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The Network Synthesis of Social Action II: Understanding Catjects*[1]

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This is the second paper of a pair of two, the first one of which looked at a sociological theory of a computer-based future society distinct from earlier language-based 'primitive' society, writing-based ancient society, and printing press-based modern society. If the form of the next society's culture will be the Spencer-Brownian *form* as we suggest, then sociological theory will have to reformulate itself in terms of an analysis of network synthesis. We look at possible reasons to do so, stemming above all from demands to be able to describe and understand how social actors are able to frame indeterminacy, present a possible model of social action, and advance the idea that it may be useful to base social analysis neither on subjects nor on objects but on a *hypokeimon* which we here propose to christen "catjects." Catjects describe how a network synthesis comes about.

1. A Model of Social Action

I. Self-Organization via Double Closure

Network synthesis means being able to deal with overflows of reference, symbol, criticism, and control. Any one social action relies on reference, self-reference, and some way of accounting for the unmarked state in order to be able to selectively capture, number, order, and name these overflows in its orientation to different situations. By introducing the idea of self-organization via double closure (Von Foerster, 2003, pp. 211-227), we propose to solve the venerable sociological problem of the missing micro/macro-link between, on the one hand, action selecting its pathways, and, on the other, a system reproducing its organization and its structures by the means of the selection of action which does not know about the system (Coleman, 1990, pp. 1-23; Abell, 2000a, 2000b). This idea consists in the assumption that it is the very contingency, that is, ambivalence, arbitrariness and discretion of communication which is able to orientate social action. Or else, social action consists in reproducing, by solving it, the problem it is at any moment solving, thereby bringing forth, and calling on, a system which is a second-order device, providing for orientations connecting among each other.

When trying to explain the self-organization of social action, all we need is the idea of a loss of two degrees of freedom. This loss relates to overflow by solving the problem at any one moment, by giving a specific orientation to a situation, without

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dissolving the problem itself, which re-emerges afresh from the very contingency inherent in any one orientation. Other degrees of freedom reproduce instantly. The first of the two degrees of freedom lost due to a system's self-organization is the possibility to act arbitrarily. Social action being given, to act arbitrarily is impossible. Even if arbitrariness were intended, or were attributed, both intention and attribution would already partake in a social action giving meaning, and thus determination, to the action. Indeed, social action consists in acting always in such a way that any of its endings is at the same time the beginning of something else. There is no conclusion of any action which does not open up for another connecting action. Any one social action does not only solve its problem of selection selectively, but it also reproduces a set of both determinate and indeterminate possibilities, among which the very next action is bound to choose.

The second of the two degrees of freedom lost is the possibility to call on new criteria, or categories, or schemata, in order to self-determine, describe and account for one's own action. Action does not only have to connect to the next action, it also has to confirm a certain redundancy in the various ways that it does connect. It has to confirm organization in its most general sense by being able to call itself by some name which is recognized among similar people and in similar situations. This loss of a second degree of freedom makes up for the double closure of the system, which not only consists in operations (first closure) but also in organization (or regulation) having to relate to itself (Von Foerster, 2003, pp. 225-226). Note that there is a space of distinction between the first and the second closure. This space provides for the organization of social action being at some variance with the ties and links it actually calls upon to connect to previous and to subsequent action. This space of a distinction, of a severance between the first and the second closure again makes for error and correction, indeterminacy and determination, overflow and framing becoming possible.

The sociological conundrum is not only solved by action but also by organization informing itself. Both of them taken together make for social action, giving it, nevertheless, quite a lot of free play in relating action to organization, because there is, at any instant, a more or less indeterminate set of possibilities interfering. We may also call this the autopoiesis of social action since autopoiesis relies on ways to reproduce a system; this, in turn, combines available and unavailable factors of production, applying self-reference, as it were, in order to cope with the unmarked states of the network which is about to be explored (Maturana & Varela, 1980; Varela, 1979).

If dissemination of communication defines the problem social action has to deal with, while nevertheless reproducing it, and if the four culture forms we identified by extending Luhmann's conjecture, and the numbers, orders, and reflections coming with them, all overlapping and intermingling in constituting the realm of the possible in contemporary society, we must now ask how a social action reproduces; that is, it has no other way but to look at the problem it is bound to solve (Baecker, 2007). And remember that social action does not wait for sociological explanation to solve its riddles, but reproduces via self-organization.

In this chapter of the second of our two papers, we try to figure out a model of the self-organization of social action. Further to the problem of network synthesis, we assume that the control problem of the next society is setting the stage for both dealing with all other dissemination media and for a sociological understanding of the self-organization of social action. That is, we propose switching from ethnological (tribes), ontological (strata), and ethical (media) explanations of social action to an *ecological* (or knowledge) model, which takes the notion of form seriously and looks into ways for self-selecting inside networks constituted of neighborhood relations, producing a synthesis which is always beyond action and has self-similarly built into it at the same time. We choose the terms of an ecological model because we think that the notion of the ecological is apt to deal with both self-organization and network, or heterarchy, without feeling obliged to assume any kind of super-system pre-establishing the social order emerging from the selection of social action. In sociology, the notion of the ecological has a certain reputation for its ability to describe and inform about heterarchical, loosely coupled social relationships, as self-organizing as they are surprise-ridden, and as robust as they are fragile (Park, Burgess, & McKenzie, 1967; Abbott, 1997; Latour, 2004). We here emphasize this reputation and deem it, along with evolutionary thinking, the tradition we call upon for our own model.

II. Framing Indeterminacy

An ecological model of social action is a *communication* model of social action, and communication means network synthesis out of dissemination. Any one social action informs itself via the selection of its meaning from among an indeterminate, yet contextualized, set of possibilities. That is, we switch not only to an ecological model for the explanation of social action, but also from a mathematical theory of communication to a sociological one. We replace Shannon's assumption of technically determinate sets of possibilities for messages to be selected with the assumption of a socially indeterminate set of possibilities, thus describing any one social action as having to opt both for a context it relies on and for a message it wants to produce (Shannon & Weaver, 1963; MacKay, 1969; Leydesdorff, 2001; Baecker, 2005).

This gives indeterminacy a central place in the social action selecting itself as well as in the communication model explaining it. Sociology captures indeterminacy via the *problem of double contingency* to be solved by actors if any action is to come about at all (Parsons & Shils, 1951, pp. 3-29; Luhmann, 1995, pp. 103-136). Double contingency means, as was mentioned before (Baecker, 2007), that one actor (ego), looking at his or her contingent possibilities to act, waits for the other actor (alter ego) to select among his or her contingent possibilities, yet this latter, is waiting as well. As long as both are waiting, nothing happens save for the most uncomfortable, because paradoxical, situation of the communication of non-communication developing (Watzlawick, Beavin, & Jackson, 1967).

Another way to frame social action's indeterminacy is René Girard's idea of a *désir mimétique*, of a *mimetic desire*, informing any social action (Girard, 1965, 1977). Here, social action consists in both imitating, and competing with, the action of

some other, thus leading not only to relation but also to conflict, which is bound to be canalized with respect to some third figure, a God, say, or money, or the horror of the atomic bomb, in order not to lead to violence among the people competitively imitating each other. Gabriel Tarde framed this problem in terms of conflicts having to be ritualized, for instance, via prices on markets, or wages in firms, in order to tell anybody how to possess the other while being possessed by him or her (Tarde, 1962, 1969).

Again, as in the concept of double contingency, the double closure of communication is evident while social action is free, save for the loss of two degrees of freedom, to select its course. How to imitate the other, and to deviate from him or her in order to compete, is up to the actor, yet imitation must happen. How to solve the problem of double contingency is up to the actors observing each other—and Talcott Parsons believes some cultural norms would come to their rescue, an idea that Luhmann deconstructs—yet some solution, amid the reproduction of the problem for any next moment, must happen.

A third way to frame this idea consists in spelling social acting out in terms of *second-order observation* (Von Foerster, 2003). Here, any one action is, on the one hand, selecting its course due to distinctions being drawn, while, on the other, being watched by second-order observers who deem what the first-order observer (the actor) thinks is just evident or necessary to be contingent, that is ambivalent, arbitrary, and discretionary. At the same time the second-order observer turns the actor into a second-order observer on his or her own part, who has to observe how he or she is observed by others in order to be able to deal with the chances and restrictions of the continuation of action, or of a change of direction, coming with that observation. Here, the contingency, and thus indeterminacy, stems from the second-order observer watching not only the distinction drawn by the actor but also the form, in the sense of Spencer-Brown's calculus of indications (Spencer-Brown, 1994), of that distinction, thereby discovering, and bringing to bear on the situation, both the contingent selection of it and the unmarked state coming with it.

In modern society, this structure and dynamics of second-order observation gets the upper hand, as the novel, an enlightened reason, the critique of ideology and common sense used to apply first psychology, and then psychoanalysis, while guessing the hidden interests and motives of the behavior of others, so introducing ever new ways to watch, distrust and pressure the other. Modern society adapts to this structure and dynamics by switching from the social order of authority, which gets deconstructed by second-order observation, to the social order of the public, which, in markets as in democratic politics, in passionate love as in the arts, is beginning to seek the new instead of the beautiful, by computing second-order observations to help to define how to go about the appropriate selection of social action (Luhmann, 1998).

All three ideas tell something about the self-organization and double closure of social action inside a communication and about the network dynamics of its selective dealing with indeterminacy. We propose to translate this basic insight concerning the structure and order of social action into a model which gives it the concreteness

necessary to possibly test it in empirical realities, on the one hand, and the clearness and vividness to actually make it theoretically evident, on the other. We remain with the idea of the culture form of form becoming dominant in the next society and, therefore, give our model the shape of a model of the form of social action, profiting, as it were, from the heterarchical and ecological network structure among the constants and the variables of such a model (Kauffman, 1978).

We call *form*, following George Spencer-Brown, any distinction considered with respect to both its operation of distinction and the two sides of the distinction separated by its calling upon a space that distinction is embedded within (Spencer-Brown, 1994). It is difficult to count them up at such an early stage of concept development, but any one form of a distinction provides for at least four values: (1) the marked state indicated by the distinction as its inside, (2) the unmarked state on the outside of the distinction indicated by a second-order observer, (3) the distinction itself, considered as the operation of an observer himself or herself, who at first sight is invisible as the one who is actually doing the distinction, and (4) the space, or domain, the distinction is drawing upon, calling upon, embedded within, and exploring. These four values of the two-sided distinction make up for a constructionist epistemology, which sets the stage both for the phenomenon to appear and for the observer to reflect on himself or herself as having to draw his or her distinctions while observing the distinctions bringing forth the phenomenon (Berger & Luckmann, 1966; Maturana & Varela, 1998). It has room for a deconstructionist epistemology which watches the paradox of *supplément* coming from a connection brought forward by a separation, and from a reference hiding, and thereby revealing, for a second-order observer, the self-reference of the observer doing the distinction (Derrida, 1998; Luhmann, 1993).

In sociological theory the Spencer-Brownian form is useful to model communication and network relations because it focuses on the co-dependency of the different sides of the distinction, and of the distinction and its space, without assuming any kind of causality which ensures that all elements of the form correlate. Since it is the second-order observer who watches the form of the distinction, the first-order observer being at first completely absorbed, if not consummated, by it, the notion of form is protected from any assumptions as to the marked state of the distinction being the effect of the distinction, or as to the space of the distinction being the effect of its form. Instead, we deal with the neighborhood of variables and their values, which self-selectively relate to each other in constituting the network synthesis of the form. Nothing could be more fragile, and more robust, if the self-selections work. That is why we speak of a communication model, and not of a causal model (Baecker, 2005). This is because self-selection has no place in causality, despite Kant trying to call the self-selection of a cause the exact foundation place site of free will's origin.

Last but not least, the form model enables us to concatenate distinctions, thus indeed networking them among each other inside the space they thereby bring forth. We will speak of constants being the distinctions themselves, and of variables, being the marked and unmarked states called by the constant distinctions, and assuming

different values according to the overall state of the form, relating to each other through memory and subversion.

III. Action in Context

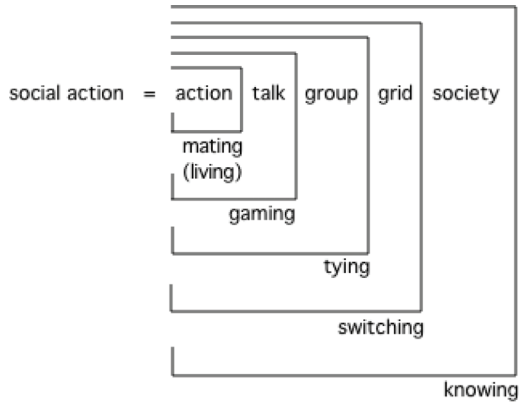
A social action both produces and manages an overflow of meaning. Any social phenomenon may be considered as providing possible overflow, drawing its constraints from the need, as made thereby evident, to deal with the overflow (Elster, 2000). That is true with respect to friendship, love, marriage, and family, as well as with respect to political, economic, pedagogical, religious, military, scientific, or artistic action. Dissemination media are just a special, yet a most prominent case, because they set the stage for the problem of communication having to deal with overflows produced by the dissemination of communication. Their overflows, and the culture forms capturing them, or so our hypothesis in this essay runs, frame how society as a whole deals with meaning.

We here propose to look at a model which describes social action in any society yet has a special leaning toward the next society because it focuses on the very form of social action, taking metacommunication for granted and relegating purpose and equilibrium to still important, yet subordinate themes. Social action, as in Max Weber's notion of it (Weber, 1978, p. 4), combines first-order behavior with second-order observation into a kind of action which is orientated toward a situation structured by observers observing observers, thus drawing its constraints from attempts to retain its autonomy. It does not come any less complicated than that.

Our model provides for both action and observation, noting that observation is action as well, since it has no effect whatsoever if it does not get noticed in turn. If there is any law to social action, it consists in the challenge of obtaining observations not just in order to get noticed, which in itself is sufficiently important, but also in order to get definitions of the situation one is then able to work with – which is why target and content ambiguity are a necessary part of these definitions (Leifer & Rajah, 2000; Leifer, 1991, 2002); Sacks, 1995). The minimal condition of any model of social action, thus, is to provide for both constants and variables, the constants defining what social action consists in, the variables defining the space to be explored by it.

The overall idea of the model is that social action consists in drawing and exploiting distinctions. These distinctions are the constants of the model, thus leading to a theory of social action which unfolds the thesis that social action draws a specific set of distinctions. The marked and unmarked states of these distinctions, of which the unmarked states get in turn marked by second-order observation, provide for the variables of the model, whose values determine what any specific social action is about. Our model, then, is a network and communication model, which means that any one variable depends on all other variables and that distinctions, as we will see, are also re-entered into the form such that not only variables, but also constants may get subverted.

This is our model:



It seems to be simple enough, consisting, as it does, of just five distinctions and six variables, yet it already provides for some basic understanding of the complexity of social action. Note that the sixth variable is the outside of the form left unmarked, which, included as the excluded third, provides the form with the necessary indeterminacy it explores and exploits (Luhmann, 1997a, pp. 36-44; Luhmann, 1997b).

The model maintains that social action first of all consists in any kind of *action* occurring, which is framed by a kind of *talk,* which presents it with definitions of its identity, thus giving it a control over itself. The particular kind of risky, adventurous, and prestigious action depicted by Erving Goffman in his essay on "Where the Action Is" is indeed actually the most general case of any action, in that less daring action just adds on constraints which it is prepared to accept, whilst the more daring one drops these constraints in order to be able to explore them by playing with them (Goffman, 1967, pp. 149-270; Goffman, 1974, pp. 41-43; cf. Bateson, 2000, pp. 177-193, Bateson, 1956; Miller, 1973; Baecker, 1999b).

With one eye on evolutionary anthropology, we venture the hypothesis that the distinction of action, as framed by the selection of talk in human behavior, is managed with respect to an enhancement of chances to *mate*, that is to control possible mates and the access to them. Of course, we do not mean that all action is up for sexual intercourse, longing for intimacy, or on the money for love. But we assume that there is more to Charles Darwin's idea of the sexual selection of behavior and action than has been actually taken up in social sciences up to now (Darwin, 2004; Miller, 2001). All social action, we would like to say, regards the distinction between action and talk with respect to the chances of achieving or maintaining a certain position in a pecking order of access to mates. We assume this restriction to play its role on the first re-entry-level of our form, the level of the re-entry of the distinction between action and talk into the form, such that we are here dealing with a reflection device, which subverts the constant distinction between action and talk into a more playful version of itself. That is, anyhow, what a re-entry, following George Spencer-Brown's calculus

(Spencer-Brown, 1994, pp. 54-68), is about. That more playful version of itself, a cross turned into a marker, re-symmetrizes the asymmetrical distinction for some kinds of observation, if only to attract different determinations from the other values of the form, and then, of course, bounces back into the asymmetry forming the constant.

Competing for an access to mates, that is, directs the attention of the observer to a kind of action that is either trying to change a position in the pecking order or to insist on it, and orientates the talk accordingly, attuning it to various possibilities to boast about, or modestly hint at, one's position. Do not think that we are here only dealing with the heritage of primate behavior or with tribal society. If you look at it, action in ancient, modern, and in the next society is as impregnated as can be with the obsession to possess a mate. Again, note that we do not say that all action is up for sexual intercourse. There are indeed all kinds of action far off the mark, so to speak, as people invest themselves into political, economic, artistic, pedagogical or other kinds of action. Yet, in defining social action, the criterion of how to relate talk to action consists in looking at the social position an actor is trying to achieve or maintain with respect to mates, including, of course, the competition among people of the same sex for the position they already have or would like to attain.

The interest in mating is only indirectly dominant in social action. All societies address it as a kind of first-order overflow demanding control, yet do so guardedly. Mating for sexual behavior is, indeed, a well-chosen site for the observation of action, since it combines behavioral, organic, mental, and social aspects of action, thus addressing humans in their complexity, and it combines the selection of behavior with self-selection, thus controlling social control with respect to humans being prepared to accept, and to enforce it. Oscillating between orgiastic and ascetic modes of moderation, society chooses its way to conduct human sexuality, as is shown, among others, by Max Weber's sociology of religion (Weber, 1988), managing, as it were, both society's distance from, and its approach to, the immediate control of mates and, thereby, of *ego* seeking its way in society.

We might, however, also choose a weaker version of the model, which looks at *living* instead of mating being the criterion of a reflection and regulation of the distinction between action and talk. This is a European style, ageing welfare society type of network synthesis which is in tune with, for instance, Bronislaw Malinowski's general theory of culture which looks at the biological foundations of human culture and calls *institutions* all kinds of regulations of actions which give form to human needs and desires (Malinowski, 1960). Living, here, means that all action and all talk have their reference in different answers to the question how the humans engaged in action and talk will be able to reproduce their life and what they both try to achieve and try to avoid living it. Note, however, that such a tuning down of mating to living might appeal to ageing societies and might even be called a general dampening device of world population growth, capping this growth with respect to a human world population acquiring a consciousness of it itself. Yet, such a dampening device is only working in a part of world society. Other parts, and the bigger parts, are still not only

growing but exponentially so, as it seems (Von Foerster, Mora, & Amiot, 1960; Umpleby, 1990), thus giving mating the upper hand over living.

Yet, even if we stick with the stronger version of the model, the second distinction and third variable of the model already show how first-order action, with respect to second-order observation, gets bound into a determination which adds another aspect than sexuality to the organization and regulation of behavior. The distinction between *talk* and *group* specifies the context of all talk occurring, which is the context of some basic cohesion framing any one individual with respect to an overall order addressing all others.

That is why we maintain that a possible re-entry of the distinction between talk and group into the form of social action might be called by the name of *gaming*, playing on the double meaning of this word, alluding both to games whose rules one may obey or not, and to the hunt one performs in searching for prey, or which one is trying to circumvent, not wanting to fall prey to somebody else. Gaming, thus, is deemed to mean that all talk, with respect to the group, is intended either to induct somebody else into some old or new group cohesion, or to let oneself be inducted into some group, thus avoiding some alternative group. Gaming means checking for both talk and group, yet always having to settle into a particular selection and combination of them, which is not available as a free choice by the actor but is bound by known or acceptable ways to talk and by all other individuals in the group accepting the new demand.

Group numbers any social action as one among others which are of a comparable, a complementary, or a parallel kind. It thereby lends it an identity which transcends and informs the talk, which captures the overflow of action. Group means to lend the talk a site, and thereby to offer action a place, providing for positive and negative sanctions in dealing with it, sanctions which flow naturally from attempts to secure, purify and embellish, the place. Group provides action with discipline and connectivity (White, 1992; Latour, 1996).

Incorporation, as Mary Douglas would have it, comes with individuation, and *group* with *grid* (Douglas, 1982a, pp. 190-199; Douglas, 1982b, pp. 54-64). So our next distinction is the distinction between group and grid, and our next variable the variable of the grid. The grid tells you which relational pattern informs the choices of the individual doing the choosing (Douglas, 1982a, pp. 190-199). Any one value, which inside the group determines what to talk about, who is doing the talking, who is doing the listening, who is to be interrupted by whom, and which turn-taking anybody is prepared to accept or to counter, including all kinds of tactful treatment of possible mistakes or the merciless prosecution of any misdemeanor, does not depend on what is talked about, but on the grid position of the individual doing the talking.

Note that the grid position is not fixed but a variable as well, which means that one can try to vary it by working on the way one looks for, and constitutes, the group. It is the distinction which is important and, indeed, constant, which means that the variables are up for variation. The observation and reflection of grid and group we call the operation of *tying,* because social action is only bound to accept a specific grid

position if the group coming with it, the identities which are on offer, and the connectivity it promises, present it with means to tie itself, and to tie others, into a position which is acceptable with respect to group and leaves some space to move about with respect to grid. Tying here means action and talk are selected with respect to the selection of both group and grid. Looking at his or her group identity, the actor selects both action and talk with respect to the grid position he or she would like to opt into or out of.

Our penultimate variable is *society*. By society we mean an overall variable, which defines ways to proceed with social action via the provision of keys or cues as to how and when to maintain its course or to change it (Goffman, 1974, pp. 40-82). Sociology is used to such an operational definition of society, having deconstructed, as it is, all more substantial definitions of it. As noted in the previous paper (Baecker, 2007), Gabriel Tarde speaks of association, Emile Durkheim of complementarity, Georg Simmel of interaction, Max Weber of socialization, Talcott Parsons of action, Niklas Luhmann of system, and Harrison C. White of networks, just to be sure that society at any instant is considered to be the outcome of, and the input back into, ways of social action for orientating itself to varying situations. There are no values, no norms, no roles, no rules, no institutions, no frames, which go untested by the communication of social action at any one moment, and may change accordingly. This is one reason, why social sciences' most elusive notion of all, the notion of culture, has rightly been chosen to track ways of testing, changing, and possibly confirming values and norms, rules and institutions, roles and frames (Geertz, 1973).

More explicitly, society is the variable which defines the possibility of *switches* from one group to another, what their nature is, and how a switch might be communicated, or keyed, both inside the old group a social action is switching out of, and inside the new group it is switching into. Such keys, forks, or switches, as we already noted, are among the most elaborate structures a society is forced to provide, and sociological theory is bound to describe (White, 1995).

There are two reasons for this elaborateness. One is that society means orientation for action, talk, grid, and group, and space for mating, gaming, tying, and switching, and thus has to provide for consent as well as for dissent, and for conflict as well as for its moderation and settlement. And the other reason is that society, inside the form of social action, is framed by the *unmarked state* of that form. That unmarked state, depending on the sort of social action distinguishing itself, may mean all kinds of things, for instance spirits, devils, and gods, or nature, physics, and universe, or the unconscious, desires, and instincts. As soon as it means something, it gets marked, pushing the unmarked state one variable further to the right, which is a process of semiosis that can only be stopped by a general kind of fetishism, that is by bans on proceeding, which attract all further attention to the both fascinating and frightening fetish itself (Marx, 1990; Freud, 2000).

We call *knowing* any way to reflect on the distinction between society and the unmarked state and to re-enter it into the form of social action. Knowing means acknowledging the unmarked state without necessarily foregoing attempts to mark it

this way or that. It means to deal knowingly with ignorance, which has of late been greatly advanced by the development of notions of a kind of anticipation, which is as creative as it is resilient (Smithson, 1989). As the next society is investing in a structure form of itself which relies on knowledge instead of on the media, strata, or tribes of earlier society, we will have to go more intently into different ways of dealing knowledgeably with ignorance. Second-order cybernetics and systems theory have always been about this, but for social sciences this has been more of a reason to avoid them than to explore their possibilities (Baecker, 2001, 2002).

IV. Understanding

Our model of social action is a network and a communication model, which means that it comprises action and observation, as well as action and experience, in its notion of how the values of the variables determine each other interdependently by drawing on the values, or prejudiced choices (Kauffman, 1978, pp. 182), of one variable in determining the otherwise indeterminate values of the other variables.

Another possible way to describe this makes use of Niklas Luhmann's notion of communication as a notion of a threefold synthesis of (a) utterance, (b) information, and (c) understanding, the latter, understanding, synthesizing all three of them by drawing the distinction, and thus making the connection, between utterance and information (Luhmann, 1995, pp. 139-145). Understanding, to be sure, is an operation inside communication; it is not a mental act relying on human consciousness to be acted out, but an event, possibly the most "sharp-valued" (Pask, 1981, p. 270) event there is in social action, to be produced, to be linked to, and to be tested by communication itself, that is by the tying of behavior, decoded and encoded as action, into the domain of the social. This does not preclude human consciousness going along with it, even if human consciousness is surprised, confirmed, or made uneasy by it, but communicational understanding is done on its own, it does not wait for human consciousness to understand as well, since there is actually no way of knowing whether it did or not, given the operational closure of both consciousness and communication (Luhmann, 1992b).

We propose introducing this notion of communication into our model of social action by calling action the utterance, information the connection between action and talk, and understanding all six variables connected to each other by distinctions between them. Utterance, then, basically means that someone taken as an actor is behaving in a way such that attribution of social meaning is not impossible. That attribution may be intended by the actor, or not. If it is intended, the actor may still be surprised by just what kind of behavior is attributed to him or her, social action having to travel all of its own way for words, gestures, silence, and "twitches and shifts" (Douglas, 1982b, p. xxiv) in bodily action, when selecting its focus of attention, let alone the possibility not to look at the actor and his or her action at all in describing what is happening, but at the situation the actor is situated in by the observer (Heider, 1958). The rule is that even intentions get attributed to the actor only by the communication of social action, thereby forcing, or inviting, the actor to comply with

it, or to deviate from it, via his or her behavior, possibly invoking social events, which again are subject to social attribution. That is why socially, and mentally, most actors may prefer to sustain some content and target ambiguity (Leifer & Rajah, 2000), the communication of social action allowing for these preferences since only attributional ambiguity is sure to capture divergence of perspective.

What social action is about, in terms of fact and reference, is subject to the talk going on, a talk, however, which is framed by both the action it frames, and by group, grid, and society. That means that there is plenty of space for the selection of information, even if nothing in that selection, due to recursive operation, is ever arbitrary. It can be presented as arbitrary, of course, but this is just a special reference to the content figured out of the values the variables are set to. Thus, information, as in Shannon's mathematical theory of communication (Shannon & Weaver, 1963), is defined as a selection of a message, here the token of an utterance, out of a set of possible messages, here constituted by the indeterminate space of the form of social action determining that the variables assume certain values when going for communication.

In order to distinguish between action and talk, all other variables are to be taken into account. Only then is understanding possible, and thus both the completion and the continuation of the communication of action. Note that understanding here means cybernetic control, not hermeneutic understanding, which is impossible, given the lack of the requisite variety for dealing with the complexity of the matter involved (Ashby, 1958).

We speak of the selection of the values of the respective variables. Note, however, that the selection we are talking about is not equivalent to some deliberate choice. Selections happen. They occur according to the variables interdependently determining each other, more often than not surprising the actor with their respective values. That is why sociological theory prefers to distinguish between action, on the one hand, and experience, on the other, to account for social action being obliged to deal with action, which is expected to vary with respect to the experience of a situation from the divergent perspectives of the actor and the observer (Schütz, 1967; Goffman, 1974; Luhmann, 1995, pp. 84-85).

In concluding, it is perhaps important to note that the further we get in unfolding and reading, from left to right, and in the arrangement of the distinctions constituting the form of social action, the less determined are the values of the variables to the right and the more determined are the variables to the left. This contradicts common sense which believes that action and talk are amenable to almost any selection one likes, while the group and the grid, let alone society, are as good as fixed, change only slowly and at a historical pace, and are certainly not up to individual selection. In a way, that is right. Any one variable to the right of the variable of action adds to the determination of it, as is noted by the adding of horizontal lines above the variable. But that exactly means that we have to read the arrangement the other way around. The variables to the right get weaker and weaker in determination, yet add on the determination of the variables to the left.

2. Catjects

I. An Underlying Reality of Operations

Network synthesis depends on units of one, which are drawn from, and embedded within, the diversity of the many. Action produces an overflow of reference; talk, group, and grid inform this reference with self-reference, thus giving it a frame, a number, and an order; and society provides for re-entries, which do not exactly reflect the whole form, but account for the unmarked state coming with both reference and self-reference.

Neither objects nor subjects are to be considered as the *hypokeimenon*, the underlying reality of network synthesis. Neither Aristotelian objects nor Kantian subjects, neither the things of the literate society nor the reason of the printing press society are able to cover what self-organization there is in any society, let alone the computer grid society. Of course, both Aristotle and Kant are well aware of this. Aristotle's categories focus on the object, only to discover the elusiveness of substance, the indecision of relation, the ambiguity of quality, and the variety of movement (Aristotle, 1963). And Kant's categories focus on the subject, only to discover that the synthesis of the manifold is to be brought about by reason, only if the latter is able to distinguish between the logical functions of quantity, quality, relation (including that of the community of the actor and the sufferer), and modality, all of them adding up to a faculty of judgment, which relies on analytical separation as much as on synthetic integration (Kant, 2003). To prevent the synthesis losing itself among the manifold again, it has to be anchored firmly in the transcendental, that is in the unmarked state, which here, and thereby, becomes the place for both the hopes of idealism and the despair of romanticism.

Ever since Kant, it has been a question of where to fix possible categories which are able to describe network synthesis. Charles Sanders Peirce looks for categories able to capture the accidental *it,* which lends quality (a ground), relation (a correlate), and representation (an interpretant) to substance and being (Peirce, 1868). Alfred North Whitehead quite similarly focuses on the category of the creativity, of the world taken as a process, to explain how the disjunctive many of the universe come to inform actual entities that combine self-identity and self-diversity (Whitehead, 1979). Gregory Bateson and Robert M. Pirsig look at the category of quality as a category to explain, or, better, call upon, both substance and relation (Bateson, 1979; Pirsig, 1974).

Paying due respect to the many epistemological turns of twentieth century philosophy, from the linguistic to the iconic, and from the social to the postcolonial, we propose switching from objects and subjects to catjects as informing the network synthesis of social action. Objects and subjects are special cases of catjects, which describe the general case of synthesis brought about by distinctions recursively organizing themselves. This is no new idea, as is witnessed by objects becoming "quasi-objects" (Serres, 1995), "hybrids" (Latour, 1993), and "boundary objects" (Star, 1989), or by both subjects and objects becoming "unjects" (Fuchs, 2001,

pp. 130-137), all of them thereby taking into account not only the manifold of relations, but also the ambiguity of meaning and the combination of reference, self-reference, and some general network value, any institution of one is embedded within.

Categories do not come for free; they are products of the same social action which relies on them to organize its reference, self-reference, and network value. Studies in the epistemology of the grammar of motives, the order of things, and the semantics of social structure have always been explicit about this (Bachelard, 1984; Bakhtin, 1984; Burke, 1957, 1969; Foucault, 1994; Blumenberg, 1981; Luhmann,1980-1995; Lakoff, 1987; Koselleck, 2006). Our idea of the network synthesis of social action, with respect to the next society superposing itself to the tribal, the ancient, and the modern society, proposes to look anew at the theoretical, or, as the case may be, sociological, foundations of any research into categories by asking what catjects are able to come from, and to organize, the overflow of reference, symbol, criticism, and memory-control.

We are here only interested in the catjects of the next society, assuming, however, that the research into relations we just quoted between semantics and social structure does not by chance arise with the appearance of, first, the motion pictures attempting to communicate the whole of perception, and, then, the computer presenting society with its overflow of memory-control. We nevertheless remain with the latter and ask about catjects organizing society's dealing with the overflow of networked memory-control. Note, however, that a parallel analysis of, for instance, Russian art and architecture dealing with motion pictures could be revealing about ways to capture an overflow of control with respect to the organization of perception (Benjamin, 1968; Bulgakowa, 1996; Malevich, 2002; Tupitsyn, 2002).

Our general idea is that, given an overflow of meaning presented by action, all other variables of our model, that is talk, group, grid, and society, step in to organize, and thereby self-organize, the capture, number, order, and re-entry of that meaning, such that catjects emerge as selective bundles among the values of the variables of the form of social action. Action, as ever, produces the overflow. It relies on second-order observation to receive any form whatsoever. This means that action, or, better, acting (Schütz, 1967), can be left to itself, thus constituting a micro-diversity of events that may or may not be attributed to either action or situation. That micro-diversity of action is both necessary for, and not sufficient to, the self-organization of social action, because the diversity of action informs the social action without being able to instruct it, having to wait, instead, for social action to lend it its attribution, allocation, and interpretation (Luhmann, 1997c).

It is through the selective handling of the overflow via the frames of a culture form that catjects come into being. This gives any social action an air of virtuality, to begin with, which is why social systems are sometimes interpreted as symbolic systems (Willke, 2005). If they do not succeed in organizing their dealing with signs by the means of signs – remember that symbols, for us, are signs signifying signs (Luhmann, 1999) – they do not stand a chance of approaching their reality by using degrees of freedom in selectively addressing and exploring it.

Thus, the culture form of social action, looked after by the talking taking care of the acting, throws in a selectivity of reference and self-reference which is both risky and necessary and can only be managed by lending it arbitrariness, ambivalence, and discretion, thus reproducing, in forms rather tame in comparison with the original one, the overflow of meaning. In order to not lose sight of the problem of selection and, coming with it, the problem of perspective, it is necessary never to really accomplish the task of numbering, ordering, and re-entering the meaning of the social, which is why so called post-modern thinking has rediscovered the virtue of the vague and unfinished, of the unknown and unknowable, all of them at any time inviting next steps, next perspectives, next considerations, at the same time as decisiveness and coolness, in dealing with them (Calvino, 1988; Rorty, 1989; Latour, 2004).

If talk takes care of the culture by searching for words and gestures, by proposing and withdrawing reference, and by revealing and concealing self-reference, group takes care of number. Gaming, that is, is done in order to be able to count in, or out, a group, which comprises events, things, and persons. The group is the number which adds up to calling a unit among the many by a name which recalls other units. Cultural analysis, like Clifford Geertz's, is at its best when dealing with observations of kinds of counting procedures (Geertz, 1973).

Grid, then, is *order* emerging from ties. They cannot avoid coming with their own contingency, i.e. the possibility to dissolve for some other tie. Grid is order which indicates that any call can be undone, or can be cancelled, because any call is nothing but the compensation of its own improbability, if not impossibility (Spencer-Brown, 1994, p. 10). That is why cultural theory excels the moment it looks at fetish, taboo, and negation organizing the self-imposition of otherwise empty signs (including MacGuffins) (Freud, 1962, 1989; Truffaut, 1985; Laclau, 1994).

And society provides for *re-entries* able to invite, and organize, switchings with respect to attempts at knowing the unmarked state. If number and order stick, re-entries unravel such that new knots become possible. References to the unmarked state unsettle both references and self-references already found, such that all kinds of therapy, including the most powerful of all, communication (Ruesch & Bateson, 1987), may step in to propose and cultivate new references and self-references. Somehow, cultural studies has only just started looking into that business of society's tying, and untying, the knots which are presented with the catjects in use. Cultural studies may well be suited to such an endeavor since it may inherit old humanities', or *humaniora's*, task of looking into the psychophysics of the social and the cultural (Carell, 1931), thus schooling the cognitive abilities of humans (Kant, 2000, §60).

II. Metadata

The mathematical theory of categories calls morphism a function which is able to preserve an object that belongs to certain categories (Goguen, 1991; Kleinert, 2004). We take catjects to act as morphisms of this kind. They produce objects and subjects, entangled into some circular structure, which defines their co-dependency. They produce themselves, providing for a heterarchy of values (McCulloch, 1989, pp. 40-

45), which gives space to oscillation, memory, and subversion (Spencer-Brown, 1994, pp. 61-62), and to proemial relationships, which define order and exchange (Günther, 1979, pp. 203-240). Their way of reproduction is to act as an attractor state, or *eigen*-value, of recursive functions, which allow for perturbation (Von Foerster, 2003, pp. 261-271).

Of course, this is more of a list of ideas indicating a research program than it is already the demonstration of the usefulness of the notion of a catject. Our idea is that catjects are to be considered as comprising of a particular set of distinctions, an "arrangement", as Spencer-Brown would have it (Spencer-Brown, 1994, p. 4), which produces a network synthesis consisting of variables whose values again are co-dependent. Our four societies, distinguished with respect to their respectively dominating dissemination medium, are cases in point. Oral or tribal, literate or ancient, printing press or modern, and computer or next society are, any one of them in its own right, catjects, which define how values must network, that is, prejudice their choice (Kauffman, 1978), in order to lend determination to the indeterminate. The overall society, which we pictured by spelling out the network synthesis of social action as such, comprising the values of the variables action, talk, group, grid, society, and the unmarked state, is another case in point of a catject.

But catjects, as I think of them, are self-similar *eigen*-values, which are to be found on the most different levels of the social. They may be thought of as resembling those steady states, or plateaus, which fascinate evolutionary theory and social philosophy alike (Bateson, 2000, pp. 107-127 and pp. 346-363; Deleuze & Guattari, 1988). Indeed, to allow for variation, to secure selection, and to at any instant provide for some re-entry of the selections among the variations may eventually be said to indicate what they are all about (Campbell, 1969; Luhmann, 1997a, pp. 451-505).

Yet, the reason why we are interested in the concept of catjects is not only that it may provide a shortcut to an analytically robust reintegration of all these concepts just mentioned. More importantly, it seems to me, the concept of catjects possibly offers a translation of some old puzzles of cybernetics into the contemporary interest in search algorithms, semantic webs, and social software, which are all three of them conveniently labeled by the name, or, rather, call to action, of Web 2.0 (O'Reilly, 2005).

There were three puzzles, says Warren McCulloch, the early cyberneticians, Norbert Wiener, John von Neumann and himself, were not able to solve: the puzzle of the statistical, the puzzle of the coupling of nonlinear oscillators, and the puzzle of continuous nonlinear prediction (McCulloch, 2004, p. 359). The puzzle of the statistical consists in the lack of the long runs of data under essentially constant conditions, which would enable cybernetics to spell out the mechanisms and formalisms of the organization of complex phenomena, such as a society the social philosophers like Margaret Mead and Gregory Bateson asked for at that time (Wiener, 1961, pp. 24-25).

The puzzle of the coupling of nonlinear oscillators relates to the question of the design of filtering devices able to provide for a mechanism of adaptive learning. W.

Ross Ashby deals with this puzzle in terms of a system consisting of an organism and an environment which are coupled by feedbacks able to distinguish between goals and their states, on the one hand, and disturbances, on the other: a kind of cybernetic reformulation of the Aristotelean *telos* (Ashby, 1960; Rosenblueth, Wiener, & Bigelow, 1943).

And the puzzle of continuous nonlinear prediction consists in decoupling a system from any physical ways to determine its states, going instead for the operational closure of information to describe its self-organization and self-determination, and then in again recoupling the system on its own terms to the physical environment (Rosen, 1985). To explain how a system may be able to predict its own states, and how an observer may discover the impossibility of doing likewise, given the complexity of the system (Ashby, 1958), means to consider information in terms of operational closure, which comes easily enough if one thinks of neurophysiology and the mathematical theory of communication (Müller, 1852; Shannon & Weaver, 1963; Von Foerster, 2003, pp. 247-259), but is, nevertheless, hard to swallow, both inside and outside academia, since it so much contradicts common sense, which is supported by the brain's perceptions making sure that all possible impressions, save dreams, get attributed externally, as long as certain indications of disturbance do not suggest otherwise.

Catjects tell us that we must look not for objects deemed to be possibly true, nor for subjects considered able to empirically back themselves up with transcendental reason, but for arrangements of distinctions able to reproduce such that they generate their own statistics, i.e. a data set of experiences and expectations, such that they are capable of dealing with variations always coming as a kind of surprise, and such that they develop some means of foresight, the most important of which is the acknowledgment of the future being unknown, not only to them but to any observer. It may indeed be helpful to look to sociology for some ideas on how the three puzzles of cybernetics may be dealt with (Luhmann, 1997b; Baecker, 2003; Baecker, 2005, pp. 85-104).

If Web 2.0 is indeed about the organization of metadata, in addition to the production and storing of data (Tom Fürstner, personal e-mail communication, December 19, 2005), then this organization may well prove to be another example of catjects, in that the search, the linking, and the socially distributed use of the data will only be sustainable if there is some self-reference informing the links, some reference becoming reliable, and some accounting for the network becoming visible, which makes the data trustworthy. Metadata will have to be informed by knowledge, that is, they will both be drawn from, and produce, a kind of knowledge, which is no longer considered to be consisting of definite data stored away in some memory, but which will emerge and disappear along with natural and artificial users producing it while surfing the data surface of the natural, social, and artificial world.

Metadata will come with catjects, which are able to capture, number, order, and re-enter social data, which are in a way, and with respect to a first approach, indistinctly oral, textual, visual, acoustic, and iconic. Our model of social action tells

us that catjects able to do so must provide for action overflow, ambiguous talk, cohesive group, grid address, and some knowing of society and the unmarked state coming with it, by the latter lending social, including emotional, fascination and material relevance to the data.

Again referring to Charles Sanders Peirce, we may say that catjects are able to organize data with reference to metadata, if they provide for terms, that is, for means to interlink sensibly, for propositions about objects of some kind, and for arguments, which both relate to interpretation and reveal it (Peirce, 1868). The most difficult piece of it may turn out to be the provision of terms. Terms indeed map catjects back to themselves, thus lending them an inner depth and void, which hitherto was experienced only by human souls (Pascal, 2004). But it may turn out to be exactly that inner depth and void which enables catjects to rely, with their operation and recursion, not on certainties of reference, but on addresses of networks.

But then, propositions and interpretations abound, which is why we just have to watch ourselves dealing with their overflow if we want to collect some metadata on how we deal with data and on how we look for more, and other, data, in order to be able to double-check on our metadata. I leave it at that, having given nothing more but the roughest sketch of some theoretical ideas coming to a mind watching the next society emerging. The proof of all this will lie in the use of some or other idea from this survey of possible sociological thinking for the construction of further examples of what we may mean in text, picture, music, or code.

References

Abbott, A. (1997). Of Time and Space: The Contemporary Relevance of the Chicago School. *Social Forces* 75 (4), 1149-1182.

Abell, P. (2000a). Putting Social Theory Right? *Sociological Theory* 18 (3), 518-526.

Abell, P. (2000b). Sociological Theory and Rational Choice Theory. In B. Turner (Ed.), *The Blackwell Companion to Social Theory* (2nd ed., pp. 223-244). London: Blackwell.

Aristotle (1963). *Categories and De Interpretatione* (with notes by J. L. Ackrill, Trans.). Oxford: Oxford University Press.

Ashby, W. R. (1958). Requisite variety and its implications for the control of complex systems. *Cybernetica, 1* (2), 83-99.

Ashby, W. R. (1960). *Design for a brain: The origin of adaptive behavior* (rev. ed.). New York: Wiley.

Bachelard, G. (1984). *The new scientific spirit* (A. Goldhammer, Trans.; Foreword by P. A. Heelan). Boston: Beacon Press.

Baecker, D. (1999b). The form game. In D. Baecker (Ed.), *Problems of form* (pp. 99-106). Stanford, CA: Stanford University Press.

Baecker, D. (2001). Why systems? *Theory Culture & Society, 18*, 59-74.

Baecker, D. (2002). The joker in the box, or the theory form of the system. *Cybernetics and Human Knowing, 9* (1), 39-62.

Baecker, D. (2007). The network synthesis of social action I: Towards a sociological theory of next society. *Cybernetics & Human Knowing, 14* (4), 9-42.

Baecker, D. (2005). *Form und Formen der Kommunikation*. Frankfurt am Main: Suhrkamp.

Bakhtin, M. M. (1984). *Rabelais and His World* (Héléne Iswolsky, Trans.). Bloomington, IN: Indiana University Press.

Bateson, G. (1956). The Message "This is a Play." In B. Schaffner (Ed.), *Group processes: Transactions of the second conference, October 1955, Princeton* (pp. 145-242). New York: Josia Macy, Jr. Foundation.

Bateson, G. (1979). *Mind and nature: A necessary unity.* New York: Dutton.

Bateson, G. (2000). *Steps to an ecology of mind* (reprint). Chicago: Chicago University Press.

Benjamin, W. (1968). *Illuminations* (Introduction by H. Arendt, Ed.; H. Zohn, Trans.). New York: Schocken.

Berger, P. L., & Luckmann, T. (1966). *The social construction of reality.* Garden City, NY: Doubleday.

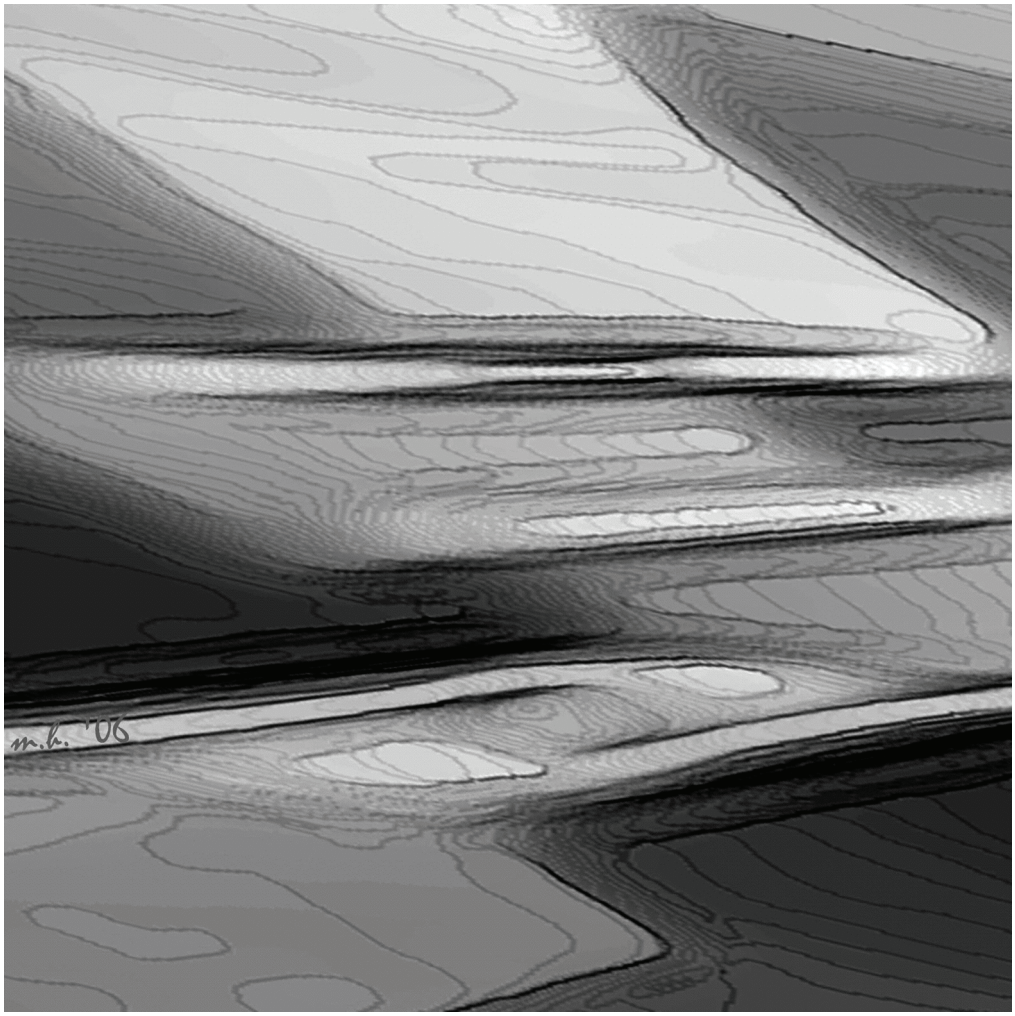
Blumenberg, H. (1981). *Wirklichkeiten in denen wir leben: Aufsätze und eine Rede*. Stuttgart: Reclam.

Bulgakowa, O. (1996). *Sergej Eisenstein – Drei Utopien: Architekturentwürfe zur Filmtheorie.* Berlin: Potemkin Press.

Burke, K. (1957). *The philosophy of literary form: Studies in symbolic action* (rev. ed.). New York: Vintage.
Burke, K. (1969). *A grammar of motives* (reprint). Berkeley: California University Press.
Calvino, I. (1988). *Six memos for the next millenium* (P. Creagh, Trans.). Boston: Harvard University Press.
Campbell, D. T. (1969). Variation and selective retention in socio-cultural evolution. *General Systems, 14,* 69-85.
Carell, E. (1931). *Wirtschaftswissenschaft als Kulturwissenschaft: Untersuchungen zur verstehenden Nationalökonomie insbesondere*. Tübingen: Mohr.
Coleman, J. S. (1990). *Foundations of social theory.* Cambridge, MA: Harvard University Press.
Darwin, C. (2004). *The descent of man, and selection in relation to sex* (introduction by J. Moore & A. Desmond). London: Penguin Books.
Deleuze, G., F. Guattari (1988). *A thousand plateaus: Capitalism and schizophrenia* (Foreword by B. Massumi, Trans.). London: Athlone.
Derrida, J. (1998). *Of grammatology* (corr. ed., G. Chakravorty Spivak, Trans.). Baltimore: Johns Hopkins University Press.
Douglas, M. (1982a). *In the active voice*. London: Routledge & Kegan Paul.
Douglas, M. (1982b). *Natural symbols: Explorations in cosmology* (rev. ed). New York: Pantheon.
Elster, J. (2000). *Ulysses unbound: Studies in rationality, precommitment, and constraints.* Cambridge: Cambridge University Press.
Foucault, M. (1994). *The order of things: An archaeology of the human sciences*. New York: Vintage.
Freud, S. (1962). *Totem and taboo* (J. Strachey, Trans.). New York: W. W. Norton.
Freud, S. (1989). *The civilization and its discontents* (James Strachey, Ed.). New York: W. W. Norton.
Freud, S. (2000). Fetishism. In *Standard edition of the complete psychological works of Sigmund Freud* (vol. 21, pp. 152-157; J. Strachey & A. Freud, Eds.). New York: W. W. Norton & Co.
Fuchs, P. (2001). *Die Metapher des Systems: Studien zur allgemein leitenden Frage, wie sich der Tänzer vom Tanz unterscheiden lasse*. Weilerswist: Velbrück.
Geertz, C. (1973). *The interpretations of cultures: Selected essays*. New York: Basic Books.
Girard, R. (1965). *Deceit, desire, and the novel: Self and other in literary structure* (Y. Freccero, Trans.). Baltimore: Johns Hopkins University Press.
Girard, R. (1977). *Violence and the sacred* (P. Gregory, Trans.). Baltimore: Johns Hopkins University Press.
Goffman, E. (1967). *Interaction ritual: Essays on face-to-face behavior.* New York: Pantheon.
Goffman, E. (1974). *Frame analysis: An essay on the organization of experience*. Cambridge, MA.: Harvard University Press.
Goguen, J. A. (1991). A categorical manifesto. *Mathematical Structures in Computer Science, 1* (1), 49-67.
Günther, G. (1979). *Beiträge zur Grundlegung einer operationsfähigen Dialektik* (vol. 2). Hamburg: Meiner.
Heider, F. (1958). *The psychology of interpersonal relations*. London: Wiley.
Kant, I. (2000). *Critique of the power of judgment* (P. Guyer, Ed.; P. Guyer & E. Matthews, Trans.). Cambridge: Cambridge University Press.
Kant, I. (2003). *Critique of pure reason* (J. M. D. Meiklejohn, Trans.). New York: Dover.
Kauffman, L. H. (1978). Network synthesis and Varela's calculus. *International Journal of General Systems, 4* (3), 179-187.
Kleinert, E. (2004). Categories in philosophy and mathematics. *Hamburger Beiträge zur Mathematik*, *199* (September).
Koselleck, R. (2006). *Begriffsgeschichten: Studien zur Semantik und Pragmatik der politischen und sozialen Sprache.* Frankfurt am Main: Suhrkamp.
Laclau, E. (1994). Why do empty signifiers matter to politics? In J. Weeks (Ed.), *The lesser evil and the greater good: The theory and politics of social diversity* (pp. 167-178). London: Rivers Oram Press.
Lakoff, G. (1987). *Women, fire, and dangerous things: What categories reveal about the mind.* Chicago: Chicago University Press.
Latour, B. (1993). *We have never been modern* (C. Porter, Trans.). Cambridge, MA: Harvard University Press.
Latour, B. (1996). On actor-network theory: A few clarifications. *Soziale Welt, 47* (4), 369-381.
Latour, B. (2004). *Politics of nature: How to bring the sciences into democracy* (C. Porter, Trans.). Cambridge, MA: Harvard University Press.
Leifer, E. M. (1991). *Actors as observers: A theory of skill in social relationships*. New York: Garland.
Leifer, E. M. (2002). Micromoment management: Jumping at chances for status gain. *Soziale Systeme: Zeitschrift für soziologische Theorie, 8* (2), 165-177.
Leifer, E. M., V. Rajah (2000). Getting observations: Strategic ambiguities in social interaction. *Soziale Systeme: Zeitschrift für soziologische Theorie, 6* (2), 251-267.
Leydesdorff, L. (2001): *A sociological theory of communication: The self-organization of the knowledge-based society.* Parkland, FL: Universal Publishers.
Luhmann, N. (1980-1995). *Gesellschaftsstruktur und Semantik: Studien zur Wissenssoziologie der modernen Gesellschaft* (4 vols.). Frankfurt am Main: Suhrkamp.
Luhmann, N. (1993). Deconstruction as second-order observing. *New Literary History*, *24* (4), 763-782.
Luhmann, N. (1995). *Social systems* (J. Bednarz, Jr. with D. Baecker, Trans.). Stanford, CA: Stanford University Press.
Luhmann, N. (1997a). *Die Gesellschaft der Gesellschaft*. Frankfurt am Main: Suhrkamp.
Luhmann, N. (1997b). The control of intransparency. *System Research and Behavioral Science, 14* (6), 359-371.

Luhmann, N. (1997c). Selbstorganisation und Mikrodiversität: Zur Wissenssoziologie des neuzeitlichen Individualismus. *Soziale Systeme, 3* (1), 23-32.
Luhmann, N. (1998). *Observations on modernity* (W. Whobrey, Trans.). Stanford, CA: Stanford University Press.
Luhmann, N. (1999). Sign as form. In D. Baecker (Ed.), *Problems of form*. (M. Irmscher & L. Edwards, Trans., pp. 46-63). Stanford, CA: Stanford University Press.
MacKay, D. M. (1969). *Information, mechanism and meaning*. Cambridge, MA: The MIT Press.
Malevich, K. S. (2002). *The white rectangle: Writings on film* (O. Bulgakowa, Ed.). Berlin: Potemkin Press.
Malinowski, B. (1960). *A scientific theory of culture and other essays*. New York: Oxford University Press.
Marx, K. (1990). *Capital; Volume 1: A Critique of Political Economy* (Introduction by E. Mandel; B. Fowkes, Trans.). London: Penguin Classics.
Maturana, H. R., & Varela, F. J. (1980). *Autopoiesis and cognition: The realization of the living*. Dordrecht: Reidel.
Maturana, H. R., & Varela, F. J. (1998*). The tree of knowledge: The biological roots of human understanding* (rev. ed.). Boston: Shambala.
McCulloch, W. S. (1989). *Embodiments of mind*. Cambridge, MA: The MIT Press.
McCulloch, W. S. (2004). The beginning of cybernetics. In C Pias (Ed.), *Cybernetics / Kybernetik: Die Macy-Konferenzen 1946-1953. Vol. 2: Essays und Dokumente* (pp. 345-360). Zürich: diaphanes.
Miller, G. (2001). *The mating mind: How sexual choice shaped the evolution of human nature*. New York: Anchor Books.
Miller, S. (1973). Ends, means, and galumphing: Some leitmotifs of play. *American Anthropologist, 75* (1), 87-98.
Müller, J. (1852). *Elements of human physiology.* Portland, ME: Sanborn and Carter.
O'Reilly, T. (2005). What is Web 2.0: Design patterns and business models for the next generation software. Http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html.
Park, R. E.,Burgess, E. W., & McKenzie, R. D. (1967). *The city* (reprint with an Introduction by M. Janowitz). Chicago: Chicago University Press.
Parsons, T., & Shils, E. A.(Eds.) (1951). *Toward a general theory of action.* Cambridge, MA: Harvard University Press.
Pascal, B. (2004). *Pensées* (R. Ariew, Ed. & Trans.). Indianapolis: Hackett.
Pask, G. (1981). Organizational closure of potentially conscious systems. In M. Zeleny (Ed.), *Autopoiesis: A theory of living organization* (pp. 265-308). Amsterdam: North-Holland.
Peirce, C. S. (1868). On a new list of categories. *Proceedings of the American Academy of Arts and Sciences, 7*, 287-298.
Pirsig, R. M. (1974). *Zen and the art of motorcycle maintenance*. London: Bantam.
Rosen, R. (1985): *Anticipatory systems: Philosophical, mathematical and methodological foundations*. Oxford: Pergamon.
Rosenblueth, A., Wiener, N., Bigelow, J. (1943). Behavior, purpose and teleology. *Philosophy of Science, 10* (1), 18-24.
Rorty, R. (1989). *Contingency, irony, and solidarity.* Cambridge: Cambridge University Press.
Ruesch, J., G. Bateson (1987). *Communication: The social matrix of psychiatry* (reprint). New York: Norton. (originally published in 1951)
Sacks, H. (1995). *Lectures on conversation* (G. Jefferson, Ed.; Introduction by E. A. Schegloff). Oxford: Blackwell.
Schütz, A. (1967). *The phenomenology of the social world* (G. Walsh, & F. Lehnert, Trans.). Evanston, IL: Northwestern University Press.
Serres, M. (1995). *Genesis* (G. James, & J. Nielson, Trans.). Ann Arbor, MI: Michigan University Press.
Shannon, C. E., & Weaver, W. (1963). *The mathematical theory of communication* (reprint). Urbana, Ill.: Illinois University Press. (originally published in 1949)
Smithson, M. (1989). *Ignorance and uncertainty: Emerging paradigms*. New York: Springer.
Spencer-Brown, G. (1994): *Laws of form*.(lim. ed.). Portland, Ore.: Cognizer Co. (1st ed. London: Allen, 1969)
Star, S. L. (1989). The structure of ill-structured solutions: Boundary objects and heterogeneous distributed problem solving. In L. Gasser, & M. N. Huhns (Eds.), *Distributed Artificial Intelligence* (vol. 2, pp. 37-54). London: Pitman.
Tarde, G. (1962). *Laws of imitation* (E. C. Parsons, Trans. Introduction by F. H. Giddings). Gloucester, MA: P. Smith.
Tarde, G. (1969). *On communication and social influence* (T. N. Clark, Ed.). Chicago: Chicago University Press.
Truffaut, F. (1985). *Hitchcock* (rev. ed.; H. G. Scott, Trans.). New York: Simon & Schuster.
Tuitsyn, M. (2002). *Malevich and film*. New Haven: Yale University Press.
Umpleby, S. A. (1990). The scientific revolution in demography. *Population and Environment, 11* (3), 159-174.
Varela, F. J. (1979). *Principles of biological autonomy.* New York: North Holland.
Von Foerster, H. (2003). *Understanding understanding: Essays on cybernetics and cognition*. New York: Springer.
Von Foerster, H., Mora, P., & Amiot, L. W. (1960). Doomsday: Friday, 13 November, A.D. 2026. *Science, 132* (no. 3436), 1291-1295.
Watzlawick, P., Beavin, J. H. & Jackson, D. D. (1967). *Pragmatics of human communication: A study of interactional patterns, pathologies, and paradoxes*. New York: Norton.
Weber, M. (1978). *Economy and society: An outline of interpretive sociology* (reprint; G. Roth & C. Wittich, Eds.; E. Fischoff et al., Trans.). Berkeley, CA: California University Press. (originally published in 1968)

Weber, M. (1988). *Gesammelte Aufsätze zur Religionssoziologie* (reprint, 3 vols.; M. Weber, Ed.). Tübingen: Mohr. (originally published in 1921)
White, H. C. (1992). *Identity and control: A structural theory of action*. Princeton, NJ: Princeton University Press.
White, H. C. (1995). Network switchings and Bayesian Forks: Reconstructing the social and behavioral sciences. *Social Research, 62* (4), 1035-1063.
Whitehead, A. N. (1979). *Process and reality: An essay in cosmology* (D. R. Griffin & D. W. Sherburne, Eds.). New York: Free Press.
Wiener, N. (1961). *Cybernetics, or control and communication in the animal and the machine* (2nd ed.). Cambridge, MA.: The MIT Press.
Willke, H. (2005). *Symbolische Systeme: Grundriss einer soziologischen Theorie*. Weilerswist: Velbrück Wissenschaft.



Heimo, M. (2007). *Chlorophyll*.