists to take actions which may have direct consequences for the organization of the scientific field. As Tillich(1965: 302) observes, utopianism functions by drawing upon the past to project an idealized future as the basis for action in the present. Science envisions future progress and consciously moves toward progress, yet it never reaches a destination. The horizon is always moving. The nature of scientific vision is to anticipate that all of the specialty's major problems can be solved while simultaneously never running out of major problems. Intellectual stagnation is considered a failure rather than an accomplishment.[5]The impossibility of total cognitive accomplishment in the future meets the possibilities embodied in accomplishments of the past in a utopistic present which incorporates elements of both. The utopian vision of scientific progress impels scientists to take actions which have consequences for the way the scientific field is organized. Because scientific worldviews correspond differ between specialty areas, scientific utopianism is the formulation of particular utopias corresponding to particular specialties.

When the scientific field is viewed as a multiplicity of clusters corresponding to specialties and each specialty corresponds to its own unique set of experiences, its future planning is utopistic, and like all utopias, it cannot account for the total reality, but only the reality which corresponds to its experiences. As such, scientists involved in utopian specialization treat the specialty's own problems, methods, and objects of study as if they are of capital importance to the realm of knowledge in general, despite being of marginal significance to all but a few scientists who constitute the specialty. Because each specialty has its own set of priorities corresponding to its own experiences, and these priorities both overlap with and contradict the priorities of other specialties and other parties outside of the scientific field, specialized research programs and the habitus they create cannot be understood without an analysis of these relationships.

Mannheim enriches Bourdieu's concept of the habitus by suggesting that the logic of the interactions of different groups (e.g., the "rules of the game" which govern the interactions scientific specialties have with other groups) need to be treated separately from the logic of the field corresponding to a particular group (e.g., the "rules of the game" which set the standard for research within a specialty) when considering the formation of the of the habitus. A Mannheimian analysis of the scientific field would focus on scientific specialties, their particular worldviews and how those worldviews are shaped by interactions with other parties. In order to explain what scientists take for granted, we need to describe the worldview of their specialty, and utilizing Mannheim's sociology of knowledge can be used to understand specialties' worldviews.

SCIENTIFIC UTOPIAS AND CHANGE IN THE SCIENTIFIC FIELD

Mannheim's sociology of knowledge also provides an explanation of how the habitus facilitates change within the scientific field. Fields are supposed to contain a mechanism (the habitus) which ensures that the basic properties of the field will be reproduced, but fields do change, and the theoretical model proposed by Bourdieu performs poorly when attempting to account for change. He does propose that "subversion strategies" (Bourdieu, 1975) can threaten to upset the logic of a field, but his field theory does not include a systematic mechanism that drives change.[6] The Mannheimian idea of utopianism as a change-oriented group-based ideology can be applied within a Bourdieuian theoretical framework, and

[5] See, for example, Smolin's (2006) discussion of the standard model of quantum mechanics. Smolin, a renowned physical theorist, laments the fact that the standard model has not been significantly altered in thirty years. Rather than taking this stagnation as an indication of its adequacy, he rebukes the physics community for not improving upon it.

[6] To Bourdieu, subversion strategies are risky, winner-take-all strategies which explicitly threaten to devalue the reigning form of scientific capital. While subversion strategies are an attempt to account for scientific change, they play a small part in Bourdieu's theory, and he in fact argues that science has become so reified that true subversion is no longer possible (Bourdieu, 1975).

doing so helps explain how scientific fields change despite the conservative effects of the habitus. Utopianism implies that the members of a sociological group formulate a vision of a more perfect world based on their group position, and then purposefully act towards the fulfillment of that vision. From the utopian perspective, *changes in the structure of a scientific specialty's specific field are a consequence of the guiding and motivational elements of the utopia*, which call for (and actually produce) constant reconfigurations in a specialty's paradigm.

The balance of scientific capital and the actual content of the habitus reflect the state of a science *as it exists in the field at any given time*. However, the group ideology associated with a scientific specialty includes expectations about how new research should change the science in the future; this is the utopian aspect of the group position: based on the experiences of the scientists that make up a particular specialty, a certain set of activities is recommended for the purpose of changing the state of knowledge in that specialty for the better. Because the structure of a field automatically advantages those with disproportionate accessto scientific capital, new contributions to a scientific paradigm are typically conservative and reflect extant professional power structures. But the exploratory nature of the scientific enterprise ensures that not all contributions will reproduce the field faithfully; every new contribution to a scientific paradigm is potentially subversive to the existing structure of the field. Unexpected findings can be ignored, assimilated, or become the basis of a challenge to accepted scientific truths. As these contributions accumulate, they require reinterpretations of existing data, theories, methods, etc., and thus the objects that make up the scientific habitus are inherently unstable. *Changes in a scientific field then result from: a) the group positions which determine what kinds of research and professional activities will be valued; b) the utopian visions which are a consequence of those positions; c) the activities which attempt to fulfill the utopian vision, and; 4) the inability of the field to assimilate new contributions in such a way that the structure of a field is faithfully reproduced*. If a scientific habitus is a set of taken-for-granted dispositions regarding appropriate theories, methods, data, and assumptions, then the actual content of a habitus will reflect the state of a specialty area of science as it actually exists at a given time. When it is recognized that contributions to a specialty area can change the state of a science, then they must be allowed to change the structure of the field and the habitus as well.

This theory of dynamism within scientific fields is more nuanced than another theory of scientific change: that of Thomas Kuhn's (1962) scientific revolutions. For Kuhn, contributions to an existing paradigm could only be conservative: real change and real scientific progress only occur when discoveries prompt the total rejection of an old paradigm in favor of a new one. Bourdieuian field theory, on the other hand, calls for a more detailed analysis of how smaller changes within the state of a science provide occasions for a shift in what kinds of things scientists take for granted. Certainly the great scientific revolutions, such as the Copernican Revolution, usher in radical changes in how scientific fields are organized. But the contributions which Kuhn described as "normal" conservative additions to a reigning paradigm may in fact have profound influences the structure of the field, even if they do not qualify as wholesale rejections. This position is corroborated by Mullins (1975), who observed that scientific revolutions seem much less "revolutionary" to the scientists who actively work within them because they are privy to the incremental changes that eventually bring about major intellectual reorganizations. Major changes in the scientific field seem much more pronounced to those who only pay attention to them after they have happened. But by then, the intellectual currency has already shifted. "Revolutions" are often better thought of as a series of "normal" contributions which take the science in a new direction rather than a sudden and wholesale replacement of one paradigm by another (See also Wray 2005). Because a specialty's utopian vision engenders a scientific field which is in constant flux, there are constantly new opportunities for the reorganization of scientific capital.

SCOTT FRICKEL'S *CHEMICAL CONSEQUENCES*: GROUP POSITION AND HABITUS IN GENETIC TOXICOLOGY

In this section I will apply my argumentsto Scott Frickel's Chemical Consequences: Environmental Mutagens, Scientist Activism, and the Rise of Genetic Toxicology (2004). Frickel's work is relevant because it empirically examines how a scientific specialty comes to understand itself and the work it

does with reference to *other* scientific specialties and political movements.

Frickel examines the rise, and eventual institutionalization of genetic toxicology. Genetic toxicologyrefers to the study of how exposure to chemicals causes mutations in genes. Genetic mutations have long been of interest to scientists interested in understanding basic genetic processes. Studying what goes wrong in genetic transmission has helped scientists to understand how basic genetic transmission processes work. One problem with studying mutations is that without human interference they are rare. Before the use of radiation in mutation studies scientists compensated for the rarity of mutations by breeding large quantities of quickly-reproducing animals, specifically, fruit flies (*Drosophila melanogaster*). However, in 1927 it was discovered that exposure to radiation could induce mutations at a much higher rate than that which occurred naturally. This discovery greatly improved the efficiency and the accessibility of mutation research. Before the use of radiation, mutation research was only available to those with access to *Drosophilia* "breeder reactors" (Frickel, 2004: 24); now anyone with a handful of flies and an x-ray machine could produce mutants. Radiation mutagenesis became a significant specialization within genetic science.

Meanwhile, during the Second World War, British scientists Charlotte Auerbach and J. M. Robson were studying the physiological effects of the mustard gas that was being used as a biological weapon by both the allies and the axis powers. During the course of their research Auerbach and Robson discovered that exposure to mustard gas could produce mutations at rates similar to the use of radiation (Frickel, 2004: 27-8). This discovery prompted others to investigate the effects of a variety of chemicals on mutagenesis.

While the discovery that chemicals could produce mutations garnered much curiosity, the practice was still intellectually and professionally tied to radiation mutagenesis because the two methodologies served essentially the same scientific purpose: producing mutations for the study of basic genetic processes. Radiation could be produced easily and cheaply and so there was little incentive to pursue chemical mutagenesis. But the study of chemical mutagenesis was soon to receive a new impetus. During the 1960s the environmental movement began to receive national attention. Spokespersons of this movement warned that pollution and degradation of the environment could have deleterious consequences for mankind. Publications such as Rachel Carson's *Silent Spring* (1962) ignited popular concern about the effects of chemicals in the environment. Some of the key scientists involved with research on chemical mutagenesis, notably Alexander Hollaender and James Crow, took notice. Crow's widely read article in *Scientist and Citizen* (1968) warned that exposure to toxic chemicals could adversely affect the human gene pool, pointing to research on chemical mutagenesis as evidence. Eventually, concern for the effects of toxic chemicals in the environment on humans became the primary justification for funding and carrying out research on chemical mutagenesis. Soon "chemical mutagenesis" was renamed "genetic toxicology", reflecting the new interest in exposure to toxic chemicals. Genetic toxicology became a research specialty intellectually and professionally distinct from radiation mutagenesis by virtue of its concern with what Frickel calls the "genetic hazards" (2004: 84) problem.

Genetic toxicology's relationship to the environmental movement produced a particular set of dispositions among scientists in this specialty area. Genetic toxicologists came to view themselves as important players in the fight against environmental degradation, accepting and expanding Crow's interpretation of the relevance of chemical mutagenesis research. Genetic toxicology developed a new habitus corresponding to its own methodology and new justification. To the scientists practicing and proselytizing for genetic toxicology, it was assumed to be a solution to myriad health, scientific, and political, and economic issues. The research performed by genetic toxicologists provided insights into the possible consequences of the reckless use of toxic chemicals, and these insights coalesced into a cognitive framework with which to view politics, industry, and other areas of science. Proselytizers of genetic toxicology, such as Sam Epstein, tailored its research program to overlap with problems associated with research on cancer and birth defects. The "genetic hazards" frame determined what genetic toxicologists would consider relevant, what they would take for granted, and what they would consider to be appropriate courses of action; it provided an impetus to *change the existing state of knowledge* by creating a research program around the genetic effects of toxic chemicals. And by changing the existing state of knowledge, it altered the "rules of the game" and the type of symbolic

capital of value to genetic toxicologists. While genetic toxicology had previously been defined in reference to basic genetic science and radiation genetics, its new relationship to the environmental movement changed its research program and also its relationships with other specialties.

DISCUSSION AND CONCLUSION

It is impossible to understand the history of genetic toxicology and the "genetic hazards" frame without understanding the relationship of genetic toxicology to other groups, both within the scientific field and those that are not directly involved in scientific research. Chemical mutagenesis began as an offshoot of radiation genetics and at this time scientists practicing chemical mutagenesis defined their work with reference to the goals and methods of radiation genetics. Chemical mutagenesis research was pursued and evaluated with reference to its relevance to basic questions that concerned geneticists. The issues defined as relevant and non-relevant in chemical mutagenesis science were a consequence of the relationship this specialty had to radiation genetics and basic biology. The chemical mutagenesis worldview wasone that reflected its affiliation with these groups. As the political economy of science evolved, and the relationships between parties shifted, so too did the habitus associated with chemical mutagenesis. A politically influential environmental movement emerged which established an explicit relationship to scientific research. Chemical mutagenesis became an integral element of this relationship, and its habitus was altered in the process. As chemical mutagenesis became genetic toxicology, the "genetic hazards" frame was in part defined by the relationship of genetic toxicology to other sciences. Genetic toxicology was framed as necessary to cancer research and scientists concerned with birth defects. In this way, its habitus was constructed not just by a relationship to the environmental movement, but to other scientific specialties as well. Champions of genetic toxicology spent much time and energy proselytizing its message to other scientists, and this process helped define what genetic toxicology is and why it is important. Different specialties and exogenous parties with an interest in science all fight for the "correct" diagnosis of the scientific field from the particular positions from which they view it. This is a Mannheimian insight that enriches a Bourdieuian analysis of *Chemical Consequences*.

Frickel's study of genetic toxicology suggests that its habitus contains utopian elements in the Mannheimian sense. The defining elements of utopian thought are: 1) utopias are a consequence of group position; 2) utopias are incongruent with the total intellectual landscape; 3) utopias are progressive, or change oriented. I have already explained how genetic toxicology's habitus was shaped by its relationship to other parties, but what about incongruence? Genetic toxicology seemed to be addressing the concerns of the groups it shared relationships with. All parties seemed to agree on the importance of studying the effects of toxic chemicals on humans. Genetic toxicologists' habitus suggested which issues were of the most importance, but because the habitus of genetic toxicology is incongruent with the habitus of the other groups, it was never able to realize all of its aspirations. Frickel observes that "a series of subtle and no-so-subtle shifts in emphasis seem to have weakened genetic toxicology's initial environmental thrust" (Frickel 2004: 140). While genetic toxicologists framed their work as indispensable to other research areas, those other areas have been less welcoming than genetic toxicologists had hoped. These other research areas occupy their own unique of position among the intellectual landscape of specialties, and produce dispositions defined by their own methods, theories, and objects of study that only partly overlap with the habitus defined by genetic toxicology. The relationship of genetic toxicology to cancer research is an excellent example of incongruent positions and dispositions. One of the research areas to which genetic toxicologists spent much effort proselytizing is that of cancer. Genetic toxicologists framed carcinogens as chemical mutagens, attempting to shift the center of gravity in cancer research to issues pertinent to genetic toxicology. However, cancer researchers held different views about what the most pressing questions in their specialty are. While genetic toxicologists thought cancer research should focus on the chemical causes of genetic abnormalities, cancer researchers have continued to lay emphasis on the mechanisms of cancer pathology, rather than focus on mutagenesis. Incongruence such as the one described here is not particular to genetic toxicology. All scientific specialties are aware of how what they do can improve other lines of research; the difficulty lies in convincing the scientists in other specialties that this is so.

The very act of participating in a specialized research program creates biases unique to that program.

Finally, the habitus associated with genetic toxicology was oriented toward changing the scientific field. Genetic toxicologists did not simply reproduce the scientific field by acting in accordance with their habitus, they sought to *change* it through additional research and building a stronger relationship with social and environmental policy makers. This change implied a reorganization of the field in which research devoted to studying individual chemicals for their mutagenic effects would be the primary currency of scientific capital, while research devoted to studying basic genetic processes would no longer be valued as highly. The habitus associated with genetic toxicology called for scientists topursue a more extensive understanding of chemical mutagensand a wider range of applications to public health. Many of the changes called for by the genetic toxicology habitus came to fruition. As Frickel notes,

> In less than a decade, the chemical mutagens that geneticists had once used exclusively as tools in experimental research gained new meaning as environmental problems, and a new interdiscipline emerged to claim 'environmental mutagenesis' as its central topic. These transformations changed the way genetics knowledgewas made and who made it. They also changed how environmental health specialists and policy makers interpreted the human consequences of chemical pollution (2004: 135).

This orientation towards change is not unique to genetic toxicology; it is part of the scientific ethos generally. The pursuit of new problems and avenues of inquiry is an institutional dimension of scientific activity (Merton 1968), and so the scientific field remains in constant flux.

Because the habitus associated with genetic toxicology was a consequence of its relationship to other relevant groups, was incongruent with the total intellectual landscape, and was change oriented, it fits Mannheim's definition of a utopian ideology. And by defining it as such, it enriches our understanding of Bourdieu's concept of the habitus as it is applied to the scientific field. I have argued that the concept of the scientific habitus has suffered from two major shortcomings: 1) the scientific field is made up of clusters of specializations which are shaped by interactions with each other, and the habitus does not account for these mesolevel interactions; 2) it can only account for *reproduction* of the scientific field and therefore ignores the mechanisms which produce change. I have attempted to remedy these shortcomings by examining Scott Frickel's work on genetic toxicologists through a Mannheimian lens. I have illustrated how the scientific habitus is constructed with reference to scientific specialties. The habitus associated with genetic toxicology was particular to those scientists' experiences with chemical mutagenesis and the environmental movement, and was not necessarily congruent with the habitus of other research specialties such as cancer. This observation allows us a more nuanced interpretation of the habitus. Analyses of the habitus in science ought to account for the localized experiences of particular research specialties.

I have also argued that change can be incorporated directly into Bourdieu's field theory if the habitus is characterized as utopian, i.e., if it has a mechanism built into it that calls for a constant reappraisal of the field. From the utopian perspective, *changes in the structure of a scientific specialty's specific field are a consequence of the guiding and motivational elements of the utopia*. In the case of genetic toxicology, the habitus provided a vision of what was to be done, and the scientists acted on that vision, changing the field in the process.

Although it is seldom acknowledged, Karl Mannheim and Pierre Bourdieu share fundamental views on the relation between social position and knowledge. Bourdieu argued that social positions determine the tastes an *individual* will have, and these tastes, when put into practice, tend to have the effect of reproducing the social order. In the field of science, these tastes manifest as preferences for particular kinds of questions, methods, materials, and styles of doing research. The Mannheimian position is that the social positions of *groups* determine their overall thought structures. This paper has attempted to reconcile these theorists by showing that Bourdieu's field theory can be enhanced by a Mannheimian perspective.

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