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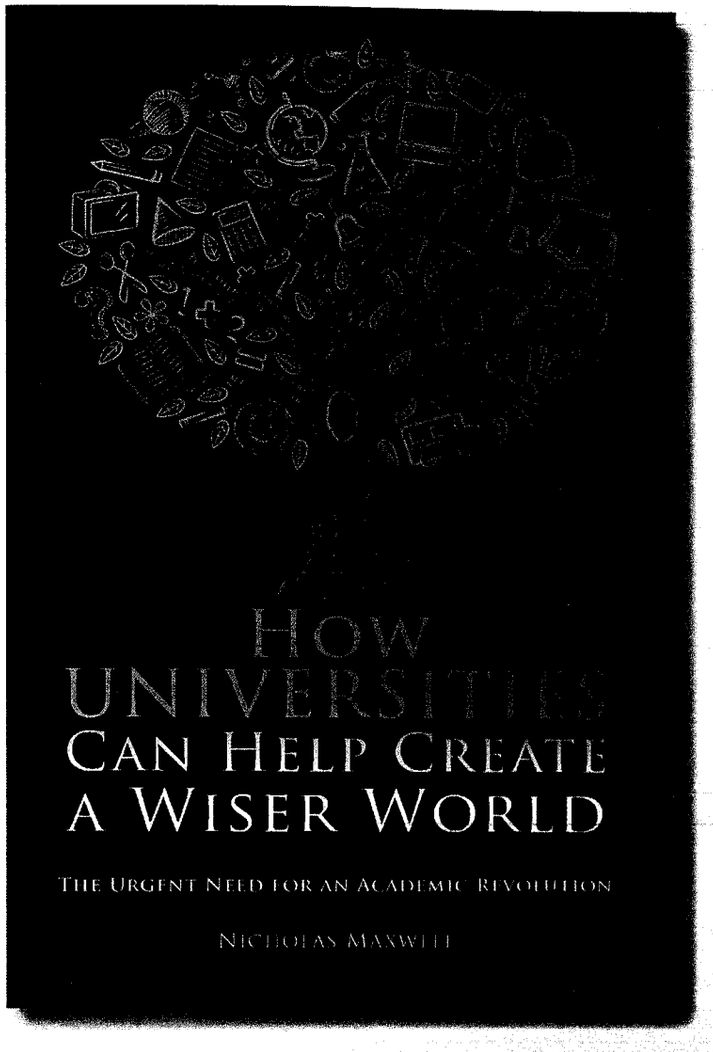

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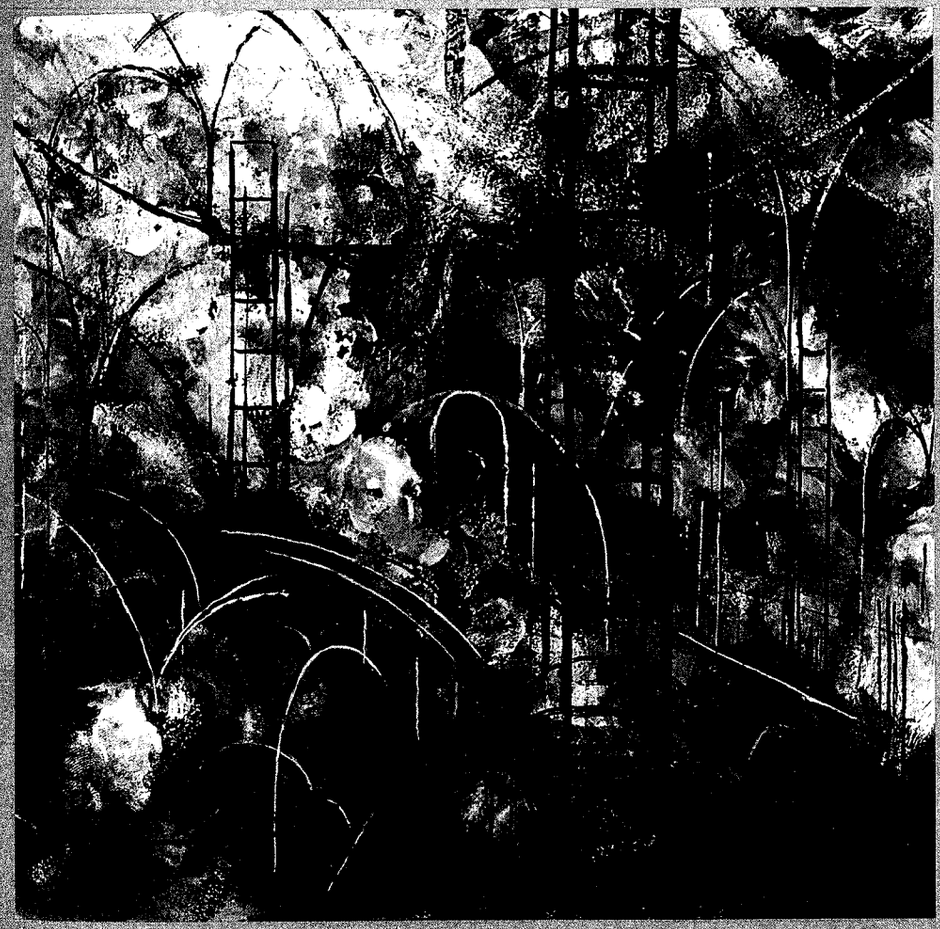

A Mathematics of Form, A Sociology of Observers

Contents

The artist for this issue is David Fox
Cover art: Chamber *(2012), gouache on paper mounted on wood, 9" x 9"*

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Comment: Socializing a Calculus

The Emergence of a Theory of Social Forms and a Sociological Notation

Athanasios Karafillidis[1]

The present paper seeks to expound the sociological prospects of a connection between the calculus of indications as presented in the *Laws of Form* (Spencer-Brown, 1994) and current sociological theory. Since sociology gets more and more interested in communication and perception, indeterminacy, boundaries, and difference, this attempt seems worthwhile. There is, however, a general condition that has to be met: A reasonable use of the calculus in sociology demands that the calculus is socialized. This paper is an attempt at such a socialization. It is not about how to *use* the calculus in sociology but rather about how to *construe* the calculus to develop a theory of social forms.
Keywords: sociology, social forms, methodology, communication, meaning, observer, sociological notation

Introduction

From a sociological point of view Spencer-Brown's calculus reveals itself as an observational device for the exploration of communication and meaning. Admittedly, this is not obvious, neither for sociologists nor for mathematicians. There is a *social* calculus trying to get out of the *Laws of Form* but this does not become salient until the calculus switches to equations of the second degree (Spencer-Brown, 1994, pp. 54). This is the moment when the calculus turns from finite to infinite expressions by allowing distinctions to re-enter their own inner space. As a consequence *time* is generated to resolve paradoxes, *imaginary values* with real computational possibilities emerge, and *indeterminacy* becomes the norm. But all of this is also featured in social phenomena and situations: a *temporal ordering*, for example, oscillations of topics and between participants (turn-taking) or narrative structures of interactions and institutions; negotiated, contested, or simply shared *expectations and identities*, which get their validity and plausibility during the process (that is, they need not be real or correct, but they are treated as real and thus provide orientation); and *uncertainty*, which is incessantly controlled by determining the indeterminacy of expectations, identities, relations, and meanings.

Spencer-Brown has found a mathematically adequate way to deal with infinite recursions and their consequences, accompanied by solutions suitable for engineering. But the latter cannot be simply adopted for sociological descriptions of socio-cultural forms. Engineering is only a limiting case of the social. We thus adopt the problem of

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recursivity and look for prevailing social solutions instead. This amounts to an exploration of a social calculus. Yet if we pursue this path consequently then it will affect any way of conceiving distinctions and forms. Thereafter any form has to be considered as a *social form*. Such a sociological infection of the calculus turns out to be a necessary condition for bringing it to bear on sociology.

These considerations, as well as any further ones in this direction, no doubt presuppose a particular form of sociological reasoning. Hence some sociologists will, at least in part, disagree with what is presented here as core problems and key concepts of the discipline. In the same way, many mathematically trained scholars might disagree with the presentation of ideas referring to the calculus. But in case that there is some interest in *distinction* and *form,* the following points regarding the combination of sociology and Spencer-Brown's work might be instructive.

I start by recounting briefly how the relation between Spencer-Brown's calculus and sociology came up (I) and will add a succinct review of available criticisms (II). Then the socialization of the calculus is presented, which amounts to a short outline of the foundations of an emerging form theory (III). These first sections are followed by considerations on methodology (IV) and a longer section that presents a sociological application of form theory, which places special emphasis on the use of the notation (V). Finally some of the raised issues regarding the practice of research are discussed (VI). I will conclude with a final claim (VII).

I. Toward a Theory of Social Forms

Back in the 1980s when Niklas Luhmann began to base his sociological thinking on some of the main conceptual ideas of George Spencer-Brown's calculus of indications, he certainly was not driven by a desire to find a mathematical foundation for his theory. On the contrary, he has always been reserved and careful regarding the utility of mathematical formalisms for sociology. The combinatorial possibilities of natural language were, in his view, richer than those of formal languages and also better suited for dealing with the problem of social complexity. However, Luhmann was fascinated by the simplicity and economy of this calculus. It promised an elegant integration and condensation of different concepts he had developed before (e.g., meaning, self-reference, distinction, observation, temporality, paradox) and it enabled him furthermore to finalize his rigorously operational approach to social systems. Due to this radical orientation to the immediate present[2] his thinking revolved around the question how process, or in his terms: the reproduction of social phenomena in time, is possible. The *Laws of Form* had much to offer in this respect (Spencer-Brown, 1994).

2. This orientation is indicated by the term *operation*. It plays a crucial role in Luhmann's overall theoretical work and indicates a situated event that vanishes as soon as it is there (Luhmann, 1995a, pp. 285-290 & passim). His conception of operation as an event thus corresponds to Mead's ideas that the present is marked by "its becoming and its disappearing" and that "the world is a world of events" (Mead, 2002, p. 35). Luhmann wondered how our impression of a stable world might come about under these circumstances. He thus examined how social events are produced and reproduced and above all how lineages of events are coupled, decoupled, and occasionally stabilized. The respective processes have been called *systems*.

Unsurprisingly the significance of Spencer-Brown's concepts for his work grew over time. In the end especially the notions of form and re-entry became key concepts in Luhmann's theory of society (Luhmann, 2012).

In the 1990s scholars started to seize upon these developments in sociological systems theory and began discussing possible sociological applications and epistemological consequences of Spencer-Brown's calculus (Baecker, 1999). Yet scarcely anybody has taken Luhmann's conjecture seriously that the forthcoming step of theory development—adumbrated a few times in some of his latest studies (e.g., Luhmann, 1997)—might be the establishment of a form theory that treats systems only as one possible application of itself. How Luhmann himself envisioned the implementation of such a step toward form theory is not sure. But some of the latest studies about this issue show that it requires recasting sociological notions like communication, differentiation, and individuality (Baecker, 2005; Karafillidis, 2010b, pp. 239; Lehmann, 2011). Besides, the whole endeavor is seen to come close to attempts at formulating a network theory and to bear epistemological as well as methodological consequences. Last but not least, all these recent studies utilize, in contrast to Luhmann himself, Spencer-Brown's topological notation for distinctions. But they do so in a decidedly sociological interpretation and it is a moot point if this is tenable at all.

Most of the severe doubts about this undertaking can be traced back to particular methodological positions that now take on the form of obstacles blocking further argument. At least some of these obstacles might be cleared if we are prepared to question the common severance between theory and method that is frequently taken for granted in the social sciences. In the present case this severance leads to putting the mathematical calculus into the pigeonhole of *method*, which in turn prohibits its contamination with sociological theory. But contamination is inevitable here. The process of contaminating the calculus with sociology is described as the socialization of Spencer Brown's calculus. The outcome is a theory of social forms.

The theory thus obtained is basically about how distinctions are drawn, combined, yoked, nested, shifted, reproduced, pitted against each other, substituted, or erased. Its purpose is to ascertain dispersed and self-similar patterns that are responsible for the generation and reproduction of observable data that can be retrieved from people's behavior, narratives, descriptions, and explanations. Sociology's main task has always been about construing such non-random and yet contingent patterns of communication and interaction, that is, in a different terminology, it has always been in one way or another about networks of related and meaningful distinctions.[3]

Before we continue, two points should be mentioned that deserve special attention from the outset. First, though a distinction is at least a two-sided affair it is not automatically binary. Neither does it necessarily imply an opposition or categorization of the sides and elements being distinguished. Yet binary oppositions and categories certainly merit close inspection as special forms of distinction. Second, a scientific

3. This is not exactly different from other sciences. But this way of looking at science is again a sociological one.

preoccupation with forms of distinctions (which also implies, as will be shown, communication and meaning) does not mean that the examination is confined to some conceptual or formal or symbolic realm. Distinctions dwell in a material realm, too. More precisely, forms of distinction indicate the point where conceptual, symbolic, and material realms meet. Theorizing and examining social forms (of distinction) always includes taking their social as well as their cultural constitution into account.

Consequently, distinctions are not only observed but also perceived as differences. That is, they are indicated consciously and socially by drawing another distinction (i.e., observation of distinction)[4] but they do also have neurophysiological correlates (i.e., perception of difference). One can smell danger as an operator in a chemical plant, feel the quality of a product as a customer, see the relief in someone's corporeal behavior, hear the subtext in voices or the malfunctioning of a machine, and taste the myriad nuances of edibles or the wholeheartedness of a kiss. Forms of distinctions are inscribed in bodies and their movements, are materialized in slight variations of our vocal cords' vibrations, appear as signs and signals, are written and printed on paper, displayed on screens, etched into technology, carved into buildings, and imprinted in and on objects of all kinds.

Viewed in this light, distinctions and their networked combinations and nested arrangements are definitely not a special sociological area of research, and even less a new phenomenon. They are not always called as they are and appear in different guises. But they are certainly part and parcel of what sociology is all about: devising conceptual distinctions in order to identify, investigate, and interpret empirical ones. No matter how you look at it, a calculus that is able to handle distinctions could give sociology additional leverage for identifying patterns in confusing and complex times and settings.

II. Criticism

In general, it is far from self-evident why some specific mathematical calculus might be of any interest for sociological reasoning. Therefore the introduction of any mathematical formalism, technique or calculus to sociology needs to be accompanied by convincing sociological reasons that justify its deployment. It has to be deemed reasonable in sociological terms. This is not an easy task anyway and becomes rather intricate if the respective calculus even lacks the requisite mathematical reputation and currency. This is the case with Spencer-Brown's calculus, which is neither common nor uncontroversial in mathematics. It is certainly not part of any standard mathematical textbooks, nor of academic teaching (there might be exceptions but they surely are of no consequence to this general assessment). Possible applications are debated only in particular circles and communities, most notably in second order cybernetics (Glanville, 1979; Kauffman, 1987). These circumstances complicate any attempt at convincing sociologists of its benefits for the practice of research.

4. Which is exactly a form taken out of the form (Spencer-Brown, 1994, chapter 2). For this generalized concept of observation not tied to consciousness see Luhmann (1995b) and Hayles et al. (1995).

Criticism of previous efforts to apply the calculus sociologically is therefore strident and yet instructive. It rests basically on three more or less connected arguments. First, the calculus itself is attacked on scientific and mathematical grounds respectively and is regarded as detrimental to sociology on this account. For example, mathematically well trained sociologists who have reviewed the calculus and early attempts to bring it to bear on sociology express severe doubts about its usefulness as a calculus. Their critique addresses its dubious internal validity (Fararo, 2001) and points out its problematic deviation from the main lines of science and modeling (White, 2008a, p. 353). This line of critique acknowledges possible conceptual insights but in the end denies any value to this kind of approach.

Second, the implementation is attacked by sociologists, philosophers, and mathematicians alike. This amounts to the reproach of not having applied the calculus proper or at least not having applied it properly (Hennig, 2000; Schönwälder, Wille, & Hölscher, 2004, pp. 245-256). This is definitely correct. Luhmann has never been interested in the calculus as a set of formal conventions for calculation but was rather intrigued by certain conceptual choices and the ensuing consequences. Hence he took its mathematical validity for granted (as this strand of critique does) though he surely was well informed about the problems others discerned. The same criticism is also applicable to current research on this integration of Spencer-Brown and sociological theory—unless one is prepared to accept that the whole endeavour takes place on a somewhat different epistemological and methodological terrain. More on this issue follows below.

The latest and last line of critique is predominantly expressed in reaction to presentations or in reviews of such work. It casts doubt on the sociological usefulness of the respective notation. It is basically attacking the sociological prospects of the notation. How does sociology benefit from this kind of notation? What is the surplus? Is the accompanying terminology not too abstract and too demanding? What difference do form equations of this kind make in contrast to linguistic expressions and what are the benefits compared with figures resorting to pointers or concentric circles or some connected boxes for the purpose of displaying the connection between elements, variables, or concepts?

These criticisms point to hard and pressing problems indeed. Alas, the answers will appear cumbersome and daunting at first sight. They require painstaking theoretical work. There is no shortcut but the pursuit is worthwhile. In the remaining sections I will sketch the path sociological form theory is currently taking to find some answers to the problems posed by the criticisms. This will be done without coming back to them in detail. In the end it should become clear, however, that a socialization of the calculus overturns the first two criticisms because both rest on assessments of the calculus as a separate and impenetrable mathematical entity. The third criticism, which is questioning the surplus of a sociological notation, will be addressed in the section on the practice of research.

III. Socializing the Calculus: Communication, Observation, and Meaning

The field in which the intended combination currently takes place is called theory of social forms, social calculus, or just form theory. It has strong roots in the formal sociology of Georg Simmel (1950, 2011) and embarks on a sociological program of research that since then is concerned with the indeterminacy of the social and the different empirical forms of its determination (Karafillidis, 2010b). This program informs in one way or another the reasoning of numerous sociologists. At present this program finds its expression above all in the theoretical approaches of Andrew Abbott (2001a, b), Bruno Latour (2005), and Harrison C. White (1992, 2008a).[5]

Niklas Luhmann (1995a) was one of the most profound thinkers in this not always explicit but reconstructible tradition. The fact that he picked up the qualitative mathematics of form as contrived by George Spencer-Brown (1994) has to be seen in direct correspondence to finding pertinent notions that matched his observations of social systems. What is now termed *form theory* in sociology is therefore closely affiliated to the sociological systems theory of Luhmann. But it should be noticed that as soon as the concept of form and further aspects of the calculus are allowed to take the lead, sociological systems theory appears in a different light and undergoes a revision in different respects. Certain weaknesses and open questions regarding for example differentiation, culture, and networks now become manageable.

How is the intended relation accomplished? How can we conceive of their relation? One very important point is to recognize that systems theory and the calculus of indications are not merely connected, but that they are composed—and form theory is the result of this composition. Spencer-Brown's calculus is not deployed as a mathematical tool in order to get results that wait for their subsequent sociological interpretation. Form theory rather is a sociological interpretation of the conceptual ideas of Spencer-Brown. It is therefore built on the idea that drawing distinctions, which includes the setting of boundaries and the activation of differences, is the social activity per se. Distinction is the precondition for creating and associating things, for connectivity, and for identity formation. The early and long forgotten sociologist Gabriel Tarde placed a considerable emphasis on this point (Tarde, 2012, p. 40) and his contemporary Georg Simmel conceived of form as a boundary that can be explored in two directions (Simmel, 2011, p. 1-18, 63). Today sociology's explicit interest for distinctions, differences, and forms is still unabated (Abbott, 2001a, 2007; Bourdieu, 1984; Bowker & Star, 2000; Cederman, 2005; Lamont & Fournier, 1992; Luhmann, 2012; Pólos, Hannan & Carroll, 2002; Tilly, 2005; Zerubavel, 1991).

Sociology is decisive for the development of a form theory out of the calculus. This becomes even more salient when Spencer-Brown argues in the last sentence of

5. Abbott, Latour, and White do certainly not describe their approaches in these terms and many sociologists would doubt that they pursue this kind of program. But their similarity with regard to what they consider as the general problem of sociology is striking. All of them look for sociological means to account for the empirical interplay between the indeterminate and the determinate: Abbott describes social chaos in terms of self-similar processes; Latour highlights the uncertainty of the social in order to be able to retrace associations; and White considers the social as a mess in which the emergence of different structural forms can be observed.

his treatise "that the first distinction, the mark, and the observer are not only interchangeable, but, in the form, identical" (Spencer-Brown, 1994, p. 76). In this passage he almost asks for bringing in second order cybernetics and sociological systems theory in particular. If we actually accept this invitation, then the basic tenet of observing systems applies: everything said, is said by an observer to an observer (von Foerster, 2003, pp. 283-284; Maturana, 1978). The *saying* is not the point here. Take it as placeholder for any operation that temporarily determines an observation. Decisive is the inevitable by-to relation between observers. Communication—understood in a fundamental, cybernetic way (Baecker, 2005; Ruesch & Bateson, 1987)—rushes in irresistibly. This supplements the calculus with one of its most compelling unintended consequences and unearths a critical sociological interpretation that went unnoticed before.

Normally, a mathematical calculus is built and valid independently of possible domains of application. It can thus be acquired as a formal language that does without any external references (or at least the external references should be confined to a minimum of readily intelligible axioms). Now this demand has to be dropped. Accepting the rationale thus far one has to recognize that the calculus changes. From a mathematical point of view it suffers a loss. But it is simply the price it pays for being social. Introducing the observer cybernetically means introducing an observing system, which in turn entails a communicative entanglement with further observers. Hence the calculus is now seen to mark the communication of meaningful observations. This is not to say that Spencer-Brown should have had any mathematical reasons to attend to this issue—but it is to say that we should have a general scientific interest to seize this corner solution of the calculus.[6]

In the notorious last two chapters of his book Spencer-Brown indeed tells us where and how to start the project. He expands his calculus to include re-entering expressions and thus infinite recursions, indeterminacy, and time. Thereby he touches, albeit unwittingly, subject matters of a sociology that is struggling with the indeterminacy of communication, the fractality of distinctions, the ambiguity of stories, the temporality of action, the reflexivity of process, the distribution of cognition, the recursivity of operations, and the (in)transitivity of relations (Abbott, 2001a, 2001b; Baecker, 2005; Hutchins, 1995; Luhmann, 2012; Martin, 2009; White, 1992, 2008a). Yet as soon as the calculus reveals its proximity to this kind of sociological problems and reasoning it ceases to be a calculus proper (Esposito, 2011). Its connection to arithmetics is now lost. Spencer-Brown (1994, p. 58) points out that it is at least possible to count algebraic steps in order "to still find our way." This might be an elegant mathematical (and engineering) solution, but it does not satisfy readers with an interest in socio-historical phenomena and their particular intricacies.

6. "Look for 'corner' solutions" is one of two injunctions that Harrison White (1997, pp. 55-56) recommends for sociologists who want to draw on existing mathematics for modeling. It refers to the corners within the "room of valid solutions" that the original writer "disdained to sweep up." Incidentally, the other injunction is "Cherry-pick," which means not to allow oneself to be distracted from the phenomenon by technicalities.

Like it or not, sociologists are obliged to find their own way in this respect. The crucial sociological question is not how scholars can still find their way, but rather how communication finds its way under circumstances characterized by infinite recursions and the ensuing lack of any externally given halting mechanisms. A mathematical calculus has the advantage that it contains a definition where to stop. In a social world the halt is not predefined but an outcome of communication itself, which besides has to deal with perpetual uncertainty: Every distinction one draws or relies upon might be called into question by other observers any time. However, there is also regularity and iteration in the social world and we are able to discern patterns or eigen-values of communicative processes that enable observers (including researchers) to somehow find their way in each moment.[7] Call such eigen-values social forms and call the process that either leads to or occurs within such forms social calculus. The purpose of form theory is tracing such patterns by using Spencer-Brown's notation in a sociological fashion. This amounts to a process of research that uses diverse data sources in order to determine the forms of distinction that render specific sequences of operations possible and reproduce the phenomenon under study.

Another highly convenient aspect of Spencer-Brown's calculus is that it endows us with the requisite means to condense and formalize our knowledge about meaning. Meaning is known to be generated by exploring and exploiting the contexts of some message, event, element, or observation (Bateson, 2000, pp. 417), by switching between network-domains (White, 1995), or, to put it more simply, by observing some element—for example, a letter, a word, some behavior, an action, an utterance—in distinction to its larger context (Cerulo, 1988; Mohr, 1998). Distinction is key across all these different conceptions of meaning. With Luhmann we may take as given that meaning is the only medium in which distinctions can be drawn and observed as distinctions (Luhmann, 1990; 1995a, ch. 2; 2012, pp. 18). Nervous systems of any kind or computers, the operations each of which are realized on different grounds respectively, are able to register differences but they cannot (yet) handle distinctions and surely not forms of distinctions. Yet when distinctions are communicated, the generation of meaning is ineluctable. Anyway, this does not preclude to think about, for example, bio-physical or electro-chemical operations that do without meaning; but as soon as we distinguish and thus observe such operations scientifically this happens inescapably within the domain of meaning.

Luhmann's close inspection of meaning in operational terms has revealed its inner workings: Any observation of an actual operation indicates possible further

7. The term *eigen-value* is used here in the sense introduced by Heinz von Foerster (2003, pp. 261-271). He takes it from the mathematics of recursive functions and applies it to the recursive sensorimotor operations of organisms. (Eigenvalues are similar to the better known attractors of dynamical systems, but von Foerster avoids the term *attractor* because of its teleological connotations.) The crucial finding that leads to the concept of eigen-value is that recursive operations do not simply end up in infinite regress but rather lead to the emergence of discrete stable dynamics. This can also be observed with reference to the recursiveness of communication. Eigen-values of communication are called *social forms* and describe the distinctive operations that lead to some specific structure, which includes particular expectations (of regularities). Persons have to be considered as such eigen-values, as well as for example institutions, organizations, markets, methodologies, or motives.

operations. Actual/possible is the pivotal distinction of meaning (Luhmann, 2012).[8] In other words, meaning is the overflow observed in any given situation that makes selection necessary. It is important to realize that it is generated by the distinction of selection and overflow or else actuality and possibility. The possibilities displayed each time are limited though. When somebody says "I love you" or "The number of crimes committed is rising" then possible following operations are empirically limited. This limitation is crucial. It gives meaning its situationally contingent structure. There is no abstract, ontologically given world of all possibilities. That is, meaning is derived by observing some present operation (text, selection) in distinction to its potentiality (context, overflow). Despite its overflow, which by the way effectively averts complete involution, meaning is a self-constraining form.

Spencer-Brown's calculus, with its distinction between marked and unmarked states, offers an almost perfect match of this process. Though the unmarked state is initially everything but the marked state, its observation as unmarked marks it as the unmarked state of the marked state. This is the self-limitation alluded to and enforces the definition that "distinction is perfect continence" (Spencer-Brown, 1994, p. 1). Since there is always an initially unnoticed unmarked state of the presently marked distinction marked/unmarked, the overflow never ceases and is renewed with every operation. But the self-limitation of a form of distinction, once observed, is inevitable. And the necessary result of this self-limitation of any form is nothing but meaning.

Once again we see that these insights add a new viewpoint of what the calculus actually does in an empirical sense and how sociology could profit from it. Though the calculus starts in mathematical terms as meaningless and timeless, a social scientific observation of the calculus reveals that it is in fact the formalization of the process of meaningful communication. It does not carry some specific meaning and is not communicating some particular intention but rather matches our ethnological and sociological knowledge of what meaning and communication is all about. This has also been one of Luhmann's major insights in this respect (Luhmann, 1999). He has demonstrated that the calculus starts empirically with a re-entry that is kept hidden for some sort of didactical reasons up to the last two chapters. Thereby its sociological potential has been concealed.

A Convention

Drawing these short and dense considerations together leads to the following convention for a sociologically extended calculus:

> Any cross or mark of distinction notated ⌐ indicates an operation of communication observed in the medium of meaning.

8. In earlier writings (Luhmann, 1990, 1995a) Luhmann has also characterized meaning by the distinction actual/potential. *Potential* might evoke somewhat different connotations than *possible*. A separate discussion of this shift could be interesting but is not necessary here.

Once this has been stated there is no need to indicate this separately in any form model. It remains possible though to notate communication, observation, and meaning respectively as social forms (in case they are the subject of research themselves) as it is possible to notate the form of concepts of the calculus itself, for example the form of the boundary separating two sides once a distinction is drawn (Karafillidis, 2010a). Self-reference by self-application is allowed and applies under all circumstances, research included. In this socialized calculus even the practice of mathematics reveals its character as a social operation. Mathematics may define its own axioms and valid abstractions but only within a form that allows for communication, is subject to observation and counts on time and meaning. Notating and arranging the tokens of the calculus then is not simply a mathematical operation. It becomes a sociological operation that notates social operations—and doing sociology is unquestionably itself a social operation.

To sum up, speaking of a social calculus in this context means to recognize that drawing distinctions cannot be separated from observers, communication, and meaning. This involves at least three epistemological consequences: the employment of a sociologically enhanced and respectively constrained notation; the knowledge that this practice involves, and thus has to account for, self-reference; and the combination of analysis and synthesis, that is, the imputation that the resulting analytic models of social forms indicate synthetic networks of distinctions actually underlying particular observable social entities.

Where the calculus of indications ends, the empirical conundrum begins. Bringing in sociological formalisms extends the calculus in this respect—though not exactly in a way approved of by mathematics. In this vein the calculus of indications has to become a calculus of forms and indeed, by embedding it in a discipline, a form theory. Only thus treated it becomes suitable for sociology.

IV. Ethno-Methodology, Hyphenated

The sociological perspective pursued here refrains from treating the calculus as an independent mathematical object either applied correctly or not. This is basically due to a peculiarity of the discipline. The social sciences are subject to self-reference in a quite radical form. To be sure, they are not alone. In linguistics one examines language via language, in biology living beings examine life, in physics one relies on the matter that is to be examined, and sociology examines practices and patterns of communication by using them. There is, however, a difference here between sociology and these other sciences. Contemplating the issue of self-reference has always been an important part of sociology's search for identity—not some quirk mentioned once in a while. For a long time, and especially with regard to method, this indeed has been considered a problem to be eliminated because it jeopardized the pursued objectivity and the (political) legitimacy of results. But the advent of terms like reflexivity and double hermeneutics (Garfinkel, 1967; Giddens, 1984) revealed that self-reference is inevitable and that it has to be accounted for from the outset.

Luhmann then installed this issue consequently in the guts of sociological theory and acknowledged autology as a main guiding principle of research.[9]

Self-reference pushes sociological reasoning to the edge (and, to be sure, many sociologists have their misgivings about that). A theory of social forms is one way of incorporating self-reference explicitly. But as soon as we begin to acknowledge that sociology, its subject matter, and its relation to its object of research are all characterized by self-reference, a purely analytic approach becomes unreasonable. We then need a synthetic sociology, as it were.[10] Such a sociology does not draw (analytic) boundaries in order to demarcate its inquiry (White, 2008a, p. xvii). It rather tries to inquire into how observers observe social phenomena that demarcate, count, order, and compute themselves by using particular distinctions in particular ways and combinations. But how can the claim be justified that sociological observers do not only analyze social phenomena at a distance but are also able to describe how the respective phenomena analyze and synthesize themselves?[11] Within a classic methodological frame such an attempt does not make sense because propositional logic and covering law explanations depend on a definite difference of subject and object (Salmon, 1989; Opp, 2002). Since this does not work in a self-referential frame, methodology has to move in a different direction. In order to lay the requisite methodological ground at least two steps have to be taken. The first is a reversal of the deeply entrenched division between theory and method (a); the second is to recollect the key role of observation as a backbone for all forms of data collection, theory, and method as well as for interaction practice in general (b).

a. The taken for granted division of theory and method is a heritage of causal reasoning and impedes the examination of recursivity and self-reference. "Again, the separation of theory and method proves to be based on a misconception" (Elias, 1978, p. 58). This misconception is a result of the interloping of standard causal analysis in the middle of the last century (Bernert, 1983; Coleman, 1986; Abbott, 1997). It has been dominating the main line of sociological (textbook) reasoning and education since then. However, this alignment of sociology with the variables of social research by the concept of causality has been eyed suspiciously from the outset (Blumer, 1956; Mills, 2000; Cicourel, 1964; Elias, 1978). Many scholars presumptively

9. Concepts and terms that imply self-application are autological (von Foerster, 1984). In other words: Autological concepts do what they say. Presumably one of the shortest linguistic examples is *abbr*.
10. This is not a call for a special or new form of sociology but rather a reminder. For Georg Simmel (1950) the synthesis of society has been the foundational problem of sociology.
11. Quine (1951) has of course shown that the distinction analytic/synthetic is itself problematic. However, here it is not quite used in the classical Kantian sense and certainly not in the way of logical positivism. It rather refers to the issue whether the observer is allowed to dissect the subject-object into elements that are inaccessible to itself (analytic) or if she/he considers and follows the limits of the examined subject-object in this respect (synthetic). A synthetic approach furthermore stresses the *assembling capacity* of some subject-matter. If some action is explained for example by referring to changes in blood pressure, to the Freudian unconscious, or to rationality regardless of temporal restrictions that effectively preclude rational decisions, then he/she employs an analytic strategy.

knew very well that sociological theories were not in need of some additional extraneous method. Sociological theories have always been set up and deployed as methods of observation.[12] In short and most pointedly: Theories are methods—lenses enabling the rearrangement of data of all sorts and origins with the aim to produce sociological data and to gain respective insights and outlooks. This point would not necessarily face outright rejection by sociologists. But it remains disabled due to the dominating notion that methods are detached from theory. This stipulates the dependency of theory on extraneously developed methods (i.e., techniques of data collection and construction) and keeps methods safe from defilement by self-reference.[13] Hence it blocks the development of methods being able to deal with self-reference and obstructs the idea that a calculus might develop into a theory. If this obstacle is not bypassed a synthetic sociology will remain beyond reach.

b. Scientific theories/methods that do not simply analyze a social process or system independently of how it unfolds itself (as it is the case, for example, when using causal modeling) but rather try to capture the social in its own terms, call for at least some similarity or proximity or contiguity between scientific theory/method and everyday practices. Since any sociological practice is itself a form of social practice this condition is easily met. There is obviously a common basis—but hardly any positions can be found that exploit this fact on methodological grounds. Ethnomethodology is the exception (Garfinkel, 1967). It is known for taking explicitly into account that both scientists and non-scientists employ diverse methods to make the settings in which they are entangled accountable. Thus different context-dependent methods (i.e., ethno-methods) have evolved in practice that are used to achieve pertinent accounts and distinguish different social domains.[14] In this vein we are also experienced in distinguishing science and non-science. We expect scientists to use scientific ethno-methods and non-

12. Usually, the meaning of *method* is confined to textbook methods of data collection. But this understanding is inappropriate for an empirical description of research. Theories are not simply related hypotheses awaiting falsification. They define at least the subject of research, the type of data one is looking for, and the form in which it can be observed. Actually, scientific observation of any kind (including common methods like interview, content analysis, ethnography, etc.) is impossible without them. In this vein it is justified to say that theories are methods of observation. It can be shown that this holds true for most approaches labeled and taught as sociological theory (Karafillidis, 2010b, pp. 27-57). Note, however, that the distinction between theory and method remains valid and instructive. But for an observer applying sociological theories their difference is not relevant.
13. John Levi Martin (in a comment on this passage) put the problem straight: Most scholars think of methods as doing something outside one's own skin. Thus it is assumed that it is the method itself that produces and structures the data (or that there substantially is a structure hidden in the data that is discovered by using the proper methods), while theories bring in an interpretive account of these objective results. But anybody who has ever constructed scales, conducted interviews, coded data, and set up tables knows that this is wrong. Theories and methods are both observer-dependent.
14. This process also differentiates science itself. Think of the different epistemic communities described by Fleck (1980) and Kuhn (1970).

> scientists to use non-scientific ones.[15] However, regarding the problem of accountability, self-similar structures can be identified in both areas. But what are we trying to make accountable all the time? It is not actions as most ethnomethodologists would contend but rather observations (of actions, states, behaviors, artefacts, interactions, etc.). Any social ethno-method proves to be a particular form of making observations accountable. This surely holds true for methods and techniques of data collection—be it interview, content analysis, field research, or experiments (e.g., Babbie, 1992, pp. 234)—but it also holds for any practice of social interaction. Social science is thus a special case of observation that employs diverse control operations in order to produce scientifically viable accounts. In the end (scientific) forms of observation are used to investigate forms of observation. This is the self-referential similarity we have been looking for. Therefore an appropriate theory of observation can serve as a foundation and legitimation for synthetic inquiries.[16]

For some, this second point might appear as a too abstract foundation for methodology but it is rather the other way round: it is too concrete and hence unfamiliar in contrast to past forms of approaching the problem of methodology. Concreteness here means closeness to the cognitive experience of observers. But it would be wrong to assume that the concrete amounts to the obvious. Rather it requires hard work to be construed (Whitehead, 1967, p. 4; Martin, 2011, pp. 341-344). Especially for sociologists this methodology rules out the possibility of occupying some superior position as distinct from the observers that participate in social situations. It is merely a different position. With reference to the ethnomethodological tradition—but also to keep in mind the existing differences and to mark the generalized character of the proposition—I will call the methodology appropriate for a theory of social forms ethno-methodology (hyphenated).

The main sociological task within such an ethno-methodological frame is researching empirically valid patterns that scientific as well as native, social as well as individual observers use to calculate their contingent but neither arbitrary nor unlimited possibilities of further behavior, perception, action, and experience. Tracing and recording such patterns that relate observers of diverse kinds and their contexts is tantamount to ascertaining self-similar and dispersed forms of communication. This re-search of social forms yields a description of the operational core of a particular

15. That is of course the simple version of the story. There is no need to delve into the old debates on the (possibility of a) demarcation of science from non-science because this is not the case in point here. Consult on this issue Stengers (2000) and Rorty (1991).
16. Nevertheless sociology still lacks such a theory. One of the last attempts formulated on the promising basis of Gestalt theory dates back to the 1970s (König, 1973). Unfortunately, observation has been tamed in the social sciences. Its epistemological primacy has been concealed by reducing it to one technique of data collection amongst others. Second-order cybernetics (von Foerster, 2003) brings the observer back in. It corresponds to the Gestalt approach used by König and stresses the pivotal role of observation for cognition and communication (Karafillidis, 2010b, pp. 167-195).

observable phenomenon (e.g., interaction, network, inequality, institution) and thus explains its iterative reproduction.

Right-minded sociologists will now raise their voice in protest: This cannot be an explanation! Where is the causality that we should expect for any explanation to hold at all? Although this immediate connection between explanation and causality is still shared by a majority of sociologists one also finds serious and reasonable doubts in this respect (Abbott, 2001b, pp. 97-125; Karafillidis, 2013; Martin, 2011). A theory of social forms offers one possible account of what non-causal explanations can look like. Gregory Bateson (2000, pp. 405-416) has coined the apposite term *cybernetic explanation* for explanations referring to the domain of communication in contrast to the world of causal forces. Taken the indeterminacy of the social, causality is simply too restrictive to be included as a premise for theorizing and modeling. Weaker premises keep empirical flexibility. This allows, for example, to examine in which contexts and how observers construct causal explanations themselves (Martin, 2011, pp. 61-73).

Another Convention

Taking stock of the methodological prerequisites and consequences for a social calculus we arrive at the following methodological convention:

> The notation of any equation containing a cross or an arrangement of crosses marks empirically employed distinctions that are deemed responsible for producing and reproducing some observed social process. In addition, conceive of these social forms as injunctions that in-form observation and provide the chance to recreate the experience of the phenomenon. Check this experience at different times against further data, and diverse observers. Describe this oscillation between injunction and counter-checking to achieve (non-causal) explanation.

No calculus can achieve such a form of explanation by itself. A theoretical backdrop is required to be able to assess the impact of the results. But it does not suffice to simply add some sociological theory for the retrospective interpretation of the calculation and its output. This would just corroborate the cleavage between theory and method. Once again the gap between calculating and interpreting would remain obscure and thus methodologically uncontrollable. Actually, we face here one of the hardest research problems in sociology: How can the results of some calculation (i.e., method) be interpreted without allowing just any possible interpretation (Tilly, 2004)? A promising solution already alluded to is weaving the calculus directly into theory and vice versa. This is what happened in the development of a theory of social forms, which basically tries to bring some light into this enduring obscurity between operation and interpretation.[17]

How is this accomplished? The suggestion is quite simple: do not try to close the gap between calculation and interpretation but rather penetrate the gap. Models of social forms are formalizations of gap dynamics that arise when (scientific or native)

observers calculate interpretations and interpret calculations respectively. In this respect the endeavour as a whole becomes a social calculus and therefore necessarily deviates from mathematical notions of calculus. A social calculus is the operational description of ethno-methods. Its conventions and rules are not mathematically fixed but social, which is to say, written and rewritten during the game. And yet a form theory disciplines the social calculus and thus claims that such processes have a structure that can be formalized by using a theoretically saturated notation tailored specifically for sociological demands. Working and struggling with such a sociologically augmented notation to determine the eigen-value of some social entity, object, or event as an arrangement of distinctions, is, however, far from arbitrary. It is an activity that involves strict discipline, that is, it requires both the methodology of a discipline and disciplined practice.

V. Notational Practice: An Application

In the following section the practice of form theory is presented and discussed. Since one of its most salient features is Spencer-Brown's notation for distinctive operations, I will concentrate most remarks on that aspect. Besides, the notational practice is a critical control operation that distinguishes social from social-scientific practice in an ethno-methodological context.

Consider an example that demonstrates the use of the socialized calculus and its notation in a comparative fashion. Let us capture the obvious by notating two distinct forms of social science methodology.[18] In order to do this, we have to state the problem first. This is done by setting up an equation. Using the sociologically interpreted notation of Spencer-Brown the general problem can be stated such:

$$\text{Methodology}_{\text{Social Sciences}} = \boxed{}$$

Equation 1

This is the first thing to do: setting up a simple equation. Equation 1 is on the one hand a condensed and most simplified account of the problem. On the other hand it is an injunction to re-search for the operational distinction that constitutes methodological

17. Since we talk about ethno-methodology we should always keep in mind that this distinction of *operation* (e.g., calculation, behavior, reaction, etc.) and *interpretation* also drives everyday communication. But in contrast to research, here the respective control operations assume a different form. There is for example no need to uncover or present some underlying structure as in social science. The simplest empirical solution of this everyday problem is: keep going.
18. For a discussion from a different angle see Karafillidis (2010b, pp. 89-104). I will concentrate on methodologies of the social sciences to focus the attention although these considerations are also applicable to debates about methodology in general.

communication.[19] It does not suffice to mark the term *methodology* with Spencer-Brown's cross (operator) in order to look for some unmarked outside. This is definitely helpful as a heuristic for testing antonym substitutions and conceptual demarcations of methodology to other concepts. But without an equation one does not take any risk of being wrong. Thus setting up an equation is mandatory if one looks for a distinction that constitutes methodology empirically. Equation 1 then reads: The identity of methodology is constructed by, and is thus confused with, some particular distinction.[20] Remembering the socialization of the calculus and its operator one should add: it is a communicated distinction to which an observer attributes meaning recognizable as methodology.

How do we find out which distinction is in use when some communication is recognized and marked as methodology? To look for available data on methodology means for example to look at texts claiming themselves to do methodology.[21] Germane accounts can be boiled down to an attempt to build a (normative or empirical) theory about the development and use of scientific methods. Methodological practice proper is driven by the explicit or implicit distinction between theory and method (Kaplan, 2004, pp. 18-27; Smith, 1991). This involves many different aspects: explication of techniques and their relations, selection of questions and topics, or specific forms of reasoning (Lazarsfeld, 1959). So there are obviously further distinctions that are combined with the distinction of theory and method; but without this distinction observers cannot recognize methodological communication as such. That is, it would not exist in practice in the form it is observed today. The claim is that this distinction generates methodology. Note with respect to this initial observation:

$$\text{Methodology}_{\text{Social Sciences}} = \overline{\text{Method}\,|\,\text{Theory}}$$

Equation 2

Communicating on the basis of the distinction method/theory shapes observation and generates meaning in a way that is recognized as methodology (equation 2). The sequence of the two terms is not arbitrary. It is contingent on what can be warranted on

19. Other scholars might prefer to speak of methodological *association* (Latour, 2005), *interaction* (Abbott 2001b, pp. 265-266), or *transaction* (Tilly, 2005, pp. 6-7). Albeit not identical, all these terms address the same process. But the term *communication* is much more explicit with regard to the operational character of social processes. Furthermore it immediately indicates (and allows to model) the inter- or the trans- of actions, while the concepts of interaction and transaction simply shift the problem to the *inter* and the *trans* respectively.
20. In this sociological context the equal sign is preferably used in the meaning "is confused with" (Spencer-Brown, 1994, p. 69)
21. This is by no means the only way to observe operations rendered methodological. But for the task of re-searching distinctions it is more reliable to consult written material and to rely on participant observation than to conduct interviews with methodologists.

empirical grounds. Method is placed first, beneath the cross, because it implies less presuppositions. It simply denotes that there must be some procedure, some practice, some action that can be addressed and thus construed by communication.[22] Sometimes methods even make an appearance in the very simple form of an injunction: "Look down that microscope" (Spencer-Brown, 1994, p. 78) or "Follow the actors" (Latour, 2005) or simply "Observe x."[23] In their conventional and sophisticated form, methods indicate research methods and include the planning of research as well as all techniques of data collection and manipulation (above all statistics). But no method can be a method—at least with regard to methodology—if it is not accompanied and contextualized by some theory. However, both terms, *theory* and *method* remain underspecified in this equation (as any terms that appear in form equations). This is due to the fact that they are defined differently in different research contexts and scientific disciplines. Furthermore they assume their specific meaning only in relation to each other. The ambiguity of terms is considered as unproblematic in such equations because it resembles the ambiguity we encounter in empirical settings. There is no need to know the exact meaning of *method* on the one hand and *theory* on the other in order to recognize communication as methodological. Their distinction is decisive and sufficient for recognition.

For the time being the above distinction (equation 2) is assumed to be valid for any methodology of the social sciences. There are many different empirical forms of methodology, however.[24] These are derived by a re-entry of the distinction into itself, so that a distinction becomes fractal as Andrew Abbott has demonstrated lucidly (Abbott, 2001a). Here I will confine myself to two methodological forms: the methodology of social research (i.e., survey research) and the methodology of sociology.[25] It is quite uncommon to impute two forms of methodology for these twins of social science. But the numerous and sometimes fierce ontological and epistemological debates of the last decades hark back to this forgotten difference. The cleavages with regard to explanation, understanding, interpretation, theory construction and evaluation are so obvious that it is reasonable to accept their difference—which is also a necessary condition for devising fertile combinations between sociology and social research.

22. Note that there is no action of sociological interest that is independent of its social observation. Action is not the preceding cause but subsequently construed by communication. This is also made clear by the order of the equations in this example. The operation of communication comes first (equation 1) and is then elaborated and specified (equation 2 etc.).
23. This is the *ur*-method, as it were. Once again it should be noted that observing is not tantamount to perceiving. The latter is continuous (Merleau-Ponty, 2003) the former discrete. Observing means making indications based on distinctions. This is not confined to language or some merely symbolic domain: Any action or practice is based on simultaneously and successively processed indications. Yet neither any indication nor the employed distinctions need to enter conscious experience for their subsequent observation to be possible.
24. This is a moot point. Sociological positions clinging to *critical rationalism* as developed by (and later with reference to) Karl Popper have dominated the methodological discussion almost exclusively since the 1960s by stipulating that there is only *one* methodology for the social sciences which furthermore is even equal to Philosophy of Science (in the meaning of the German term *Wissenschaftstheorie*). See for example Opp (2002).
25. Just to avoid any misunderstandings that might arise due to the namings: Of course both of them imply research activities. It has *not* to do with some contraposition of research and theory as the following discussion will show.

A notation of the corresponding forms of methodology is revealing. The methodology of social research as taught and discussed explicitly in textbooks has the following form:

$$\text{Methodology}_{\text{Social Research}} = \boxed{\text{Method}\ \boxed{\text{Theory}}}$$

Equation 3

Equation 3 is a specification of equation 2 with reference to the case of social research. Method and theory are both marked separately and framed as a unity that is recognized as methodology of social research. The reason for notating the form in this way is quite simple: Methods are developed in the context of theories but the latter have no direct determining influence on the development of techniques like, for example, sampling or factor analysis or measurement levels or index construction or scales. In other words, such research methods have not been developed for some socio-theoretical reason—they are contextualized by theory but not framed theoretically.[26] Most textbooks of social research refer in initial chapters to some philosophy of science, preferably some form of critical rationalism, but they do not work themselves on such theories of scientific practice. They are taken for granted instead and regarded as necessary context. The same can be observed when turning to respective theories of science (e.g., logical positivism, critical rationalism, scientific realism etc.) that have obviously not been developed with the purpose to devise concrete research techniques.

At this stage a more differentiated view is advisable to get the argument and the benefits of the notation more clear. In the last equation (equation 3) there is another very important detail not discussed thus far. The distinction *re-enters* into itself. We might write down the re-entry of equation 3 once removed:

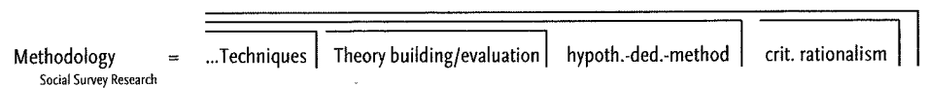
$$\text{Methodology}_{\text{Social Research}} = \boxed{\ldots\ \text{Method}\ \boxed{\text{Theory}}\ \text{Method}\ \boxed{\text{Theory}}}$$

Equation 3.1

The dots indicate the endless recursion and the nested character of the re-entering form respectively (see Spencer-Brown, 1994, pp. 56-58, for this alternative notational

26. Any method might be theorized of course (think of measurement theory for example) but this obviously does not constitute a methodology of social research. Any theory that justifies a methodology of this kind is almost exclusively some theory of scientific inquiry (philosophy of science). Hence it is this kind of theories that are relevant here (for equations 3, 3.1, and 3.1.1).

version of re-entries). Equation 3.1 is identical to equation 3. But now one can see how the re-entry works. Let us discuss the form from right to left. "Theory" on the right side is marked by some philosophy of science and most prominently marked by critical rationalism in all its diverse manifestations (Popper, 1993; Albert, 2010).[27] The "Method" right next to it denotes the hypothetico-deductive-method as a kind of master-technique that found its ultimate realization in the context of critical rationalistic propositions.[28] The theory and method framed by the hypothetico-deductive-method are the more specific ones that we frequently discuss in a form not explicitly marked as methodological. However, we see here, that the methodology of social research involves normative methods of theory-building and evaluation (Stinchcombe, 1987) and the incorporation of special techniques (statistics, sampling, survey construction, etc.). Theory building becomes itself a method of constructing and connecting lawlike propositions and determining antecedent conditions. We can plug these terms into the equation 3.1 and get the following equation:

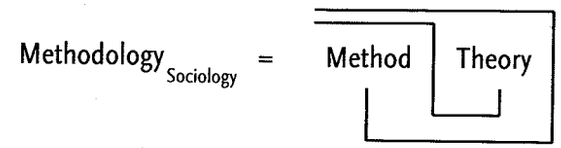


Equation 3.1.1

Note that we had to change the index on the left side of this equation 3.1.1 because it notates a more specific form than eqs. 3 and 3.1. It is only valid for a particular, albeit mainline, form of social research known as survey research. We should furthermore keep in mind that eqs. 3.1 and 3.1.1 are already contained in equation 3, which is the most condensed (and thus most general) form of social research methodology.

How does the form of sociological methodology look like compared to equation 3? It emerged earlier in history than the form of social research methodology but rather appeared in treatises labeled as *sociological theory* and therefore did not find its way into textbooks and teachings of methodology. Thus, an explicit formulation is missing. However, the works of Elias (1978) and Abbott (2001b) give us enough clues to record the following form (equation 4), which features two different re-entries.[29]

27. The following discussion pertains to the form of social research that is typically labeled *quantitative* in order to give a more concrete example. Equations 3 and 3.1 also hold true for the so called *qualitative* approaches but then the different variables/observables under the crosses assume different values, e.g., not critical rationalism would prevail, but rather hermeneutics.
28. One could ask justifiably why critical rationalism does not frame the hypothetico-deductive-method since the latter is determined by the former. Their contiguity notwithstanding, I think that it would do justice neither to critical rationalism nor to the deductive-nomological approach because they emerged historically independent.
29. One re-entry is drawn the other way round but this makes no difference with regard to its operational meaning here. The inner hook indicates that the distinction between method and theory re-enters into theory (this is the case when *formalisms* are generated), the outer hook indicates that the distinction between method and theory re-enters into method (which is a precondition for scientific *observation*). I will come back to this.



Equation 4

I would like to direct the attention to three notational characteristics that this equation displays in contrast to the other forms introduced thus far: same distinction, different form; the distinction of context and frame; and the already mentioned different re-entries. All of them have a particular empirical reference and meaning. The first salient thing is that the distinction remains the same but is now realized in a different form (and this raises doubts regarding the sameness of the distinction, to be sure). This points to one of the main advantages of using the notation in contrast to talking about distinctions or writing about them in ordinary sentences. A form of a distinction differs from the distinction itself. Else there would be no reason to introduce a concept of form. The notation used here takes this into account.

Second, we can see that the term *theory* does not contextualize method but frames it instead. A clarification of this particular difference between eqs. 3 and 4 (or context and frame) might be achieved by using brackets:[30]

$$\text{Methodology}_{\text{Social Research}} = [[\text{Method}]\,[\text{Theory}]] \quad \text{--> contextualized}$$

$$\text{Methodology}_{\text{Sociology}} = [[\text{Method}]\ \ \text{Theory}] \quad \text{--> framed}$$

That is, method is not only determined by its own restrictions but also substantively determined by theoretical decisions about what to observe, which questions to ask, or how to embed and interpret observations. If you have a theory of spatial and temporal situatedness of social process as the Chicago School developed in the 1920s then this theory frames which methods are needed or have to be devised respectively: tracing natural histories, recording careers, or describing interactional fields (Abbott, 1997).

A third point is that we see two re-entries in equation 4. The distinction re-enters itself into the position of method on the one hand and into theory on the other hand. It

30. This is not an equivalent representation of form models. It simply illustrates the adumbrated difference between context and frame (any frame is a context but not vice versa). See, for a notation using brackets to formalize Goffman's frame analysis, Scheff (2005). Albeit not equivalent, we should cherish that Scheff's attempt is close to ours and tries to tackle the same problems—especially fractality, interpretation, context, nested frames, and formalization.

is not relevant if a second re-entry is mathematically redundant or even unnecessary for it is surely relevant in sociological terms. It helps us distinguish two different processes involved in sociological methodology. The re-entry within the form indicates the process of contriving formalisms and the outside re-entry indicates the process of making observations (Karafillidis, 2010b, pp. 59-87). Both are ways of connecting theory and method, that is, turning theory into a concrete method of research (formalism) and turning method into a device for theory construction (observation).[31] By the way, observation is a kind of gate-keeper that controls the boundary between the marked side and the unmarked outside of the form.

Equation 4 can also be re-written in the form of a network[32]—an option that turns out to be a suitable further notational feature in a theory of social forms.

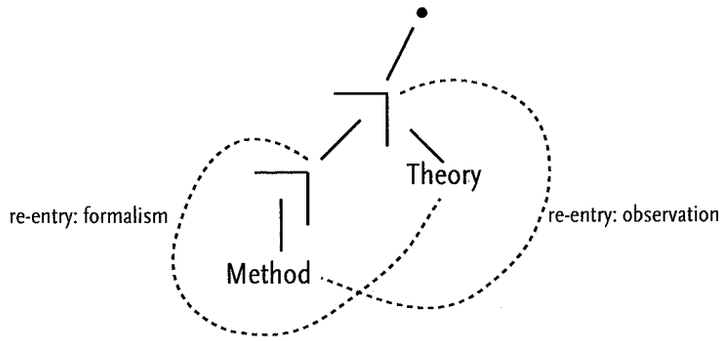


Figure. 1: Sociological methodology (equation 4) depicted as network of distinctions[33]

This representation appears to be somewhat closer to mainline models of network theory. It resembles a semantic network of two concepts. But we should also keep in mind that this is not merely the representation of a semantic network but rather of a network of communication, which is cultural (imbued with meaning, semantics), social (representing a relational structure, syntax), and practical (giving orientation and position to observers, pragmatics) at the same time. Furthermore the two

31. We have seen above that this kind of modeling claims to construct communicative and observational models of meaning. However, observation here becomes explicit, which is to be expected in methodology and other scientific contexts. The relation between theory and method is accomplished because both theory and method are understood as forms of observation. The seeming difference between theory and method thus breaks down: Sociology invents and employs theory-methods. An obvious example is actor-network-theory (Latour, 2005) but this holds also true for formal sociology (Simmel, 1950), systems theory (Luhmann, 1995a, 2012), network theory (White, 1992, 2008a), frame analysis (Goffman, 1974), and theories of social process (Abbott, 2001b, 2007).
32. This goes back to an idea of Varela and Goguen (1978; see p. 300 for the simple transformational procedure from Spencer-Brown's notation to this one). It is adapted for sociological purposes here. Actually, any social form is a network of distinctions but this becomes more salient in this alternative representation. Incidentally, this complies with the anti-essentialist definition of networks as networks of related distinctions (Fuchs, 2001, pp. 17-20). Consult the appendix for detailed information about how arrangements of distinctions can be transformed into such network representations.
33. The point at the top indicates the embeddedness of the network in other yet undetermined forms and contexts—the unmarked space. This is also discussed in the appendix.

recursions and their indication of two different social processes are named explicitly. *Formalisms* and *observations* are the forms in which methodology is brought into operation—the ways in which it is operationalized.

We have to add one last thing that is conspicuous in equation 4 when compared to equation 3. The distinction does not re-enter the space of the crosses but rather re-enters the variables thus marked.[34] This is due to the observation that sociology has always designed its theories such as to function simultaneously as methods. That is, the distinction between theory and method remains valid but their difference is hardly discernible. *Method* then means theory-method and *theory* means method-theory. We can see this process of how a method becomes a theory and vice versa for example in the work of Harrison C. White. In one of his early works (White, 2008b) we observe the transformation of (mathematical) network methods into network theoretical considerations and a few years later we witness the advent of block modeling as an immediate offspring of theoretical considerations (White, Boorman & Breiger, 1976).

Re-entering the space under a mark (like in equation 3) subverts the distinctive properties of the distinction and makes us lose any sense of where we are in the form (Spencer-Brown, 1994, p. 58). The re-entry results in an *oscillation* between the values and constitutes a *memory* of the immediately preceding value (Spencer-Brown, 1994, pp. 60-61; Karafillidis, 2010b, pp. 141-149). Both oscillation and memory are indispensable for any sequence or process to occur at all. However, all this does not necessarily affect the distinctive properties of the variables themselves. But this is additionally the case when the distinction re-enters into its own variables (here: method and theory), which occupy the space under a mark (like in equation 4). Then we have to recognize that the indeterminateness of the form is not only operational (due to the re-entry) and not only linguistic (due to the polysemy of the used words or phrases)—but that it is substantial/material as well.[35]

34. We adopt the algebraic term *variable* for the linguistic terms used in social forms and keep it as shortcut for denoting the variability and connectivity of observable phenomena. The understanding of variable employed here is much closer to the *boundary objects* of Star/Griesemer (1989)—which denote concepts or material things that gain variable meanings in different contexts for different observers—than to the abstract and isolated variables of standard causal analysis. Consider, that any variable can be decomposed into a distinction if there are empirical cues that justify such further decomposition. Moreover, the fact that these variables assume different values should be understood empirically: it implies processes of valuation. See Martin (2011) and Stark (2009) on pertinent notions of value, valuation, and judgment.
35. This point is rather intricate and needs more elaboration. Although the indeterminateness of social forms is not due to the linguistic ambiguity of the incorporated terms it should not go unmentioned that linguistic expressions (words, phrases, clauses) are part and parcel of the coherence of a social form. The polysemy of words and the ambiguity of language in general might seem like an additional curse for a calculus that has to deal with endless recursions already. But they are also a blessing. We cannot jam something into uniqueness for the sake of unequivocal results when there is no empirical clue for that. Thus, in social forms and their modeling both *operative* and *linguistic* ambiguity have to be accounted for and endured. With the form of re-entry discussed in this paragraph (re-entering the variables and not the space they occupy) we now encounter a third type of ambiguity which is tentatively termed *substantial* (or material) ambiguity. Maybe it is exactly here, where Latour's hybrids dwell (Latour, 1993).

Concluding the Example

Let us conclude the discussion of these two social forms (equations 3 and 4). The aim has been to give an example of how a theory of social forms might proceed and how the notation can be used for sociological research.[36] One interesting feature of form modeling is to make literally visible that one distinction may appear in different forms. This has been briefly exemplified for two different empirically observable forms of methodology in the social sciences. Even without knowing all the notational implications from the outset their differences become readily discernible. The comparative range increases, however, as soon as one gets used to read the subtleties of the equations.

A comparison of social forms explains by no means why each form is the way it is. Yet it can explain their differences: the difference between them; the different identities, positions and relations that come about in case of methodological conflicts; and the difference each of these forms makes in sociological discourse, including pertinent misunderstandings.[37]

In one respect the comparison seems skewed at first sight. This is due to the different meanings of *theory* in the relevant equations. In the form of social research methodology theory refers to general theories of science and scientific reasoning, while in the form of sociological methodology theory refers to sociological theory. That is, in contrast to the methodology of social research, the observations of any philosophies of science are unmarked in the form of sociological methodology (equation 4). Sociology is still subject to observations done by philosophies of science but there is a crucial difference: it does not need them to justify its own scientific procedures. In other words, they are not part of its methodological form and there is no need for an additional backup by some philosophy of science. Thus its methodology is sociologically self-contained. Social research instead has always been looking for a justification by some philosophy of science—and critical rationalism has been one of the most prolific theories in this respect. Chapters on science and inquiry containing definitions of theory, some logic, and questions of causation are standard in every textbook of doing social research. They are mostly absent, or play a different role, in sociological treatises.

This finally leads us to two general and important implications for "reading" social forms. One is that the unmarked space to the right of the expressions appertains to the form. That is, though an arrangement of distinctions displays a form of closure thus decoupling an island of meaning (Zerubavel, 1991) or a network-domain (White,

36. The purpose has been one of demonstration, not evaluation. It is therefore crucial to understand that these forms are not methodological prescriptions but claim to be condensed descriptions of actually practiced methodological communication. They do not aim at some analytical separation of two distinct groups of scholars. This would make no sense. Rather these different methodologies may be employed by one person at different times and for different purposes. Social forms are about communication, cognition, perception, patterns, and time—and not about individual people, intentions, groups, and categories.
37. Note that the drawing of any cross/mark and the placement of any term or phrase—that is, whether a cross/mark (⌐) covers a term (e.g., theory, method) or not, where the re-entry takes place exactly (does it point to the space or to the value/variable?), which term/phrase is placed first in the expression on the right side of such equations—has to be warranted empirically and defines the uniqueness of each form.

1995) it is never completely involuted. The overflow of meaning, the connectivity of communication, and the appearance of other observers constitute further, currently unmarked, contexts that situate and embed the form. The other implication stresses the role of communication in such a model. In doing social research for example (see equation 3) most scholars know very well that normative theoretical rules of doing research are frequently violated in scientific practice. But this generous acceptance of methodological rule violations is not an integral part of the form of methodological communication.[38] If it is communicated after all, then its meaning is either isolated in some narrative (e.g., in the preface) that does not belong to the methodological rationale proper or it is observed as a methodological fallacy. Thus, deviations and fresh action are not precluded but only occur within, or alternatively, in relation to the form of social research methodology. We are dealing here with a dispersed and self-similar form of communication that is seen to identify the methodology of social research.

The purpose of this example has been merely to catch a glimpse of how a sociological notation like this is brought into operation. The deployment of a notation contaminated with crucial sociological notions does make a difference.[39] It might function as a gateway for the social scientific adoption of form theory and a recognition of its possibilities. Accordingly I would like to close with some reflections on the sociological context of notations and the origins of practical problems when working with form models.

VI. Sociological Notations and the Practice of Research

The development of a genuine notation for sociology has never been part of the professional task description. If at all, notations are borrowed and hardly ever designed. But an active engagement of sociology in notational design might open research possibilities and enhance existing ones. How is this possible? Aren't notations just representations of elements and relations that are already there? If we consult relevant studies the answer is definitely negative. Notations are no simple visualization devices (although this is an important function they serve) or simply representations of existing things and concepts. Rather the use of a notation brings forth elements and relations never seen before (see Havelock, 1963 on the alphabet). Notations endow us with fresh operations for construction. They manage our perception, renew and guide our abstractions, and make recombination possible

38. But it is certainly part of scientific communication. The latter comprises more than methodology. The general argument is neither that science is all about methodology nor that every operation observed as scientific can be classified as either theory or method. Both is empirically wrong. Such total perspectives are avoided by what is called here an operational approach to structure. This approach marks minimal events of the immediate present (i.e., operations) as elements and tries to describe their connectedness to further events in order to explain the emergence and reproduction of social forms (in this text, for example, the social form of methodology).
39. One might think that there is an issue about whether the notation itself carries along these notions or if we simply read them into the notation. Since self-exemption of the observer is ruled out here, this is undecidable. Is the sociology of Spencer-Brown's calculus discovered or invented? It is a discovered invention and an invented discovery.

(Long, 1999a, b). In this vein the notation of social forms formalizes observations in a way that expands our cognitive capabilities for dealing with the complexity of the concrete.

Mathematics is actually one of the best illustrations for the power of notations and has thus become a kind of master notational system for science. Sociologists have borrowed different algebraic and set theoretic notations, too. Contingent on the problem at hand, on specific disciplinary interests, and on the available data, the conforming mathematical models are selected and the pertinent notation adopted—albeit not really adapted. This is the problem of using such notations: though they are used with sociological intent they are not allowed to carry sociological meaning themselves. That is to say, only the corresponding sets or variables are related to discrete social objects (and both the discreteness and the nature of the relationship are problematic) the operations performed on the variables or sets are devoid of sociological (albeit not social) meaning. At any rate, since this proceeding has been sufficient for producing creditable results and scientific legitimacy, the demand for a uniquely sociological notation did not arise thus far. Yet prominent sociologists like Erving Goffman and Harold Garfinkel have already thought about the possibilities of having such a notation at their disposal. Garfinkel (2006; written in 1948) has in fact made concrete attempts in this direction but never came back to this early effort. Goffman in turn only expressed the wish for a sociological notation in his book on frame analysis (1974, pp. 251-252), but he did this in an intriguing way indeed.[40] He openly deliberated on working with nested brackets that would allow to mark the spatio-temporality of interactional episodes—an idea later picked up and fleshed out by Thomas J. Scheff (2005) who devised an analogous notation that furthermore considered the recursivity and fractality of nested frames explicitly.

In form theory such a decidedly sociological notation, very close to the one that Goffman and Scheff had in mind, is an integral part of the whole effort. As a consequence, learning to write is inevitable. Unfortunately there is no curriculum one would just have to follow in order to learn and finally master the script. Alas, the process is time consuming, equivocal, and far from linear. There are several reasons for this. Since social forms include the observer under all circumstances neither objectivity nor subjectivity prevail as last resorts. Hence there is no comprehensive vantage point for ultimately judging the correctness of a form model. Yet the availability of such a point of judgment would certainly facilitate the acquisition of form theory and fuel the motivation to work with it.

If we had not socialized the calculus we would not have these problems. Then the simple injunction "learn the calculus of indications" would suffice. But an immersion into theory is inevitable if the usage of the notation is to be disciplined. Incidentally,

40. Among such efforts to develop particular sociological notations one could also number the basic social configurations of Charles Tilly (1998, p. 48) and especially the transcription rules of conversation analysis. Both, however, did not aim at developing a notation in the strict sense. The conventions for the transcription of recorded conversations come really close to a notation but have hardly ever been reflected as a notation. See the seminal papers of Sacks, Schegloff & Jefferson (1974) and Schegloff (1992).

this elucidates a major drawback of form theory: Apposite coding for computers to automate certain procedures of the research process becomes an almost intractable, albeit not exactly impossible, task. Devising feasible algorithms to make the theory more accessible for both computers and students is therefore one of the major future challenges.

After all, learning to use the notation of form theory is a matter of reiterated practice. In fact, notating here means researching.[41] Currently there is no alternative but to start playing around with a specific empirically observed distinction or combinations of distinctions, to try out different versions, and to see how in the course of the process theory and data meet to increasingly constrain possible versions. In the (tentative) end a coherent social form emerges, which is convincing enough and empirically defensible—for the moment at least. The process of notational practice does neither have a natural nor a prescribed end. But how is it then possible to recognize the point when the social form is coherent and thus complete and defensible? This is a crucial question indeed. If one thinks of doing sociology as problem-solving then a definite answer is inevitable but if we subscribe to doing research the answer is indefinite: Though you do not know how the result looks like, you will recognize it as soon as it is there (Stark, 2009, pp. 1-6). However, it might be helpful to orient oneself by the principle of defensibility, that is, once a form equation becomes defensible the form can be seen as temporarily complete. Checking the validity of a social form thus captured is then left to communication, that is, both to professional discourse and to objections of the objects of research. At last the establishment of a social form is itself a social process. It is based on negotiated, contested, and contingent forms of communication observed in the medium of meaning.

VII. Chapter 13

What gives mathematicians a headache in discussions with sociologists is that Spencer-Brown's simple operator is charged with sociological knowledge. Thus complexity is introduced on a level, which has been characterized by utmost simplicity so far. It seems as if the calculus loses one of its major strengths: to show how complexity accrues from simplicity. In addition the yoking of the calculus with particular disciplinary problem constructions impedes comprehensibility for scholars not accustomed to sociological reasoning. In the end it even loses its status as a mathematical calculus and its applicability seems sacrificed.

These concerns are definitely justified, at least from a certain perspective. Just to get it straight: the calculus of indications does not need any extension at all to fulfill its intention. But one cannot escape the fact that distinctions are drawn (in both senses implied) by observers that are socially embedded—without exception and even

41. The form models we see in papers are only the final results of a research process that cannot be reproduced in a journal article. Part of this process is consuming dozens of sheets of paper with many useless and failed models until a final, defensible form is taking shape.

independent of the question whether these observers are human beings or not. Since empirical observers always re-enter the distinction they make (remember Heinz von Foerster's [2003, p. 285] prerequisites for a theory of the observer: self-reference and infinite recursions) the calculus itself starts with a re-entry kept implicit only to catch it up at the very end. Francisco Varela tried to account for this by introducing the autonomous state already on the level of arithmetics (Varela, 1975; Kauffman, 1978). This is not the place to judge success or failure of Varela's move but the motive was certainly similar to the one expounded here: empiricizing the calculus for reasons lying in some particular disciplinary background.

Varela had problems of biology in mind. Here a sociological rationale is applied and it results in a general claim: socializing the calculus is unavoidable. Any distinction made and any token drawn on a piece of paper is an operation occurring in some socio-empirical world and thus inherently involves, as I have tried to show, observation, communication, and meaning. Thus the calculus emerges as a theory of the self-determination of the always contingent, temporal, dispersed, and fractal social process. This does obviously not involve some extension of the calculus either on the level of arithmetics or algebra since both are complete. Rather form theory frames the *Laws of Form*, as it were, with a chapter 13 that re-enters the calculus right into the "we" with which Spencer-Brown (1994) starts the whole treatise on page 1.

For some this might be a much too restrictive frame and unsatisfactory from a foundational, philosophical, mathematical, or maybe aesthetic point of view. But it expands research possibilities for any social science that acknowledges recursivity, looks for comparability, and tries to seize phenomena like identity formation, networks, cognition, boundaries, organizational forms, inequality, and cultural differences.

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References

Abbott, A. (1997). Of time and space: The contemporary relevance of the Chicago School. *Social Forces, 75*(4), 1149-1189.
Abbott, A. (2001a). *Chaos of disciplines*. Chicago: The University of Chicago Press.
Abbott, A. (2001b). *Time matters. On theory and method*. Chicago: The University of Chicago Press.
Abbott, A. (2007). Against narrative: A preface to lyrical sociology. *Sociological Theory, 25*(1), 67-99.
Albert, H. (2010). *Kritische Vernunft und rationale Praxis*. Tübingen: Mohr Siebeck.
Babbie, E. (1992). The practice of social research (6th ed.). Belmont, CA: Wadsworth.
Baecker, D. (Ed.). (1999). *Problems of form*. Stanford, CA: Stanford University Press.
Baecker, D. (2005). *Form und Formen der Kommunikation*. Frankfurt: Suhrkamp.
Bateson, G. (2000). *Steps to an ecology of mind*. Chicago: University of Chicago Press. (Originally Published 1972)
Bernert, C. (1983). The career of causal analysis in American sociology. *British Journal of Sociology, 34*(2), 230-254.
Blumer, Herbert (1956). Sociological analysis and the 'variable.' *American Sociological Review, 21*(6), 683-690.
Bourdieu, P. (1984). *Distinction. A social critique of the judgement of taste* (R. Nice, Trans.). Cambridge: Cambridge University Press.

Bowker, G. C. & Star, S. L. (2000). *Sorting things out. Classification and its consequences*. Cambridge, MA: The MIT Press.
Cederman, L.-E. (2005). Computational models of social forms: Advancing generative process theory. *American Journal of Sociology, 110*(4), 864-893.
Cerulo, K. L. (1988). Analyzing cultural products: A new method of measurement. *Social Science Research, 17*, 317-352.
Cicourel, A. V. (1964). *Method and measurement in sociology*. New York: Free Press.
Coleman, J. S. (1986). Social theory, social research, and a theory of action. *American Journal of Sociology, 91*(6), 1309-1335.
Elias, N. (1978). *What is Sociology?* New York: Columbia University Press.
Esposito, E. (2011). Kann Kontingenz formalisiert werden? *Soziale Systeme, 17*(1), 120-137.
Fararo, T. J. (2001). Problems of form (Review). *Contemporary Sociology, 30*(3), 306-307.
Fleck, Ludwik (1980). *Entstehung und Entwicklung einer wissenschaftlichen Tatsache. Einführung in die Lehre vom Denkstil und Denkkollektiv* (Introduction by L. Schäfer & T. Schnelle, Eds.). Frankfurt: Suhrkamp. (Originally Published 1935).
Fuchs, S. (2001). *Against essentialism. A theory of culture and society*. Cambridge, MA: Harvard University Press.
Garfinkel, H. (1967). *Studies in ethnomethodology*. Englewood Cliffs, NJ: Prentice-Hall.
Garfinkel, H. (2006). *Seeing sociologically. The routine grounds of social action* (Introduction by A. W. Rawls, Ed.). Boulder, CO: Paradigm Publishers. (First published in 2006, this item was written in 1948.)
Giddens, A. (1984). *The constitution of society: Outline of a theory of structuration*. Berkeley, CA: University of California Press.
Glanville, R. (1979). Beyond the boundaries. In R. F. Ericson (Ed.), *Improving the human condition: Quality and stability in social systems* (pp. 70-74). London: Springer.
Goffman, E. (1974). *Frame analysis. An essay on the organization of experience*. Cambridge, MA: Harvard University Press.
Havelock, E. A. (1963). *Preface to Plato*. Cambridge, MA: Belknap.
Hayles, K., Luhmann, N., Rasch, W., Knodt, E. & Wolfe, C. (1995). Theory of a different order: A conversation with Katherine Hayles and Niklas Luhmann. *Cultural Critique, 31*, 7-36.
Hennig, B. (2000). Luhmann und die formale Mathematik. In P.-U. Merz-Benz & G. Wagner (Eds.), *Die Logik der Systeme. Zur Kritik der systemtheoretischen Soziologie Niklas Luhmanns* (pp. 157-198). Konstanz, Germany: UVK.
Hutchins, E. (1995). *Cognition in the wild*. Cambridge, MA: The MIT Press.
Kaplan, A. (2004). *The Conduct of Inquiry. Methodology for Behavioral Science*. New Brunswick, NJ: Transaction Publishers. (Originally Published 1964).
Karafillidis, A. (2010a). Grenzen und Relationen. In J. Fuhse & S. Mützel (Eds.), *Relationale Soziologie. Zur kulturellen Wende der Netzwerkforschung* (pp. 69-95). Wiesbaden: VS Verlag.
Karafillidis, A. (2010b). *Soziale Formen. Fortführung eines soziologischen Programms*. Bielefeld: transcript.
Karafillidis, A. (2013): Erklärungen in rekursiven Verhältnissen. *Zeitschrift für Theoretische Soziologie 2*(2), 218-239.
Kauffman, L. H. (1978). Network Synthesis and Varela's Calculus. *International Journal of General Systems, 4*, 179-187.
Kauffman, L. H. (1987). Self-Reference and Recursive Forms. *Journal of Social and Biological Structures: Studies in Human Sociobiology, 10*, 53-72.
König, R. (1973): Die Beobachtung. In R. König (Ed.), *Handbuch der empirischen Sozialforschung: Band 2. Grundlegende Methoden und Techniken der empirischen Sozialforschung* (erster Teil; pp. 1-65). Stuttgart: Ferdinand Enke.
Kuhn, T. S. (1970). *The structure of scientific revolutions* (rev. ed.). Chicago: The University of Chicago Press.
Lamont, M. & Fournier, M. (Eds.). (1992). *Cultivating differences. Symbolic boundaries and the making of inequality*. Chicago: The University of Chicago Press.
Latour, B. (1993). *We have never been modern* (C. Porter, Trans.). Cambridge, MA: Harvard University Press.
Latour, B. (2005). *Reassembling the social. An introduction to actor-network-theory*. Oxford: Oxford University Press.
Lazarsfeld, P. F. (1959). Problems in methodology. In R. K. Merton, Le. Broom & L. S. Cottrell, Jr. (Eds.), *Sociology today: Problems and prospects* (pp. 39-78). New York: Basic Books.
Lehmann, M. (2011). *Mit Individualität rechnen. Karriere als Organisationsproblem*. Weilerswist: Velbrück.
Long, J. G. (1999a). Editor's Note. *Semiotica, 125*(1/3), 1-13.
Long, J. G. (1999b). How could the notation be the limitation? *Semiotica 125*(1/3), 21-31.
Luhmann, N. (1990). Meaning as sociology's basic concept. In *Essays on self-reference* (pp. 21-79). New York: Columbia University Press.
Luhmann, N. (1995a). *Social systems* (Trans. by J. Bednarz, with D. Baecker). Stanford: Stanford University Press. (First German edition published 1984).
Luhmann, N. (1995b). The paradoxy of observing systems. *Cultural Critique, 31*, 37-55.
Luhmann, N. (1997). The control of intransparency. *System Research and Behavioral Science, 14*, 359-371.
Luhmann, N. (1999). The paradox of form. In D. Baecker (Ed.), *Problems of form* (pp. 15-26). Stanford, CA: Stanford University Press.
Luhmann, N. (2012). *Theory of society, Volume 1* (R. Barrett, Trans.). Stanford, CA: Stanford University Press. (First German edition published 1997).

Martin, J. L. (2009). *Social structures*. Princeton, NJ: Princeton University Press.
Martin, J. L. (2011). *The explanation of social action*. Oxford: Oxford University Press.
Maturana, H. R. (1978). Biology of language: The epistemology of reality. In G. A. Miller & E. H. Lenneberg (Eds.), *Psychology and biology of language and thought: Essays in honor of Eric Lenneberg* (pp. 27-64). New York: Academic Press.
McCulloch, W. S. (1989). A heterarchy of values determined by the topology of nervous nets. In *Embodiments of mind* (pp. 40-45). Cambridge, MA: The MIT Press. (Originally published in 1945)
Mead, G. H. (2002). *The philosophy of the present*. Amherst, NY: Prometheus. (Originally published in 1932).
Merleau-Ponty, M. (2003). Das Primat der Wahrnehmung und seine philosophischen Konsequenzen. In *Das Primat der Wahrnehmung* (pp. 26-84). Frankfurt: Suhrkamp. (Originally published 1946).
Mills, C. W. (2000). *The sociological imagination*. (Fortieth Anniversary Edition). Oxford: Oxford University Press. (originally published 1959).
Mohr, J. (1998). Measuring meaning structures. *Annual Review of Sociology, 24*, 345-370.
Opp, K.-D. (2002). *Methodologie der Sozialwissenschaften. Einführung in Probleme ihrer Theoriebildung und praktischen Anwendung* (5th ed.). Wiesbaden, Germany: Westdeutscher Verlag.
Pólos, L., Hannan, M. T. & Carroll, G. R. (2002). Foundations of a theory of social forms. *Industrial and Corporate Change, 11*(1), 85-115.
Popper, K. R. (1993). Die Logik der Sozialwissenschaften. In Theodor W. Adorno et al.(Eds.), *Der Positivismusstreit in der deutschen Soziologie* (pp. 103-123). Munich: dtv.
Quine, W. V. (1951). Two dogmas of empiricism. *The Philosophical Review, 60*(1), 20-43.
Rorty, R. (1991). Is Natural Science a Natural Kind? *In Objectivity, relativism, and truth: Philosophical papers, Vol. 1* (pp. 46-62). Cambridge: Cambridge University Press.
Ruesch, J. & Bateson, G. (1987). *Communication: The social matrix of psychiatry*. New York: W. W. Norton. (Originally published 1951).
Sacks, H., Schegloff, E. A. & Jefferson, G. (1974). A simplest systematics for the organization of turn-taking for conversation. *Language, 50*(4), 696-735.
Salmon, W. C. (1989). *Four decades of scientific explanation*. Pittsburgh, PA: University of Pittsburgh Press.
Scheff, T. J. (2005). The structure of context: Deciphering 'Frame Analysis.' *Sociological Theory, 23*(4), 368-385.
Schegloff, E. A. (1992). Repair after next turn: The last structurally provided defense of intersubjectivity in conversation. *American Journal of Sociology, 97*(5), 1295-1345.
Schönwälder, T., Wille, K. & Hölscher, T. (2004). *George Spencer Brown. Eine Einführung in die "Laws of Form."* Wiesbaden, Germany: VS Verlag.
Simmel, G. (1950). *The sociology of Georg Simmel* (Introduction by Kurt H. Wolff, Trans.). Glencoe, IL: Free Press.
Simmel, G. (2011). *The view of life: Four metaphysical essays with journal aphorisms* (J. A. Y. Andrews & D. N. Levine, Trans.; Introduction by D. N. Levine & D. Silver). Chicago: University of Chicago Press. (Originally Published 1918).
Smith, J. (1991). A methodology for twenty-first century sociology. *Social Forces, 70*(1), 1-17.
Spencer-Brown, G. (1994). *Laws of form*. Portland: Cognizer. (First edition published in 1969).
Star, S. L. & Griesemer, J. R. (1989). Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-1939. *Social Studies of Science, 19,* 387-420.
Stark, D. (2009). *The sense of dissonance. Accounts of worth in economic life*. Princeton, NJ: Princeton University Press.
Stengers, I. (2000). *The invention of modern science* (D. W. Smith, Trans.). Minneapolis, MN: The University of Minnesota Press.
Stinchcombe, A. L. (1987). *Constructing social theories*. Chicago: The University of Chicago Press.
Tarde, G. (2012). *Monadology and sociology* (T. Lorenc, Ed. & Trans.). Melbourne: re.press. (originally published in French in 1893)
Tilly, C. (1998). *Durable inequality*. Berkeley, CA: University of California Press.
Tilly, C. (2004). Observations of social processes and their formal representations. *Sociological Theory, 22*(4), 595-602.
Tilly, C. (2005). *Identities, boundaries, and social ties*. Boulder, CO: Paradigm Publishers.
Varela, F. J. (1975). A calculus for self-reference. *International Journal of General Systems, 2,* 5-24.
Varela, F. J. & Goguen, J. A. (1978). The arithmetic of closure. *Journal of Cybernetics, 8*, 291-324.
von Foerster, H. (1984). Principles of self-organization—in a socio-managerial context. In H. Ulrich & G. J. B. Probst (Eds.), *Self-organization and management of social systems: Insights, promises, doubts, and questions* (pp. 2-24). Berlin: Springer,
von Foerster, H. (2003). *Understanding understanding. Essays on cybernetics and cognition*. New York: Springer.
White, H. C. (1992). *Identity and control. A structural theory of social action*. Princeton: Princeton University Press.
White, H. C. (1995). Network switchings and Bayesian forks: Reconstructing the social and behavioral sciences. *Social Research, 62*(4), 1035-1063.
White, H. C. (1997). Can mathematics be social? Flexible representations for interaction process and its sociocultural constructions. *Sociological Forum, 12* (1), 53-71.
White, H. C. (2008a). *Identity and control. How social formations emerge*. Princeton, NJ: Princeton University Press.
White, H. C. (2008b). Notes on the constituents of social structure: Soc. Rel. 10 – Spring '65. *Sociologica, 2008*(1), 1-15. URL: http://www.sociologica.mulino.it/journal/issue/index/Issue/Journal:ISSUE:4

White, H. C., Boorman, S. A., & Breiger, R. L. (1976). Social structure from multiple networks. I. Blockmodels of roles and positions. *American Journal of Sociology, 81* (4), 730-780.
Whitehead, A. N. (1967). *Science and the modern world. Lowell Lectures, 1925*. New York: Free Press.
Zerubavel, E. (1991). The fine line: Making distinctions in everyday life. Chicago: University of Chicago Press.

Appendix

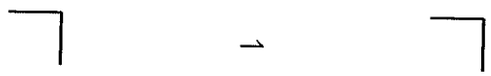
Apart from Spencer-Brown's notation the reader also finds a figure in the text (fig. 1, p. 128), which is introduced as an alternative way of representing expressions of an equation. The basic idea about such a re-writing of forms as networks can be found in Varela and Goguen, (1979). Their intention was to facilitate the comparability of forms with respect to their degree of determination. Facilitating comparisons is also an intriguing option for the research of social forms. But the sociological surplus is above all generated by a change in perspective. This way of representing the equations provides additional views and angles of social forms, which might surprise—that is, inform—the observer. Network transforms of arrangements of distinctions turn out to be valuable for both the process of research and the presentation of results.

This appendix demonstrates, starting from simple and proceeding step by step to complex forms, how a form equation can be transformed into its network representation. The following transformational conventions are partly extrapolated from the paper by Varela and Goguen and partly adapted for the display and examination of social forms. Note that such transformations neither change the value of the equations nor of any of its parts (tokens, expressions, or values). One simply gets network representations of form equations. They make the networked character of forms visually explicit. This supports attempts to devise models for an emergence of social entities out of networks of related distinctions (Abbott, 2001a, pp. 3-33, 2001b, pp. 267-279; Fuchs, 2001).

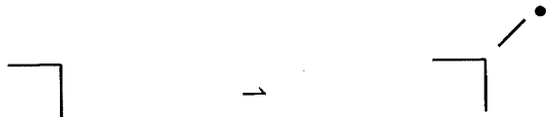
In contrast to the form equations, the resulting network figures serve no injunctional function. They are merely structural figures (visualizations) of operational forms. Since these networks are not equations, a labeling such as "fig. x" and a title are mandatory.

We go back to the example of methodology developed earlier in the paper to illustrate the conventions of transformation. The resulting networks remain unlabeled here because this appendix in mainly about the technical issues of transforming the expressions of equations into network representations.

On the left side we see the expressions in the notation of Spencer-Brown and on the right side the forms re-written as networks. At the most basic level of the mark of distinction there is no difference between them:

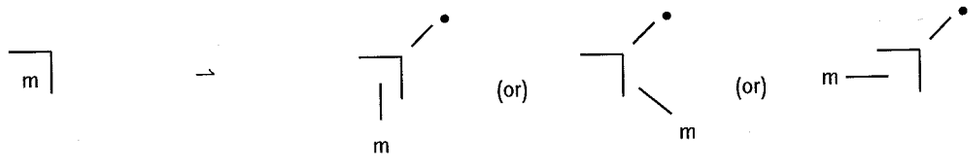


At this level the mark is identical to a *cross*, that is, an affordance to draw a distinction (operate!; Spencer-Brown, 1994, p. 6). The difference between the notation and its network transform becomes discernible when the token is observed with regard to its form.



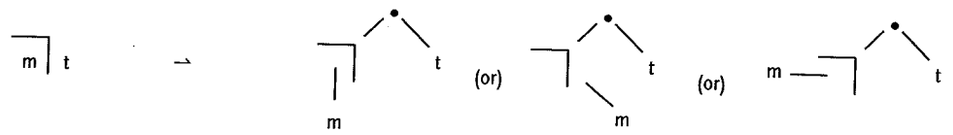
The point connected to the mark indicates that the observer observes not only the inside of the distinction but also its outside, the severance of the two sides, and the space in which it is drawn. In other words, it visualizes that every distinction has an unmarked outside—a yet undetermined but subsequently determinable further context—in which it is embedded. Varela and Goguen (1979, p. 300) call it the "continence operation" thus referring to Spencer-Brown's definition: "Distinction is perfect continence" (Spencer-Brown, 1994, p. 1). This might sound like an odd definition (Fararo, 2001) but it bears some interesting sociological consequences and insights. If any distinction drawn contains its unmarked outside (i.e., its context) by default, then social boundaries and enclosure demand intense work to become durable or to achieve purity. In the same way the long debated issue of integration is not a problem to be solved (as frequently supposed) but rather to be expected, whereas any process of differentiation needs some real and continuous effort. In general, we then are compelled to ask, how distinctions are historically transformed and (re-)combined to produce seemingly ‚natural' differences and categories.

Let us continue with further conventions. A variable standing under a cross can be connected in the network transform in different ways. Three possibilities are shown here. The value does not change by placing *m* in the different displayed positions. Which of the possible network representations is chosen, depends on convenience and preference.



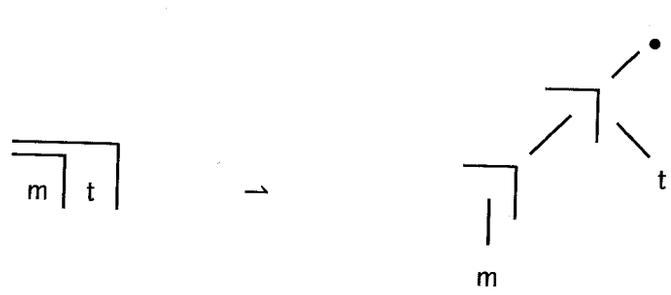
Even if *m* points to the outside of the mark (as in the second of the three selected possibilities above) it is not actually on the outside. In the following step we have the outside marked by *t*. The difference is readily discernible. For *t* to be on the outside an

indirect path via the point of continence has to be taken. The variable *t* thus refers to the unmarked state, while *m* refers to the mark/cross.



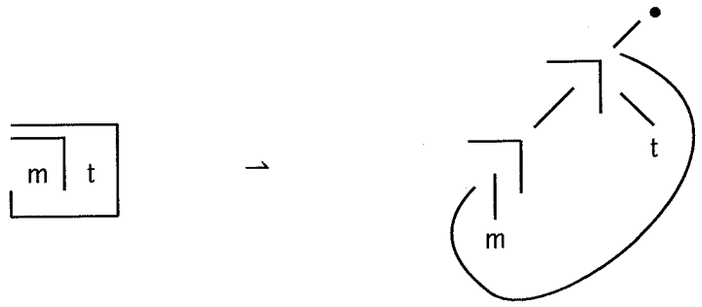
(Since it has now been demonstrated that variables like *m* and *t* can be placed in different positions with reference to their mark without altering the meaning of the network representation, there is no need to continue showing alternative visualizations as in the two examples before.)

If the outside is itself marked by a mark of distinction, so that the marked *m* is contained under the second mark and a further unmarked outside is generated, the expression in the network transform gets a somewhat hierarchical, tree-like shape:

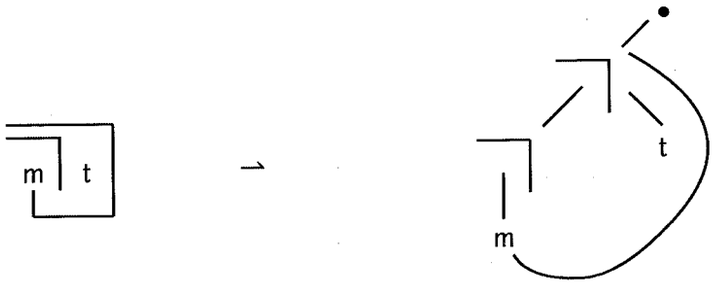


But this hierarchy of distinctions is subverted as soon as the distinction is allowed to re-enter itself. Re-entering, recursive forms are heterarchical by definition. Hierarchy does not simply vanish but has to be understood as realized *within* a heterarchical form (McCulloch, 1945; Karafillidis, 2010b, pp. 344-347).

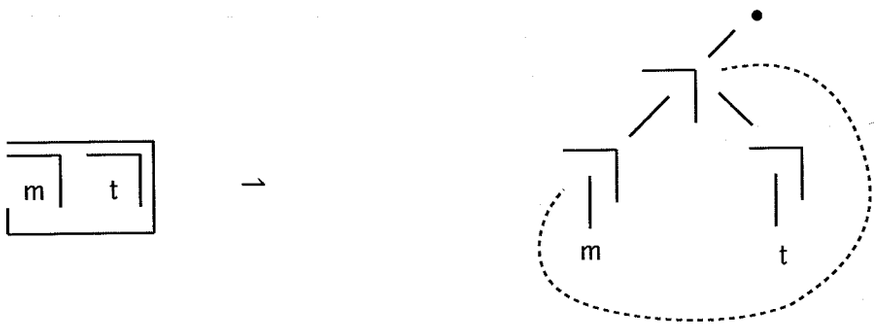
The way in which a re-entry is represented in the network transform is shown in the next step. Here the distinction re-enters its own space, that is, it re-enters the space occupied by *m*.



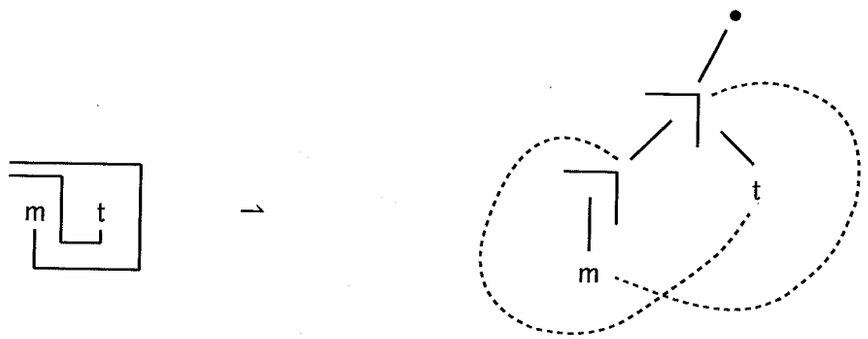
A distinction might also directly re-enter into one (or more) of its variables. This is shown in the next form.



Coming now back to the two forms of methodological communication introduced in the paper and comparing their network transform gives an idea of the difference that a network visualization of forms might make.



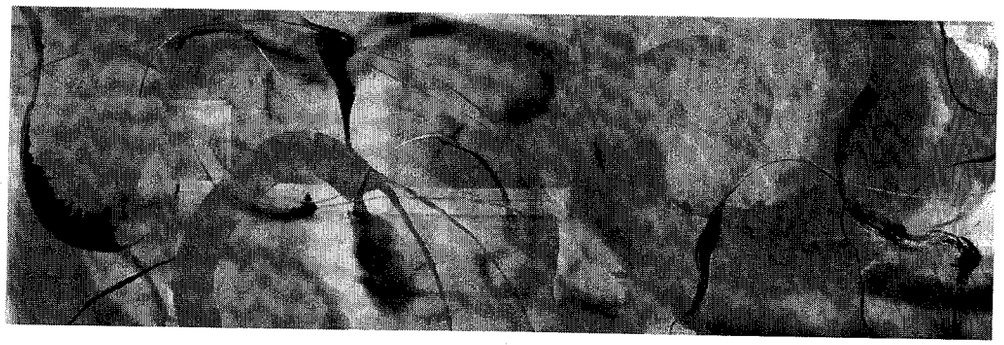
Methodology of Social Research



Methodology of Sociology

The re-entries are dotted here to set them visually apart form the other relations. But it makes sense to do this because it is indeed a different form of relation. Further the variables *method* and *theory* are abbreviated and appear as *m* and *t*.

These two different social structures (or eigen-values) of methodological communication have been rudimentarily compared before (see pp. 129-131). At least two more things become apparent once we also have a network transform of social research methodology at our disposal. First, in the form of social research methodology we see that method and theory (remember: in this form *theory* assumes the value of some general theory of science) are mediated by a third distinction, which serves as a connector (via the re-entry) between them. This is the structural reason for the customary search for connections between theory and method that can be observed empirically as one of the main tasks of this kind of methodology. Second, we see that method and theory stay mainly unaffected in this form of methodology. They are not addressed directly but are standalone applications, as it were. Theory is somewhat isolated. One effect of this isolation is that methods and methodology are frequently confounded: The process of using methods which are aligned to some particular theory of scientific practice is taken to indicate the whole form.



Fox, D. (2012). *Untitled.* Monotype; 22 x 18 in.