John Levi Martin

Field Theory and Self-Organization*

Abstract: Theories of self-organization in the social and behavioral sciences are now most commonly associated with systems theory. However, field theory puts forward a somewhat different species of self-organization. This conception, one which turns on the symmetric relations of free and largely interchangeable units, was inherent in the earliest work on magnetism, and was brought into the social and behavioral sciences by the Gestalt school. A reconsideration suggests that there may be times when the capacity of sets of units to self-organize may be seen as resulting from a field effect, as opposed to indicating the presence of a system in contradistinction to an environment.

Keywords: field, self-organization, force, field theory, systems theory

Feldtheorie und Selbstorganisation

Zusammenfassung: Theorien der Selbstorganisation in den Verhaltens- und Sozialwissenschaften werden zumeist mit der Systemtheorie assoziiert. Allerdings macht die Feldtheorie auf eine andere Art von Selbstorganisation aufmerksam. Diese Konzeption, die sich mit symmetrischen Beziehungen freier und zumeist austauschbarer Einheiten beschäftigt, wurde schon in frühesten Arbeiten zum Magnetismus entwickelt und fand durch die Gestaltpsychologie Eingang die Sozial- und Verhaltenswissenschaften. Eine Neuerwägung legt nahe, dass es Umstände gibt, unter denen die Fähigkeit einer Menge von Elementen zur Selbstorganisation eher mit feldtheoretischen Begriffen zu erklären ist, statt auf das Vorliegen einer System-Umwelt-Differenz hinzuweisen.

Schlagwörter: Feld, Selbstorganisation, Kraft, Feldtheorie, Systemtheorie

THE ISSUE OF SELF-ORGANIZATION

The Problem of Order

There are few options for answers to the question, »where does social order come from?« Unless one evades the question altogether (for example, by proposing a strictly historical account, in which today's order comes from yesterday's, and so on), we are limited to two great classes: theories of planned and theories of unplanned arising. The former set includes theism, but also forms of rational action in which a set of persons (sometimes the shadowy coordinating committee for a class) arranges social structures (or, for analytic purposes, can be treated as having done so). Theories of unplanned arising, so far as we remember them now, have two roots: economics, and biology. These two versions have been largely synthesized in different visions of systems theory. But these are not the only options. I here return to the origins of field theory and its importation into the human sciences, to bring back to our attention a third.

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Organismic, Functional and Systems Theory in Sociology

Social theory began as metaphor. »The state is like a ship«, or perhaps like a house, or an organism, perhaps even an »artificial man« (see Martin/Lee 2015). Sociology largely became a science when some rather unmetaphorical people began to interpret this metaphor literally: Comte, Mill, Spencer, and later Durkheim. One interesting thing is that originally, *organismic*, *functional* and *systems* theory were not »differentiated« (as it were); indeed, when Hobbes (1943: 171) coined the term »social systems«, he meant *organs.*[1]

Beginning with this organismic analogy, functional social theory proceeded via a series of conceptual adjustments that moved further and further from the direct analogy to a body. Durkheim (1933) rejected the strong argument that society *was* a physical body (and thereby also rejected the notion that sociology was a sub-discipline of biology, as argued by his eclectic philosophy teachers [Brooks 1998] and, most notably, Espinas [Logue 1983]). The Parsonian synthesis travelled even further from the organismic metaphor by arguing that the functional imperatives of a social system could not necessarily be located in clearly delimited institutional spheres (although this has quite reasonably been a focus of concern regarding the falsifiability of his scheme [Bershady 2014]).

Now Parsons had set out to distance himself from his functionalist forbearers as completely as possible: he opened his first major work, *The Structure of Social Action* (1968: 3), by stating unequivocally, »Spencer is dead.« In fact, he quoted Crane Brinton, asking »Who now reads Spencer?« Interestingly, the answer was soon to be: Talcott Parsons, as he contributed a foreword to the 1961 republication of Spencer's *The Study of Sociology*. Here, Parsons (1966: vii) argued that

> »The combination of a self-regulating system and of functional differentiation taken together brings Spencer very close to the position of modern ›functional‹ [i.e., Parsonian] theory in sociology and related disciplines. Indeed, on the level of 'approach' all the essential ingredients are present.«

This judgment is quite defensible; a fair reconsideration of Spencer finds him a sophisticated systems thinker. Spencer famously had a vision of the same fundamental dynamics happening at all scales of reality, from the atomic to the societal. These involved a general tendency of transition from undifferentiated and indifferent homogeneity to differentiated and integrated heterogeneity (an idea later repackaged by Durkheim [1933]). But more interesting than the overall direction are Spencer's *dynamics*.

Spencer began with a principle that would be later emphasized by Wolfgang Köhler as the »law of dynamic direction«, namely a tendency towards movement in the direction of least resistance (1915: 190, 194). Most of us would connect this with a notion of a tendency towards increasing homogeneity and disorder over time. But Spencer, strangely to our eyes, instead derived its opposite, a notion of (what we would now call) reverse entropy. For example, a mass of water brought to a homogeneous temperature, he wrote, tends to have differences in heat arise, as the outside cools (1915: 327). This, of course, is

1 And this from someone who argued that one reason for the proliferation of »absurd conclusions« is the »use of metaphors, tropes, and other rhetorical figures, in stead of words proper« (1943: 36)!

only true because the system is not isolated, and that was precisely Spencer's point: any social configuration must be understood in reference to an environment with its own unevenness (1915: 335).[2] Thus Spencer rooted these dynamics in the organism's tendency to reach equilibrium with a specific environment (1898: 95; 1910b: 609). The spontaneous emergence of order has to do, first and foremost, with this difference, and so Parsons's rethinking seems quite apposite: Spencer had a functionalism that grounded itself on core evolutionary principles, and in fact, involved fewer additional axioms than did Parsons's own system.

Within a few years of the second edition of Parsons's foreword, most American sociologists would have now complacently said that it was Parsons who was dead. Undoubtedly, some of the difficulties that undid the preeminence of Parsons's work were stylistic. Much of his work was tedious, and where it had empirical claims these were generally completely trivial (e.g., 1951); and where the theory transcended triviality it was complex, abstract and possibly gibberish (e.g., 1978). Even more problematic was that no ›functional‹ approach, least of all one that turned on an axis of a Great Chain of Being running from the highest societal values to the lowliest unit act, could shake off the air of privileging stasis. This struck many of the ›turbulent generation‹ as overly conformity-loving, and Parsons was rejected in American academia along with other aspects of conventional middle-classism. Those who continued to take his project seriously were often those interested in issues of self-organization: those like Erving Goffman and Harold Garfinkel, and then those interested in reviving systems theory, most importantly, Niklas Luhmann.

Luhmann and the Current State of Systems Theory

Once mentored by Parsons, Niklas Luhmann developed a different approach to systems theory whose core is communication rather than action (e.g., Luhmann 1996: 24), taking us even further from the biological metaphor. More important for our purposes, there is a self-organization (*autopoiesis*) of this set of communications that may be largely decoupled from the needs of organic individuals. Thus, although Luhmann accepted that the major social subsystems corresponded to well understood realms (which he successively explored: law, art, politics, religion, economy, education, science, and perhaps even the mass media), functional sub-sub-systems may arise that are potentially divorced from needs of individuals and even from a social role structure.

This notion of self-organization brings sociological systems theory more in line with thinking in other sciences regarding systems. Modern systems theory, the rise of which is often assumed to begin with Ludwig von Bertalanffy's (1968) work in the 1940s, explores the regularities that emerge when sets of elements – whether physiological, environmental, or social – assume such a form that they maintain internal relations via self-correcting feedback mechanisms.

2 Further, Spencer thought of this relation in terms of a constant »force« that comes from outside the system; such force (and not matter) is the fundamental nature of reality, both for the physical and the human worlds (1915: 192f, 202, 349).

Formulaically, we can say that there are two ways of defining such a system. One is to consider a system to be a set of elements ($A = \{a_1, a_2, \ldots\}$) with attributes that allow the set to be characterized as having a state, and allowing us to speak of the set of all possible states as a »state space«. This set A is organized via a set of processes such that the range of actually occupied states is smaller than the set of all possible states, and smaller than the number of states that might be expected under some null hypothesis of disorganization.

A second way of thinking about a system would emphasize that its internal relations exist so as to maintain its position in this state space *given necessary interactions with an environment*. Thus an electric heating system with a thermostat is a good example of a system. A bimetallic switch responds to heat by bending (it has two metals side by side which expand and contract differently with temperature, so, for example, as it gets colder, the strip bends to one side). When the temperature reaches a certain point, the strip will touch a metal plate, completing a circuit, allowing electricity to flow and to power an electric heater which will raise the temperature. When the temperature *outside* the system increases, the strip straightens out, the connection is broken, and the heat is turned off. Below we will find that this second way offers us some advantages in thinking through the distinctive approaches to self-organization characterizing systems theory on the one hand, and field theory on the other.

There are three things to note about this case. The first is that we can make a partition between any observed things (or observations) into those that are part of the system (in this case, the heating system), and those that are part of the environment (in the case, the atmosphere of the room). There are relations of the system A to the environment ($E = \{e_1, e_2, \ldots\} \mid E = {\sim}A$), or of parts of the system to parts of the environment (hence these relations are of the form (a_1,e_1) or (e_2,a_2)). These relations are linked to internal (a_1,a_2) relations of elements within the system. The second thing to note is that the key relations are asymmetric. The temperature of the room directly affects the bimetallic strip (e_1,a_1); the reverse is not true. The bimetallic strip only affects the room via other within-system (a_1,a_2) and system-environment (a_2,e_2) relations.[3]

The third notable thing is that, like most of the examples of systems that come to mind, the heating system has been *consciously designed*. Indeed, the success of the organic system's capacity to maintain its internal relations in the face of an often volatile environment was historically one of the greatest supports for theism in Western thought. The new burst of energy that social systems theorizing received from Luhmann's work is akin to that which organic systems theory work got from Darwinism – a conviction that internal dynamics could account for the existence of functionality in the absence of design.

It is not my intention to compare any specific field theory to any specific systems theory (e.g., Luhmann's), but, rather, the general characteristics of field theories to the general characteristics of systems theories. However, it is worth noting that the general characterization of systems theory made above, though not employing the particular vocabulary developed by Luhmann, is, at the level of generality intended, compatible with some fundamental aspects of his approach. This is not to say that these are the *core* of his ap-

3 I am grateful to Forest Gregg for emphasizing these points.

proach, merely that he shares these aspects with other systems theorists. First, like other systems theorists, Luhmann sees as central that a system exists in reciprocal contrast to the environment (1995: 10, 77, 176). While any events in the environment must be translated into systems terms to affect the system (1995: 350, 185), it is certainly the case that there are processes that cross system boundaries, and hence can lead to problems of system maintenance (1995: 17, 29).

Second, Luhmann (1995: 23) accepts that we can decompose systems into elements and relations between them. Here, it will help to dispel any confusion about minor terminological issues. A system is generally seen as a set of *relations*; for this reason, in some cases, two analysts can talk about the same system yet use the term ›elements‹ differently, the first using the term to mean some set of units (or actors), and the second, to mean the *relationships* between these units. Just as it is a mere matter of mathematical convenience whether we treat a network as a set of elements *and* their ties, or only the ties,[4] so too here. Most importantly, social systems, Luhmann (1986) argues, can be seen as being composed of communications. Since every communication is a relation – indeed, it is hard to think of effectual relations, especially in self-referential social systems, that cannot, with moderate ingenuity, be recast as communication – once again, Luhmann's basic conception is compatible with the simple characterization given above.[5]

Third, for Luhmann, systems give rise to the possibility of functional analysis, which turns on the relationship between system and environment (1995: 176). Specifically, it involves the identification of problems and their solutions (1995: 53f), and here Luhmann, deliberately, treads quite lightly, refusing to attempt to specify ›the‹ functions that any system, or even any social system, must meet. While he concedes that stability/permanence *is* indeed a functional need, this is, he notes, saying very little, for each functional subsystem generates its own problems, and every solution to a problem generates new problems, and so on. His actual analyses of social systems vary in terms of the degree to which a core, recognizable, problem, for a ›society‹ is placed at the center of analysis (Fuhse 2005: 79).[6] When it comes to politics, Luhmann is confident: »The *function* for which the political system is differentiated can be characterized as *supplying the capacity to enforce collectively binding decisions*« (1990: 73). In contrast, when it comes to the system of art, we get nothing so clear: »The question about the function of art is therefore the question of an observer who must presuppose an operatively generated reality; other-

4 Graph theory considers a graph to be a set containing both the elements and the relations. Some may prefer to define a network as only the latter, to allow for networks to be wholly disjunct even if they share nodes. But there is certainly no deep theoretical justification for preferring one to the other.

5 Further, Luhmann also recognizes that these relations are conditioned such that there are stable relations between these relations.

6 I note that Luhmann may perhaps have unnecessarily substantively restricted his notion of system to a subset of autopoietic processes that are related to recognizable system-environment problems, and that in fact there are many such processes that satisfy the first definition of a system given above, but solve no problems.

wise it would never occur to him to raise this question« (2000a: 138). This difference will be considered again below.

Still, social systems are one particular form of self-referential systems, ones composed of communications that allow for self-organization in ways that do not require conscious direction. This notion of self-organization has been one of the most exciting aspects of Luhmann's approach, but has, at times, led to some unnecessary confusions. First, the fact that social systems are *capable* of self-reference, and that such self-reference is at the heart of the unity of the system (1995: 175, 9) has sometimes given the impression that these communications can only make reference to the system. Instead, Luhmann (1995: 144) emphasizes that »every communication refers via meaning references directly or indirectly to the system's environment«. Autonomy is not autarchy. Thus while a communication in a social system can be self-referential, it can also be other-referential, which would correspond to the (*a,e*) and (*e,a*) relations discussed above. Of course, the degree to which some set of communications has internal or external references is empirically variable, as is the degree to which aspects of the environment can easily be ›chunked‹ for specific reference and appear as at least pseudo-elements. This is an analytic dimension that will be of some importance in our concluding considerations.

In sum, relations with the environment can be key for explaining *why* a set of elements might spontaneously organize themselves into a set of relations with systemic properties. Yet there is another approach to self-organization, one that temporally preceded and in fact influenced systems theory in sociology (see, e.g., Parsons 1991: 77), and one that does not involve relations with an environment. This is found in field theory; here I wish to consider the role that this approach to self-organization played in field theory, and how it forces us to reconsider the nature of force.

FIELD THEORY AND GESTALT PSYCHOLOGY

The Origin of Field Theory in the Social Sciences

For better or worse, field theory in the social sciences is currently associated with the prodigious output of Pierre Bourdieu. But in the mid-twentieth century, field theory was a coherent approach to social explanation that was influential in social psychology, psychology, sociology, international relations and even anthropology. This field theory was developed by the Gestalt psychologists as a derivation from their efforts to understand the visual system. (Discussions are found in Mey 1972; Rummel 1975; Ash 1998; Martin 2003.) In contrast to many current uses of field terminology in the social sciences, to these field theorists, what was crucial was not the capacity to analyze this or that particular field (which would lead to a topical orientation), but rather, a pursuit of the nature of the *field effect* (an analytic orientation).[7] The nature of this effect, they believed, indicated the need for a fundamental revolution in our approach to the human sciences.

7 Although Bourdieu himself clearly cared about the nature of the field effect, this has been largely ignored by many of his followers.

The Gestalt psychologists were fascinated by evidence that seemed to cut against the emerging consensus among psychologists as to how the visual system worked, namely that the retina was a screen on which were projected a mosaic of independent percepts (bits of perception) that were assembled in the cortex and compared to mental templates. What the Gestalt psychologists found was that our perception of the ›matter‹ could not be dissociated from the perception of the *form* (Gestalt) – the mutual relations between the elementary percepts. Thus Köhler recalled that his goal was to determine »why percepts at a distance have an effect on one another. This is only possible, we assumed (and we followed Faraday in doing so), if the individual percept has a field and if the field, which surrounds the percept, does not merely reveal the presence of this percept but also presents its specific properties« (cited in Mey 1972: 14f).

For example, in Figure 1, two sets of lines lead us to ›see‹ an occluding parallelogram that is not there. This is because the bits of each line ›reach out‹ to be connected with other nearby pieces, just like drops of oil in water. Where this natural linkage is frustrated, we *see* a reason. (We also may tend to see *pairs* of lines emerging, as we try to group these into the *sets* we expect on the basis of figure/ground considerations; were the spacing narrower, however, we would instead begin to see *texture*, not *sets*.)

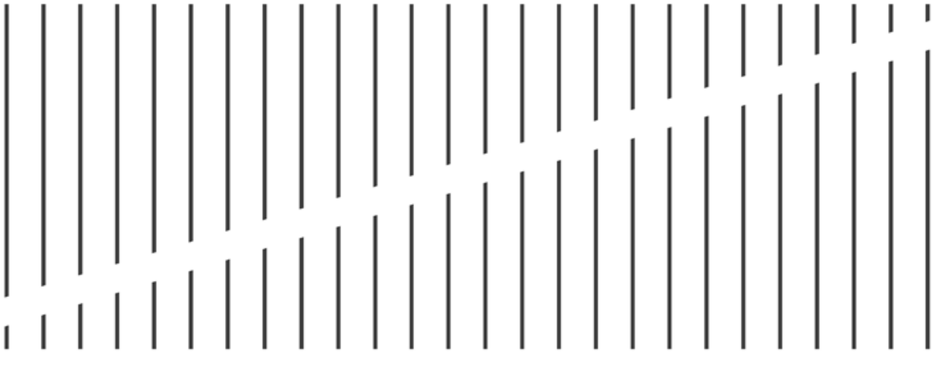

Figure 1: Tension Field

This is an example of a *Spannungsfeld* – a field of tension. This is a general and technical term from physics (in English it would be called *stress*) applicable to fluids and continuous materials. One can imagine a rubber sheet stretched taut, with a weight placed in one portion, which leads the stress to radiate outwards. If it is easier for us to think discontinuously, we can consider a set of elements and a set of relations of attraction or repulsion, such as drops of water in a free fluid state, each with relations established to neighbors. The Gestalt and field theorists used this as a core way of conceptualizing the organization of sets of elements (e.g., Fürstenburg [1969] for mobility). You will note here that the relations in question are all *within* members of our set *A*, and that they are all intrinsically *symmetric*. Thus the stress is a state of the set of forces.

A key principle of the *Gestalt* theorists was of cognitive economy or »terseness«, *Prägnanz* (Koffka 1935: 682). For the *Gestalt* theorists (here drawing in part on Ernst Mach), this principle was that a system would attempt to occupy the state of minimum stress, and in visual terms, this means a tendency towards the completion of the incomplete (Koffka 1935: 373f). (In social psychological terms, it often means the completion of a self-set task.)

This notion of stress-reduction became influential in the psychology that derived from the *Gestalt* school, as it jibed nicely with related general ›explanations‹ of behavior (for example, »dissonance reduction« [Festinger 1957]). What was less often noted was that to the Gestaltists, this was tied to a vision of self-organization that was radically at odds with many of the other assumptions that orthodox psychologists embraced.

Tension and Self-Organization

Here I will follow Wolfgang Köhler, whose thoughts here are the most well developed of all the Gestalt theorists. Köhler had studied mathematics and physical science with, among others, Max Planck, who together with Einstein supported Köhler in a number of instances (see Ash 1998: 112f, 170, 196, 214, 262). As a result, he had an impressive capacity to wed psychological, philosophical, and physical considerations together.

Köhler's (1929: 112, 121) vision often turns on a set of interdependent elements, leading to an evolving dynamic situation that can be characterized as a field. For example, consider a drop of water in the ocean, along with other drops – each one moves according to the resultant vector of forces coming from its interaction with all other ones. At any place and time in the field, there is one resulting force, and »all the resultant forces together form one texture of stresses« (1929: 134, 139; also 1920). This stress-surface will attempt to stabilize into an order of low tension.[8]

Further, Köhler daringly proposed that the same sort of phenomenon was found in brain architecture. Because of the way neurons fire, with a pulse of changing electrical charge on the inside balanced by an opposite pulse on the outside, we cannot expect one neuron's action to be independent of others' (1938: 210, 212). Given that at least in some portions of the visual cortex there is a geometric arrangement of areas corresponding to the geometry of the retina, this implies that if we have inhomogeneous retinal stimulation (a lighter disk against a darker background, say), there will be a corresponding inhomogeneity physically organized on the cortex. The surface of the cortex, in turn, can be understood as an electrolyte characterized by ion mixture. This means that on one side of the boundary corresponding to the perimeter of the disk, there is one concentration of ions, and on the other side, a different concentration, which in turn implies an electrostatic potential (1938: 213ff).[9]

8 »In contrast to the indifferent mosaic of sensations assumed in older theory, this order of the field shows a strong 'predilection' for certain general kinds of organization as against others, exactly as the formation of molecules and the working of surface forces in physics operates in certain definite directions« (Köhler 1929: 158).

9 For this reason, argued Koffka (1935: 47), we can see forces emerging in social life where there are different concentrations abutting; when gold was discovered in the Americas, and it ended up flow-

Take the logic further – because there is a gradient of potential, the gradient will naturally increase the closer the two areas are to one another (since we are basically dividing the difference in potential by the spatial distance in the brain) (Köhler 1938: 214, 228f, 230f). This means that there is a force which can induce a current. Thus there is actually a physical correlate in the brain to the black line that appears between two differently colored areas (a common visual ›illusion‹). Similarly, if we return to Figure 1, Köhler's logic – optimistic as it was – expected that the phenomenological illusion of a superimposed rectangle would have a physical correlate in the organization of the brain states, as they also snapped into the lowest tension form they could take, given their physical organization (230).[10]

Thus, argued Köhler, the field theoretic approach is quite different from most influential theories in psychology which take for granted that »the processes of nature, if they are left to their own 'blind' play, will never produce anything like order« (1929: 107). In contrast, field theory begins from the capacity of elements to organize themselves, and Köhler demonstrates that all that is necessary for this to occur is that the elements have some sort of *mutual susceptibility.*[11] And this opens up an approach to self-organization that is different from that developed by systems theory.

Fields, Gestalts, and Systems

One Gestaltist gave explicit attention to the relations between systems theory, field theory, and Gestalt theory in terms of their approach to self-organization. This was Wolfgang Metzger, a student of Köhler's. Metzger (1999: 131) began with what he took as key in the Gestalt approach, the fact that »the parts and positions of a gestalt are in more or less tight dynamic communication and interaction: each affects every other, and is affected by them in turn.« He went on to add that what was key here was that despite this »tightness«, there was a *freedom* to the orderliness. »The opposition between free dynamic and rigidly forced order *pervades the entire realm of existence*.« Such free order was certainly found in what physics considers movements in a force field.

Despite the lack of rigidity, such systems could have dynamic equilibria (*Fließgleichgewichte)* in contrast to stationary ones (1999: 220). Metzger (1999: 119; 1999: 201) emphasized that both Köhler and Bertalanffy had independently demonstrated that in some of these situations, we do *not* find that the thermodynamic laws of increasing entropy

ing across the ocean, this is strictly analogous to a high pressure container hooked up to a lower one. For this reason, Say's law (that demand creates its own supply) has a real truth to it: »What produces the goods? The machines in the factory; yes, but also the demand for the goods.… « One will note the similarity to Simmel's (1978) theory of value.

10 For Köhler, the payoff to this perhaps extravagant line of thinking was the demonstration that this would imply that »requiredness« has a *physical* existence, and therefore that »value« was an objective matter, at least in some cases (1938: 329f). We do not need to pursue this important suggestion here.

11 The centrality of this mutual orientation has been noted not only by Bourdieu (1984) but also by Fligstein (2001). It is worth noting that the central role of such mutual susceptibility has perhaps been somewhat de-emphasized by Bourdieu, in large part because he descended from a Durkheimian tradition, and this notion of mutual susceptibility—and, indeed, a proto-field theory—was strongly associated with Durkheim's arch-enemy, Gabriel Tarde.

necessarily hold. This is because the systems are open ones. (This curious reversal of the law of entropy, we recall, was central to Spencer's theory of self-organization.) Metzger (1999: 142; 1982: 184) believed that *Gestalt* theory had helped in defining the nature of what might now be called »attractor« states (Köhler called them 'excellent final states' or *ausgezeichnete Endzustände*); the law of »*Prägnanz*« showed that these states were those of lowest overall tension.

I noted that Metzger emphasized the convergences between Köhler's views and those of Bertalanffy (also see 1967: 143); indeed, he paired them as doing parallel work in the realms of the subjective and the objective, attempting to formulate a sort of grand alliance against behaviorism (1973: 122f). Even more, he tried to order the relations between three types of kindred theory: Gestalt theory, field theory, and systems theory. All three perspectives, he argued (1975: 219f), are dynamic, and oppose the idea that the elements can be treated as isolated and independent. Metzger suggested that if we begin with Einstein's definition of a field as »a totality of contemporaneous existent facts, that are conceived of as mutually interdependent of one another«, then »Gestalt theory and System Theory have the nature of field theories.«

I believe that there is a better way of ordering the relations between these – at least, for the social and behavioral sciences (including psychology). Properly speaking, it is Gestalt theory that is the most general, as it deals with any non-independence of elements that takes the form of obdurate relations. We speak of *systems* theory when the relations between a set of elements *A* cannot be understood without *reference to an environment* whose members are ~*A*; we speak of *field* theory when the relations and references are *only* between members of *A* and can be studied thusly. To make this case, I wish to return to Köhler's conception of self-organization, and the nature of ›force‹, as he contrasted the Gestalt approach to the mechanistic.

Newton and the Scholastics

Köhler clarified the difference between his conception of force and other approaches in psychology with a very telling analogy, opposing Isaac Newton's conception of motion to that of the scholastics. The Gestalt theorists, like other German scientists of their day, often used Galileo as an example, as he took on the role of a model not only for his capacity to abstract from sensuous observations and propose dynamic invariants, but for his stance against religious obscurantism (see, e.g., Cassirer 1923: 354; for other field theoretic discussions of the importance of this example, see Mey 1972: 92, 239; Lewin 1999: 32; and Köhler's own work). But Galileo did not serve Köhler's purposes as well, because he lacked what Newton provided – a new approach to *dynamics*, in contrast to that of the Aristotelians.

The scholastics, wrote Köhler (1929: 108), assumed that the regularity of motion had to come from some external constraint – crystal spheres *forced* the planets to stay in their paths. In the Newtonian approach, it is the »free play of gravitational vectors« which leads to an orderly arrangement of motions.[12] We have come to accept this new vision when it

12 I would like to note that Gabriel Tarde (see previous note), made the same point as he followed con-

comes to physical masses…but not when it comes to human perception, cognition, and action: If »the order of sensory experience be conceived as the result of sensory dynamics, this will seem to most people like explaining the quiet life of an orderly citizen as the outcome of many moral struggles and catastrophes« (145). Thus Köhler proposed to do for psychology what Newton had done for physics, in proposing a new way of thinking about force.

Yet Köhler was wrong, in the sense that the change he attributes to Newton had already occurred a century before, precisely because of the incipient development of field theory in physics. The notion of self-organization seems to have been connected with field dynamics from the earliest stages of its history. I want to give some attention to the intellectual environment in which a proto-field theory first emerged: early seventeenth century England.

FORM AND MAGNETISM

Gilbert and the Rise of Science

To make this point, I want to first consider the previous ways that European thinkers tended to understand the sorts of relations that would be natural templates for thinking about the field effect. Most important was that of *attraction*, and it was extremely common to equate the relation of the magnet (the »loadstone«) to iron with that between a lover and the beloved. And this relation was largely seen as an *asymmetric* one (see, for example, the influential treatment of the *Symposium*, by Marsilio Ficino [1985: 161]). The iron by itself lacks any attractive qualities; it is only when it is in the presence of the active magnet that it takes on the passive capacity of being drawn. In the words of Ficino's appreciate reader Giordano Bruno (1998), it has (like the Greek youth) a passive potency.

In the year that Bruno, one of the last magicians, was burned at the stake, one of the first new scientists, William Gilbert, published a revolutionary contribution to physical science, his work on *The Magnet*. Let me begin by noting what might seem four seemingly odd notions that Gilbert put forward. The first is that, although he recognized that a loadstone's power was increased if it took on an oblong form, he insisted that the loadstone was best analyzed in *spherical* form, which he considered more »natural«. Second, he argued that we should not speak of magnetic *attraction,* but *coition*. Third, he argued that the loadstone had, in a real way, a soul. And fourth, he believed that there was a close connection between his analysis of the loadstone and the analysis of the cosmos.

Let us begin with Gilbert's (1958: 323) dismissive reaction to scholastic geocentrism.[13] He used the following metaphor: »But he who supposes that all these bodies [e.g., the

temporary economists to help push his fascinating monadology of influence towards a field theoretic conception: »As the economists conceived it, society was not an organism but, what is clearer, an astronomical system whose freely linked elements, each gravitating separately in its individual sphere, only influenced each other externally and at a distance« (1969: 75).

13 Gilbert refrained from entering the debate about whether the earth or the sun should be treated as the center of the cosmos; it is not entirely clear that in his conception *either* would be, as he, like

earth] are idle and inactive, and that all the force of the universe pertains to those spheres, is as foolish as the one who, entering a man's residence, thinks it is the ceilings and the floors that govern the household, and not the thoughtful and provident good-man of the house«.

This metaphor may initially seem somewhat odd. But it makes sense, given the orthodox conception that different heavenly bodies were embedded in different crystalline spheres that orbited the earth in somewhat complex patterns – the conception criticized by Köhler. The earth, on the contrary, remained still. Gilbert had many practical rebuttals to this notion, but the above analogy shows that his objection was more fundamental. These spheres (which Gilbert does not believe in!) are like the walls that surround the house *made by a sentient being*, the man. As we will see, Gilbert came very close to believing that this earth *was* the (or, at least, *a*) sentient being. His rejection of conventional geocentrism came less because he was opposed to the privileged position that it gave the earth, and more from the *passivity* and *deathly stillness* which was believed to characterize this central point.

The orthodox conception of spheres was most literally top-down – the largest sphere (the *primum mobile*) vied with God for the position of the first mover. Hence, Gilbert (1958: 321) emphasized, this notion meant that means »we should have to accept a universal force, an unending despotism, in the governance of the stars«. In contrast, he argued that when it came to the heavenly bodies, »The higher do not tyrannize over the lower, for the heaven both of the philosopher and of the divine must be gentle, happy, tranquil, and not subject to change; neither will the violence, fury, velocity, and rapidity of the *primum mobile* bear sway.« (325).

Force and Form

Thus we see that the conception that Köhler attributed to Newton (in contrast to that of the Aristotelians) actually should be attributed to Gilbert, nearly a century before Newton. »Whatever in nature moves naturally, …[is] impelled by its own forces and by a consentient [!] compact of other bodies;« thus, for example, the earth »moves under no external compulsion; there is nought to make resistance…, but the path is open« (1958: 322, 326).[14] These considerations seem to be inherent in the recognition of the field phenomenon. Indeed, as we shall see, Gilbert's considerations led directly to a proto-Gestalt theory.

Recall that Gilbert (1958: 131, 154, 23) believed that the spherical shape was »the best and most fitting« for the analysis of the loadstone; this was because the earth itself is a »great loadstone«. This one-to-one correspondence turns out to be crucial for his understanding of the magnetic phenomenon. This is best clarified by following Gilbert's comparison between the magnetic and electric phenomena. Electrical attraction, he argued,

Bruno, was fascinated by the notion that there were many similar worlds and stars.

14 Indeed, Gilbert seems to have seen the earth as not merely in equilibrium, but in a very conservative one; like a gyroscope, if it were perturbed so that its pole pointed elsewhere, it would quickly right itself (1958: 331f).

came from a *material* relation between bodies – basically some sort of outflow of matter, an invisible fluid. Magnetism, on the other hand, was a purely *formal* relation (his reasoning was that the magnetic effect is not depleted in the same way that electrical charge is; a single loadstone can magnetize many pieces of iron without loss) (1958: 85, 105).

To those familiar with classical and medieval philosophy, the implication was clear. One common understanding of the nature of the soul was that the soul is to the body as is form to matter. The soul is, in more contemporary terminology, a Gestalt configuration, something that adds no matter but determines the meaningfulness of the material parts. Gilbert did not shirk from the conclusion: magnetism was the soul of the loadstone, and therefore of the earth itself. The »world soul« that was key to some of the Cambridge Platonists like Henry More and Ralph Cudworth (here see Cassirer 1953) – and that Bruno was, among other things, being burned in Rome for discussing openly – was a scientific fact.

This notion that the magnetic phenomenon was one of *form* was key for one of Gilbert's (e.g., 1958: 306) breakthroughs, as he basically came up with the notion of the »lines of force« emitted from or surrounding a magnet, a discovery we usually associate with Faraday.[15] His (admittedly somewhat, though justifiably, obscure) conception was that the energy of the loadstone was somehow *locally* transmitted, but in a *cumulative* way (1958: 115, 118f, also see 130). This notion of local action then allowed him to re-envision the issue of what we would call the field above the surface of the loadstone. Imagining an onion-like succession of nested spheres (which he emphasized were not real things existing by themselves), Gilbert argued (more or less correctly) that the needle pointed not to the pole of the *earth*, but to the pole in its own sphere. His notion was that each sphere brought out a potential in the adjoining one, just as the loadstone brings out magnetic potential in iron, namely by »informating« it – by inducing its *own* form in that of its neighbor (1958 [1600]: 304f).

In other words, because magnetism is a *form* applied to matter, it can be indefinitely propagated. Because a loadstone »awakens« the magnetic potential already in iron (1958: 217), the motion of the iron to the magnet is a *mutual*, *harmonious* and *natural* one. Rather than the iron being *dragged over to* (»attracted«), the violence is carried out if the two are *not* allowed to unite, or placed with identical poles together, which leads to »the flight of one part from the undue position of the other, and hence the discord unless everything is arranged according to nature. And nature will not suffer an unjust and inequitable peace…« (1958: 30).

This explains why Gilbert thought it was so important to reduce all the different magnetic motions to one, and why it should be called »coition«, and not »attraction« (1958: 73, 97). While the electric force seems to simply reach out and pull something else towards it, the magnetic one transforms its partner into something that seeks *it* with a re-

15 This came from him doing the thought experiment of, first, what would happen if one took a magnetic needle all over the surface of the earth, and notated which direction it pointed at any place (thereby generating a vector field) (1958: 24, 205f; see also 183).

ciprocal attachment, and does this only by actualizing an existing potential in the partner. In brief, the amber *grabs*, and the loadstone *marries*.

In sum, we see that the field approach to magnetism that begins with Gilbert is associated with a rejection of the notion of previous writers that the magnet's effect – like *all* force and indeed all love – is one-sided and to some degree violent. When the iron is awakened by the loadstone, »hence does it leap to the loadstone and eagerly conforms thereto (the forces of both harmoniously working to bring them together)« (1958: 109). Gilbert means »conforming« literally. They share one species, less because of their material relation than their capacity to take on the same *form*, the same *Gestalt*.

This conception solved a number of difficulties that previous attempts to explain magnetism foundered on: most important were the inexhaustibility of the magnetic effect, the locality of transmission (as opposed to true action at a distance) which led to the curved lines of force, and the self-similarity of the severed magnet. We may, in these terms, see a ›field‹ as that sort of medium that can propagate pure form. If the field, confusingly, seems a place in which a potential for energy is present, yet completely undetectably until a suitable object is placed in it, it is because it is *not* an energy that comes from without the object, but from within.

FORCE, FIELDS, AND FREEDOM

Fields and Science

Now it is not the case that Gilbert's work was received with uniform enthusiasm, even in his home country. Francis Bacon, in particular, was quite displeased that Gilbert had »made a philosophy out of the observations of a loadstone« (1952: 16).[16] Bacon's hostility came less from being snubbed (he was not invited to the circle of scientists who regularly met at Gilbert's house), but because, as Gaukroger (2006: 367) says, Gilbert brought coherence to a set of observations without reference to the notion of *cause*, something »that is quite different from anything Aristotle or Bacon aspired to. It is not that it is unsystematic, but rather that the systematic connections are drawn at [the] purely phenomenal level.«[17]

16 Yet even Bacon (1952: 73) accepted the importance of such informating, for »there is impressed upon all things a triple desire or appetite proceeding from love to themselves; one of preserving and continuing their form; another of advancing and perfecting their form; and a third of multiplying and extending their form upon other things: whereof the multiplying, or signature of it upon other things, is that which we handled by the name of active good. «

17 The capacity of field theories to give accurate predictions and descriptions in the absence of mechanisms has been the chief ground of the complaints against them; as John Wallis said, in his response to critics at the Royal Society when he presented his work on the mutual gravitation of earth and moon, critics who pushed him on the nature of the connection between these two bodies: »it is harder to shew *How* they have, than *That* they have it. That the Load-stone and Iron have something equivalent to a Ty; though we see it not, yet by the effects we know. *How* the Earth and Moon are connected; I will not now undertake to shew…« (cited in Bennett 1981: 172). Newton himself of course famously eventually made the same argument (e.g., 1952: 401), that phenomenal and causal

Thus Gilbert showed a remarkable success of a particularly British approach, grounded in the Cambridge Platonists, that was very different from that of the mechanists. And historically, one of the most important results of Gilbert's extremely popular work was a rehabilitation of the notion of something like »action at a distance«, which made it more difficult for atomists to dismiss all »occult effects« as beyond the pale of science (Verschuur 1993: 38). Indeed, it seems that Gilbert's revision to the notion of »force« was key for Newton's further breakthroughs. Gilbert not only contributed our notion of »mass« (Burtt 1927: 157), but it was his work that helped snap Newton out of his more Francophilic and fruitless approach to force.

Descartes' notion of force, at least in this context, was exclusively one tied to what we would now consider *momentum* – a characteristic of a moving extended body (Westfall 1971: 63, 529-534; 1977: 122, 142, 145). Newton began with this, but ran into contradictions that were only solved when he moved towards a more classically British conception, most probably due to the influence of his correspondence with Robert Hooke (who considered what we now call gravitation to be a species of magnetism) (here see Bennett 1981). The British influenced by Gilbert not only were free from a prejudice against non-mechanical forces, but they tended to see force as a »mutuality«. Thus John Wilkins (1708: 118) considered gravity »a respective mutual desire of union« of bodies to »naturally apply themselves, one to another by attraction or coition« (Wilkins immediately went on to cite Gilbert's researches).[18]

Newton only made his breakthroughs when he connected with this British school. Force as understood by Newton has often posed a puzzle for philosophers of science (especially for the more mechanistically oriented). Is the law $F = ma$ (force is equal to mass times acceleration) a discovery? A definition? A convenience allowing us to link different changes (for example, $ma = kx$, the compression in a simple spring)? Some light can be shed not by considering Newton's second law alone, but the *set* of laws. The third law (for every action, an equal and opposite reaction) points to the fundamental symmetry of his notion of force.

It is also interesting that in this new conception of force, used both for gravity and magnetism, whatever impetus was given an object seemed to come from *within*, and not from *without* via collision, as was assumed by materialists who required that all explanations invoke transfer of momentum. Now this conception of force *is* compatible with a kind of external forcing via continuum mechanics, and it was for this reason that scientists – including Newton – hoped to discover an ether that could transmit force. And indeed, these efforts were vital for the development of modern electromagnetic field theory. But even here, we find a challenge to our conception of force. It is true that, considered as an individual molecule, we may model each water molecule in a current as being

explanations were separable…even as he perhaps hoped to uncover a mechanistic explanation.

18 This came in his marvelous treatise, *That the Moon May Be a World*, in which he argued that each of the heavenly bodies was its own center of gravity, and only had a field effect within some radius. Were we outside the radius of the earth's effective gravity, Wilkins mused, our survival would no longer require acting against this force, and thus we might need no replenishment of our energy via food, and perhaps even could subsist only on smells (1708: 124).

pushed along by its neighbors. But this challenges the fundamentally *asymmetric* notion of force. As Simmel (1950: 35) might say, »the individual, by being carried away, carries [others] away«. It is this notion of force that Köhler considered central. Looking more closely at his conceptualization of force sheds new light on some of the core principles of field theory, and its approach to self-organization.

Köhler vs Durkheim

Köhler's most detailed discussion comes in his fascinating suggestion that there is a direct parallelism between physical brain processes and perceptual gestalts noted above. Here he wondered how the trace of one experience or percept can have an effect on another. »I know of only one class of physical facts that represents the properties of a given entity beyond this entity and thus can ›do something‹ about a second thing with reference to the first. This is the class of ›forces‹ or ›fields‹« (1938: 334).[19]

Given that at the time, the very idea of force was under attack as meaningless, Köhler first defended his use of the term. He accepted that it could not be defined, and so instead, it must be stabilized by giving it a *phenomenological* source (1938: 341). To Köhler, the core of this force is what he called *requiredness*. This requiredness occurs within a specific context (*Zusammenhang*), though it has the capacity to transcend some part of this context. In particular, requiredness has a *demanding* characteristic, often one that increases with the distance of the set of elements from some »best« arrangement (1938: 336, 74n13, 338).

These characteristics of requiredness, argued Köhler, are also found in our characterization of the idea of *force*. This force, argued Köhler (1938: 342, 360), should not be understood as implying passivity; at the very least, we must recognize that, as force relates two elements, if one is passive, at least the other must be active (cf. Martin 2011: 175ff)! Even more fundamentally, the Newtonian approach to force, in contrast to the Cartesian, sees a kind of activity in both components (for a two body case). In such cases, the force either leads to shortening or lengthening functional distance, as in gravity and electrostatic repulsion respectively (1938: 343), but in larger configurations, we often have a set of elements characterized by some degree of *stress*, or potential energy. The tendency of the system to lessen this amount of energy can be considered a simple law, which, as we recall, Köhler termed the »Law of Dynamic Direction«.

This notion of force is quite different from the version that characterized Durkheimian sociology. As Gabriel Tarde (1969: 118f) had objected, Durkheim's ontology of the social relied on its *coerciveness*. Now Durkheim's own position here was erratic, because he both needed to say that the social entered as some form of constraint, and that society (at least, in a non-pathological state) did no violence to the individual. Thus sometimes Durkheim emphasized that external constraint could be internalized (e.g., 1938: 54; also see 1961: 29; 1951: 89), while other times he (1951: 89) emphasized that »the pressure which

19 Similarly, Koffka (1935: 46, 43) not only insisted that we had every right to use the term *force* literally for our analysis of phenomenological psychology, but offered as an axiom, »No change of movement without a force.«

society continually exerts upon us« is one »of which we cannot be unaware«. And at still other times (espec. 1961), he suggested that we only experience such constraint when we attempt to violate social orders. Yet in all these conceptions, the very nature of force is something external, and its internalization simply decreases the radius of the location of the force, and not its nature.[20]

Such an external force requires the expenditure of energy (at least initially) to create order. Indeed, it will be remembered that a key for systems theory was the notion that an open system could move in an anti-entropic direction by taking energy or organization from the environment. In contrast, in Köhler's conception, the progression to the »attractor« states of minimum tension is one that requires no energy input, and indeed, may release energy.[21]

In contrast to the notion of external constraint, Köhler's conception of force as fundamentally a dyad (for example, the person-object relation[22]) that generates force in terms of the vector that connects the two does not imply what Latour calls the »double entry bookkeeping« in which any effect that is external must come at the expense of the internal and vice-versa. While Durkheim could only understand the requiredness that came from moral constraint (»thou shalt not«), actors experience other forms of requiredness that they see as both wholly about the self and about the other – for example, when they find something interesting, or find that they have an interest in it. This conception of force, then, is one that is compatible with a certain type of self-organization via the free play of vectors. I close by discussing a few well studied examples in which this leads to fields.

Democracy and Markets

Let us begin with a case that often been impatiently dismissed for professional reasons by sociologists, namely the notion of a perfect market. Economists at least since Smith (1777) have famously emphasized the necessity for some sort of »freedom« of individual choice if markets were to be that species of social organization that they wished to analyze. This seemingly obvious issue has fascinating implications when it comes to mathematical modeling. In his foundational formalization of economics, Edgeworth (1881: 5, 9) began by comparing the case at hand to that of hydrodynamics, and argued that human *pleasure* could provide an analogy to *energy* allowing for a physics of maximization/

20 In Durkheim's (1995: 369) last major work, containing his most extended discussion of the nature of these forces, his derivation of the very idea of force from the moral nature of social experience emphasizes that the forces are not coming from outside us, but inside. Indeed, these reconsiderations of force have much to be taken seriously (and Lizardo's recent [2013] critique may not sufficiently appreciate Durkheim's own position here). But in most of Durkheim's work, the social force that we feel must be an external one from something that is bigger and better than we are. This fits the notion of force that was basically taken from mechanic collision, and not from Newtonian physics.

21 I am grateful to Forest Gregg for making this point more clearly than I did.

22 Again: »Things in our environment tell us what to do with them; they may do so more or less urgently and with any degree of specificity. But their doing so indicates a field of force between these objects and our Egos, a field of force which in many cases leads to action, and which is in most cases of the non-silent kind« (Koffka 1935: 353f).

minimization. He then went on (1881: 17f.) to define not the »market«, but the »field of competition«, which was (unlike most notions of a market) not necessarily a *bounded* one. This was not a problem, he argued, for »if one chose to define the field of force as the centres of force sensibly acting on a certain system of bodies, then in a continuous medium of attracting matter, the field might be continually of indefinite extent, might change as the system moved, might be said to vanish when the system reached equilibrium.« What made the field of competition solve a maximization problem was the combination of local dynamics, and the freedom of movement: to contract (or re-contract) with any other, or not to, and the absence of barriers to entering and exiting.[23]

Most sociologists will accept that actually existing markets almost always are a bit in-between the extremes of no compulsion on the one hand, and deadly threats on the other. There *is* a necessity (e.g., we must get *something* to eat), but that does *not* necessarily remove a kind of freedom, a freedom of choice. We have – correctly – found this admission troubling and irritating because it was used (by some social thinkers, if not by economists) to *normalize* the situation: »if they are choosing freely, why then, they have no grounds for complaint«, a theorization which is stupid and a sentiment which is unworthy. What economic thinkers were more likely to emphasize was that, for better or worse, this type of freedom of choice was important not because it was the same thing as existential freedom, but because *where it existed*, the self-organized ensemble of interactions had particular characteristics (cf. Stigler 1957).[24] What is interesting is less that the equilibrium has some sort of morally defensible properties than simply that there *is* an equilibrium at all.

Now let me give a second example, and it is »politics« as conceived of by Hannah Arendt (1958). To Arendt, politics is about the self-organization of free persons in a public realm of mutually observable speeches (a model she takes from ancient Athens). Arendt was not ignorant of the fact that there were distinctions of wealth, prestige, family and power in ancient Athens, even among the adult male citizens. But she believed that, up to a point, *politics* as a distinct form could exist even with these. Past a point, and politics disappears, as one would see in the late Roman Republic and Empire. Too few »free« people were able to move independently for one to say that there *was* a polity.

What may be interesting about these two examples is that they share a few similarities. First, they are sites that are justly famous for being loci of *substantive* coercion. Yet it may be that they emerge distinctly only when there is some sort of *formal* freedom of individ-

23 This insistence on the necessity of free movement was hardly idiosyncratic or unnecessary ideological verbiage. For another case, F. H. Knight (1921: 77) emphasized that the assumptions of his analysis required not simply »formal freedom« of the actors, but that all persons either be wholly dependent upon someone else (in which case they do not appear as persons, but are subsumed into the agency of their controller), or wholly independent. »Each person enters into economic life on an absolute equality with others or not at all.«.

24 Some of these characteristics disappear with only minor variations from the pure case (for example, the presence of any externalities means that the system no longer maximizes utility), while others (such as comparative advantages) are robust to all but the strongest violations.

ual movement. Second, they are sites that have, at least since Plato, been analyzed in terms of their functional contributions to the whole. Yet it may be that crucial characteristics of what we mean by a ›market‹ or a ›polity‹ do *not* have to do with this this environmental-functional relation, but are organized only by internal imperatives. This is easiest to see in Arendt's analysis of the Greek polity. What motivated individual actors was not necessarily to accomplish certain group goals, but to shine, and hopefully outshine one's rivals – that is, to do great acts that would be remembered, and that would reveal one's own (excellent) nature. This could lead to extremely non-functional results for the polity as a whole. What determines the nature of the polity *as* a polity (in this view) is not its relation to its environment, but the mutual orientation of the members to one another.

Something similar may happen in certain forms of pure markets. Certainly, a market can exist to facilitate want satisfaction and it may have the unintended consequence of efficiently solving certain allocation problems. This is most likely to occur, however, when it lacks the characteristics of a *polis* – that is, the mutual observability of action that takes place in a *forum*. Where there is such observability – even if it is only in the form of publicly available prices – then buyers can be oriented to *other* buyers, and sellers to *other* sellers. Buyers may buy things that they do not want, merely to sell them. The market can become a wildly destructive game of »hot potato« (in which whoever ends up with the ›good‹ being traded finds it is a ›bad‹) (see Orléan 1988).

Fields, Systems, and Endogeneity

Thus we can imagine an analytic dimension on which our cases can vary. At one extreme, the relations involved are not only distinguishable from but indeed are entirely separable from external states; here, the field effects are paramount. If one attempts to cast such a case as a functional system, the explanations become dreary exercises in tautology (the problems that are solved are merely the absence of the particular solutions observed). Further, we see that it is not simply that the elements are related to other internal elements, but that they are characterized by a more general *mutual susceptibility* – an »irritability«, one would have said a century ago, using biological metaphors – that facilitates the emergence of a texture of stresses. These effects are therefore heightened by situations of high general visibility (e.g., the polis), as opposed to compartmentalization of observations.

At the other extreme, the relations within the set cannot all be separated from external states; in these cases, we can hope to have a non-trivial functional explanation, and to understand the organization of the whole in regard to the combination of internal and boundary-spanning relations (for Luhmann, communication and external references, respectively). Further, this sort of organization is heightened by a reliance on channeled communication as opposed to broadcasts. It is important that the fact that self-referential systems will contain much of the endogeneity that characterizes fields not mislead us to reject the substantive importance of this analytic distinction. Further, this distinction suggests (though it does not prove that this is the case) that as field effects grow in importance, we would find the capacity of the set of relations to meet attributed functional imperatives to be lessened. If the set of political relations (e.g., communications) are wholly decoupled from the environment, even by reference, the capacity of a body to deliver binding decisions may be undermined. Similarly, when economic relations are wholly involuted (for example, economic actors are solely oriented to what other economic actors will think about their actions, or securities securitize nothing other than themselves), the capacity of an economy to ensure future supply (Luhmann's definition of its function) may be undermined.[25]

These considerations suggest that Luhmann has perhaps actually obscured some of the more distinctive characteristics of systems, by highlighting the ways in which self-reference *allows for* (but does not require) certain extreme forms of endogeneity. Consider his important and impressive work on aesthetics (2000a), which recognizes that art is what the artworld says it is, and the artworld consists in a continual reformulation of the answers to the question »What is art?« This general conception is a widely accepted characterization of the artworld, a position now known as the institutionalist one and rooted in Danto (1964). Yet Luhmann uses the same analytic account in crisper cases; thus he argues that »the system can be described through a tautology: only the political system itself can determine what is political« (Luhmann 2000b: 119). This seems at best only vacuously true, akin to saying that »reality is what actors think it is«. Certainly, if the political system thought that only things having to do with dairy products were political, then, by supposition, milk and cheese, and not parliaments and campaigns, would be politics. However, unlike with the art world, the rest of us are not forced to await the decisions of the political subsystem to determine what is politics; politics hugs the contours of the state quite closely, and lacks the extreme volatility of definition of the artworld.

Yet we would be wrong to take this to mean that strong endogeneity is characteristic only of fields, and to deny that the artworld has key characteristics of a system, for it does, namely, the crucial orientation to relations with an environment. The question of »what is art?« is indeed pivotal for what (in the current constellation of high art) it means to make and appreciate art, and there is thus reason to think that the artworld should be, to some unknown extent, amenable to a systems theoretic analysis. Such an orientation to an environment is not necessarily a result of each and every involution of relationships that might lead to a field effect. For example, the field of high cuisine (see Leschziner 2015) involves a set of actors who are quite aware of one another's positions, and who pursue strategies cognizant of their implications for field position, as well as the appropriateness of strategies for those in different positions (as do, say, painters). Yet in the field of cuisine, there is no interest in policing the borders, either by drawing a distinction between who ›is‹ and who ›is not‹ a true chef, nor by determining what ›is‹ and what ›is not‹ edible – there is no observer to orient to this difference. Instead, participants generally emphasize the connection of their own craft to home cooking, are quite comfortable

25 I note that this analytic dimension has a close correspondence to the distinction between *involution* and *dependence* that White (1992: 19) discussed, and that I previously (Martin 2009: 108) found to be alternate bases for the development of differentiation. In this light, any empirical case can have differentiation to the degree that it has at least either involution or dependence; moving towards the former alone pushes towards a field structure, moving to the latter alone pushes towards a system structure.

with a world like Edgeworth's market – one of infinite or at least indefinite extent, where the force of self-organization slowly drops off into insignificance.

In sum, although there may be continuous variation between cases that are best understood as fields and those that are best understood as systems, the nature of the variation is analytically tractable, and it turns on the importance of an environment, on the one hand, and the degree of specificity of internal relations, on the other. Specifically, we should tend to move towards systems theories when there is a weighty distinction of the Gestalt to an environment, when there is that sort of equifinality that suggests a functional contribution to the solution of a problem, or when there are strong dynamics returning the deviation of a large number of system parameters to a restricted range of values. In the absence of these characteristics, we may move towards field theory. The field effect is a remarkably powerful and theoretically intriguing extreme of involuted relationships wholly independent of any environment based on a generalized visibility and mutual susceptibility of elements.

CONCLUSION: SELF ORGANIZATION IN THE ABSENCE OF AN ENVIRONMENT

We have seen that since the earliest formulation of the notion of a field, there has been a recurring belief that it involved a kind of free-self organization via mutual orientation. The inner consistency of this approach is seen in the independent rediscovery, not only of Gilbert and Köhler, but of Tarde, who, in opposing Durkheim's corporatist model of society, turned not only to hydraulic metaphors (1969: 84), but specifically to an ensemble of vectors. Each person sent out a ray of influence (confusingly termed a »ray of imitation«) (1899: 101), which propagated in a medium of varying elasticity (1903: 115, 370). Such order requires that each element be free to respond to the aggregate influence from all other elements, which boil down to a vector at a position, a position in a tension-field.

It is for this reason that we see certain field effects collapsing when functional imperatives become weighty; as relations with the environment require increasing attention, the sort of simple mutual orientation and free movement that characterizes the field effect becomes less and less plausible. Yet it may be that field- and systems-effects continue to exist side by side, in some cases, leading to dysfunctionality, an important topic for future consideration.

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Anschrift:
John Levi Martin
University of Chicago
Department of Sociology
1126 E 59th Street; Chicago IL 60637; USA
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jlmartin@uchicago.edu