WRITING SCIENCE

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Niklas Luhmann

TRANSLATED BY John Bednarz, Jr.

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FOREWORD BY Eva M. Knodt

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Foreword

❖ Eva M. Knodt

The Postmodern Predicament

The major challenge confronting contemporary thought, according to Mark Taylor and Esa Saarinen, authors of a recent study on media technology, is to overcome its fixation on written narratives and the culture of print. "Since texts are what count as primary, the diagnostics of our era are carried out vis-à-vis textualities. Reading postmodern theoreticians, one is puzzled to observe how the earth-moving implications of the techno-structures of world production and commerce, as well as the administrative networks, go unnoticed even in the writings of the brightest and wittiest." The indictment is symptomatic of a growing discontent with text-centered theories of culture, which have dominated the humanities since the heyday of structuralism. Behind the closed walls of the academy, the theoreticians of postmodernity "are looking for potential narratives in the shelters of written culture," narratives that capitulate in the face of the global economic and technological changes that continue to transform our social reality with a historically unprecedented speed. According to Taylor and Saarinen, the popular appeal to the end of the *métarécit* obscures the fact that "the metanarrative of our age is not a written product. The metanarratives of ecocatastrophe, the world economy, the technologizing of the lifeworld are not first literary creations that are later materialized. To the contrary, incipient metanarratives involve material practices that have not yet been theorized."[1]

Philosophy, the authors maintain, will not survive into the

twenty-first century unless it overcomes its fear of contamination and embraces what it tends to "avoid at all costs: praxis and the media."[2] The irony is that the aestheticized techno-vision presented here feeds off precisely the nostalgia for a waning literary culture to which it wants to serve as an antidote. The promise (or premise) of liberation—from the cage of textuality to the vast, unlimited possibilities of cyberspace—makes the paradoxical sense it does *only* to those for whom the problems of contemporary theory boil down to the question: "What comes after deconstruction?"[3] The millions of engineers who live on the global net do not need a "media philosophy" any more than the current restructuring of the nation's trillion-dollar health care industry needed to await the outcome of the congressional health care debate.[4] Taylor and Saarinen's media philosophy thus reenacts once again the familiar axiology of impossibilities from which it seeks to escape: the message announcing the end of the book is contained between the covers of—a book.

But the questions remain. The need for more pertinent analyses of today's complex social reality and the corresponding demand for methodologies that can "illuminate convergences between disciplines"[5] is widely recognized. At the same time, postmodern ambitions remain preoccupied with expanding the list of what is no longer possible. Meanwhile, the flooding of the market with theory has reached a level of saturation more likely to generate indifference than to stimulate curiosity. The rhetoric of impossibility is beginning to wear thin. Niklas Luhmann, who in recent years has emerged as Germany's most prominent and controversial social theorist, suggests that postmodern theorizing has arrived at what Ilya Prigogine and Isabelle Stengers call a "bifurcation point," a state of instability in which a system can reorganize itself in unpredictable ways.[6] But unlike most of today's theoreticians, Luhmann is convinced that "something can be said about this," that, indeed, there are "theory materials already available" that can help us conceptualize the end of metanarratives as the "beginning" of something new. In his view, the postmodern semantics of impossibility is a belated reaction, on the part of modernity, to the shock of its own contingency: "There is no métarécit because there is no external observer."[7] The philosophical constructs designed to conceal this realization—from Descartes's insistence on a "God who does not deceive" to the invention of the transcendental sub-

ject—have broken down, and linguistically based successor theories such as hermeneutics, structuralism, and analytical philosophy have been unable to halt the erosion of modernity's trust in its own self-descriptions. Once the classical problems of knowledge, objectivity, and truth were reformulated as problems of language, "reflexivity became unavoidable and, with the emergence of deconstruction, was linked to an inability to determine or establish origins."[8]

Luhmann concedes that there is no longer a "binding representation of society within society,"[9] but refuses to describe this situation exclusively in negative terms, as a loss of legitimation or a crisis of representation. Instead, he proposes that we search for new ways of coping with the enforced selectivity that marks any self-description under the conditions of a "functionally differentiated" modern society. For Luhmann, the end of metanarratives does not mean the end of theory, but a challenge to theory, an invitation to open itself to theoretical developments in a number of disciplines which, for quite some time, have been successfully working with cybernetic models that no longer require the fiction of the external observer. Much of Luhmann's discontent with contemporary theory is, of course, specifically related to the state of his own discipline, sociology. Luhmann started out as a sociologist and continues to describe himself as such, which is somewhat amusing, given his rather unflattering view of sociology as a discipline that compensates for its notorious theory deficit by constructing tribal genealogies and dissecting its classics. It is not without irony that Luhmann should respond to this situation by constructing something like a genealogy of his own, a kind of counter-genealogy that includes, among others, a cybernetician (Heinz von Foerster),[10] two evolutionary biologists (Humberto R. Maturana and Francisco Varela),[11] an obscure mathematician (George Spencer Brown),[12] not to speak of the Devil Himself.[13] This list of names does not merely replace one set of canonical texts with another, however. Rather, it is meant to define a constellation of problems that explodes the boundaries of sociology by linking social theory to recent theoretical developments in scientific disciplines as diverse as modern physics, information theory, general systems theory, neurophysiology, and cognitive science. In these disciplines, the erosion of classical paradigms, far from suggesting the end of

science, led to a fundamental revision of its theoretical premises. The timeless, machinelike universe of Newton was replaced by a "recursive universe," in which disorder, non-linear complexity, and unpredictability are the "rule" (whereas order, simplicity, and predictability constitute the exception), and the collapse of the boundaries between observer and observed has stimulated the exploration of theoretical models capable of handling problems of self-reference.[14] Consequently, the quantum-revolution in physics did not invalidate the laws of classical mechanics but merely redefined their scope within a more comprehensive theoretical framework. Nor did the realization of the inevitable circularity of observation entail renouncing scientific claims to objectivity and universality. Modern physics continues to dream of a "grand unified theory" that would explain the entire physical universe, including the theory's own possibility.[15] Likewise, the biology of cognition traces its own emergence as a result of the evolutionary process it describes.[16] There is mounting evidence that the recent focus on principles of self-organization in a great number of different disciplines signals a "fundamental paradigm shift in the sciences—a scientific revolution" in the Kuhnian sense.[17] For Luhmann, one important question is whether, and to what extent, the conceptual innovations of twentieth-century science can be brought to bear in the realm of social theory.

In *Social Systems*, Luhmann presents a comprehensive answer to this question. In response to the "theory crisis" in sociology (p. xiv, below), he proposes a general theory that exploits the conceptual resources of modern science for a study of social phenomena. Across more than six hundred pages, Luhmann lays out a theoretical groundwork which subsequently provides a frame for a description of modern society as a complex system of communications that has differentiated itself horizontally into a network of interconnected social subsystems. Each of these systems reproduces itself recursively on the basis of its own, system-specific operations. Each of them observes itself and its environment, but whatever they observe is marked by their unique perspective, by the selectivity of the particular distinctions they use for their observations. There is no longer an Archimedian point from which this network could be contained in an all-embracing vision. And yet—and this is perhaps Luhmann's most controversial proposition—

the theory of social systems, like any "supertheory," insists on the universality of its claims. This is not to say that the theory claims an exclusive right to some ultimate, non-contingent truth, but that it must account for the self-implicative nature of its own observations: a general theory of social systems must deal with *everything* social, including itself as a contingent part of the reality it describes.

Contingencies

The originality of the book's theoretical design—Luhmann himself prefers to speak of a capacity to "control heterogeneities through concepts"[18]—is that of an outsider who ended up in sociology more or less by accident. Indeed, Luhmann's rather unusual professional career perfectly illustrates his conviction that biographies are little more than a "collection of coincidences" (*AW*, p. 134). Born in 1927 in Lüneburg, Germany, he obtained a law degree from the University of Freiburg/Breisgau in 1949, but soon became disillusioned with the repetitive routines of the legal profession. In 1955, he left the Lüneburg Administrative Court for a "more political" career in the Culture Ministry of Lower Saxony. Working on war reparation cases during the day, he spent his free time reading Descartes, Kant, Husserl, and the functionalist theories of Malinkowski and Radcliff-Brown. Yet the possibility of an academic career never crossed his mind—"regarding the university, I could only think of something small, something perpetually repeating itself" (*AW*, p. 131)—until his administrative duties began to interfere with his intellectual interests. In 1960 he obtained a year-long leave of absence to study with Talcott Parsons at Harvard. Upon his return, he resigned from his position as a senior government councillor to devote himself entirely to the pursuit of his theoretical interests. Sociology naturally suggested itself: "as a sociologist, one can do anything without being confined to a particular topic" (*AW*, p. 141). Between 1965 and 1968, Luhmann held various positions at the Academy for Administrative Sciences in Speyer, the Institute for Social Research in Dortmund, and the University of Münster. When the German Sociologist Helmut Schelsky invited him to join the newly founded Reform University of Bielefeld, however, a serious technical problem arose. Luhmann had already published several books, but he had no official degree in sociology and so

lacked the formal requirements necessary to teach as a professor at a German university. In 1966, two of his publications were retroactively accepted in lieu of these requirements,[19] and two years later, Luhmann followed Schelsky to the University of Bielefeld, where he held a chair in sociology until his retirement in 1993.

In the early seventies, Luhmann quickly gained publicity as a relentless critic of Jürgen Habermas, the main representative of the then-dominant Frankfurt School sociology. A joint publication, which appeared in 1971 under the title *Theory of Society or Social Technology: What Does Systems Research Accomplish?*[20] sold more than thirty-five thousand copies in just a few years.[21] As the title suggests, the Frankfurt-Bielefeld polarity was framed in political terms, as an opposition between the New Left and what it perceived as neo-conservative tendencies in the German "counter-Enlightenment." Insisting on continuing the Enlightenment project, Habermas accused Luhmann of a technocratic functionalism that undermined the very possibility of critique and an emancipatory politics. In response, Luhmann criticized Habermas's consensus-oriented discourse ethics as a hopelessly inadequate response to the complex issues that arise in highly differentiated postindustrial societies. In the politically charged climate of the seventies, however, Luhmann's disengaged intellectual style had little going for it. Yet despite, or perhaps even because of, continuing political attacks from the academic left, systems theory managed to establish itself on the German intellectual scene as a force that could not simply be dismissed as just another version of bourgeois ideology.

In the mid-eighties, the pendulum began to shift, and the German reception of Luhmann entered a distinct "second phase." Several factors account for what Luhmann describes as a generally more receptive attitude toward "solidly built theories" (*AW*, p. 125). With the appearance of *Soziale Systeme: Grundriß einer allegemeinen Theorie* (*Social Systems*) in 1984, a comprehensive outline of his theoretical position was available for the first time. Moreover, Luhmann's proposed "paradigm shift" in sociology signals a corresponding shift in his own work, marked by a break with the structural-functionalism of Talcott Parsons and by the adaption of theoretical models developed in the biology of cognition and second-order cybernetics. At the same time, the broad reception of post-structuralism and the subsequent theory boom of

the 1980's had created a heightened awareness of the paradoxical implications of linguistic self-reflexivity and an increasing demand for more complex theories. As Luhmann continued to elaborate his theory of social systems in the direction of a theory of modern society—following the publication of *Social Systems*, several major studies appeared in rapid succession, among them *Ecological Communication* (1986), *The Economy of Society* (1988), *The Social System of Science* (*Wissenschaft*) (1990), *The Sociology of Risk* (1991), and *Observations of Modernity* (1992)[22]—his work began to receive serious attention in academic circles in- and outside of sociology.[23]

In the meantime, the German reception of Luhmann has advanced well into what might be called its "third phase," characterized by a strong emphasis on epistemological concerns and an increasing interest in the theoretical background of his work. As the writings of von Foerster, Maturana, and Varela, as well as other previously untranslated works in the cybernetic literature, become available in German, Luhmann is finding himself drawn into a theoretical controversy concerning the epistemological and political implications of the "autopoietic turn" for the humanities at large. Fueled by the proliferation of titles on chaos theory, invented realities, and the biology of cognition in the repertoire of major German publishing houses, a new discourse—the "discourse of radical constructivism"—is rapidly transforming the German intellectual scene. It is difficult to convey to an American readership the sense of intellectual excitement generated in Germany by the broad reception of authors who in the United States are barely known outside their own highly specialized disciplines. It is even more difficult to characterize in a few words a discourse that is transdisciplinary by nature and far from homogeneous. The label "radical constructivism"—a coinage by the cognitive psychologist Ernst von Glaserfeld[24]—does not stand for a single doctrine or a unified theory, but refers to a growing body of literature that explores, from different angles and in a variety of contexts, a set of problems related to the idea of autopoietic closure.[25]

Luhmann remains skeptical of these developments, especially of popularized versions of constructivism that attempt to sell, under a new name, old forms of epistemological idealism or even solipsism. There is nothing more "annoying" to him than the instantaneous commodification of new ideas in terms of what has

been thought before (*AW*, p. 93). "Some exciting formulations are emerging fresh from the press—and already the matter is taken as established fact."[26] When the introduction of a new paradigm almost coincides with what appears to be its almost instant normalization,[27] misunderstandings and oversimplifications are unavoidable. As play with "tangled hierarchies"[28] becomes the game of choice among German academic intellectuals, conceptual precision often yields to the evocative force of metaphors that promise a new language for familiar theoretical agendas. The potentially subversive connotations of information-theoretical concepts—complexity, chaos, entropy, and noise—are beginning to captivate the postmodern imagination, provoking an already ambiguous fascination with techno-science that combines with post-structuralist motives and political-aesthetic impulses to form an explosive mixture.[29] To counteract "applause from the wrong quarters," Luhmann continues to cultivate the ironic attitude of the dispassionate observer who "provoke[s] rejection" as an antidote to an all too facile consensus—sometimes to underscore a point, sometimes "for no reason at all, out of a sheer delight in provocation, or delight in nonsense, or whatever" (*AW*, p. 93).

Complexities

Social Systems, as Luhmann readily admits, is a difficult book, ambitious in its scope and relentless in its abstraction. It cuts across the great divide between the "two cultures" and moves freely between (or above?) disciplines as it traverses their histories, quarrying those histories for conceptual tools or ideas and appropriating whatever is needed to solve a particular problem. The book's circular design invokes comparison to Hegel's system, though Luhmann begins and ends with difference rather than with unity or a grand synthesis. In a manner reminiscent of Husserl's phenomenological reduction, Luhmann invites us to bracket out all our habitual intuitions, yet offers little guidance to those unfamiliar with the enormous theoretical background of the book. Reading *Social Systems* for the first time can be quite an irritating experience unless the reader has enough "patience, imagination, intelligence, and curiosity" (pp. li–liii, below) to adopt the "experimental attitude" (*AW*, p. 128) of its author and look at the world from the denaturalized perspective of its improbability.

To avoid false expectations, it is important to begin with a clear understanding of the book's objectives. *Social Systems* does not present a sociological analysis of modern society or a theory of society (*Gesellschaftstheorie*) but elaborates the general conceptual framework for such a theory. It supplies the instruments for observing a variety of social systems—societies, organizations, and interactions—not primarily such observations themselves. The distinction is far from trivial. In positing a difference between "what" questions and "how" questions, the theory of social systems situates itself within the "de-ontologized" realm of "second-order observations," a level of abstraction where, to speak in Kantian terms, questions concerning conditions of possibility arise.[30] But unlike Kant—and here Luhmann parts company with transcendentalism and all forms of foundational philosophy—systems theory turns away from the knowing subject to a reality that consists solely of self-referential systems and their "empirically" observable operations. (It goes without saying that the self-referential operations of theory are part and parcel of that reality.) The observations of systems theory are both situated and interested observations. They focus on a specific *problem*—the problem of social complexity—from within one of society's particular subsystems, science (*Wissenschaft*).[31] The Kantian question of how a subject can have objective knowledge of reality thus gives way to the question: How is organized complexity possible?

Luhmann defines complexity in terms of a threshold that marks the difference between two types of systems: those in which each element can be related to every other element and those in which this is no longer the case. In information-theoretical terms, complexity designates a lack of information that prevents a system from completely observing itself or its environment. Complexity enforces selectivity, which in turn leads to a reduction of complexity via the formation of systems that are less complex than their environment. This reduction of complexity—Luhmann speaks of a complexity differential (*Komplexitätsgefälle*) between system and environment—is essential. Without it, there would be nothing, no world consisting of discrete entities, but only undifferentiated chaos. The need of systems to maintain an asymmetrical, "simplifying" relationship to their environment can perhaps best be illustrated in the psychic system. A psyche that becomes too complex runs the risk of turning "pathological" in the sense that it

will be unable to make decisions, perform simple tasks, or function in society. What we call "madness" is nothing more than the hyper-complexity of psychic systems that can no longer distinguish themselves from their environment.

While the ability to reduce complexity functions as a kind of protective mechanism, it also permits the system to build up internal complexity and thereby to transform unorganized into organized complexity. To the extent that complexity enforces selectivity, it implies contingency—every selection is one of several possibilities—and therefore risk. The wrong choice can threaten the system's integrity to the point of extinction. This link between enforced selectivity, contingency, and risk points to the other side of the initial problem: focus on the emergence of organized complexity, being itself a selection, includes the possibility that system formation may fail to take place. In fact, information-theoretical research suggests that the latter possibility is statistically infinitely more probable than the former.[32] An adequate understanding of organized complexity must therefore include an awareness of its improbability; hence Luhmann's "methodological recipe" for cutting through the appearance of normality and searching for "theories that can succeed in explaining the normal as improbable" (p. 114, below).

The challenge, then, for a theory of social complexity lies in the paradoxical multi-dimensionality of a state of affairs that defies definition: strictly speaking, complexity cannot be observed. Any attempt to do so is already engaged in the process of reduction, of transforming unorganized into organized complexity. A theory of complex systems, in other words, cannot help but perform the very operations it describes, and everything it states about these operations refers "autologically" back to itself. In order to cope with this problem, theory must perform its reductions in a strategic manner, that is, with an eye toward a potential increase in theoretical complexity. *Social Systems* begins with what appears to be a simple ontological claim: "there are systems" (p. 12, below). (In sharp contrast to Parsons and some radical constructivists, Luhmann insists on the "empirical," i.e., more than analytical, status of systemic boundaries.)[33] However, this seemingly naive statement implies a powerful methodological reduction: the distinction between system and environment, which serves as the theory's

"guiding difference" (*Leitdifferenz*). With the introduction of further concepts (time, meaning, communication, etc.) and distinctions (element/relation, self-reference/external reference, structure/process, closure/openness, unity/difference, etc.), the initial distinction is elaborated to the point where it re-enters what it distinguishes,[34] and the theory is forced to encounter itself as one of its own objects. Systems theory, in other words, *simulates* complexity in order to *explain* complexity, and it does so by creating a flexible network of selectively interrelated concepts that can be recombined in many different ways and thus be used to describe the most diverse social phenomena.

It goes without saying that once social theory has passed the "threshold of complexity," it defies the linearity of the printed medium. Since there is no first principle or "natural" starting point for such a theory, any particular arrangement in chapters rests on a contingent choice, and it is possible to rewrite the theory in many different ways. Luhmann explicitly invites the reader to experiment with his theory and presents it in such a way as to facilitate recombination by constructing his text in small, relatively discrete units, which progressively open up and explore, with further and further amplification, a given question. Thus it is possible, for example, to start with the concluding chapter on epistemology and work back to the beginning, a strategy Luhmann adopts in many of his more recent publications. In fact, as he suggests elsewhere, a reverse presentation of his theory might have reduced the level of misunderstanding by facilitating an apprehension of its "autological" design.[35] One could also approach *Social Systems* by way of Luhmann's analysis of communication in the fourth chapter, or begin with Chapter 7, "The Individuality of Psychic Systems."

No matter what approach one takes, however, there is no shortcut through a book that "resembles a labyrinth more than a freeway off into the sunset" (p. lii, below), and a foreword must resist the temptation of providing what Luhmann expressly denies his reader. The most it can do is facilitate the reader's orientation in this labyrinth by tracing some of the multiple trajectories that link Luhmann's theory of social systems to a variety of intellectual traditions. Most readily apparent is perhaps the functionalist tradition in sociology from Emile Durkheim to Talcott Parsons, which sought to explain "social facts," regardless of the intentions of

individual actors, by reference to the role they play as variables within an interrelated whole. But there are also considerable ties to the philosophy of consciousness (Kant, Hegel) and phenomenology (Husserl), not to speak of numerous affinities with post-structuralist thought. But at the same time, the theory of social systems breaks with these traditions by recasting their insights within a conceptual framework borrowed from recent scientific theories of self-organization. The adaptation of these theories to the social realm represents Luhmann's unique achievement and a methodological decision with far-reaching consequences. In circumscribing the point of view from which systems theory apprehends social reality, the notion of "self-organization" (or "autopoiesis") fulfills an autocatalytic function within the theory itself: it simultaneously accounts for the theory's internal design as a self-limiting context (pp. xlvii–xlviii, below) and for its ability to synthesize the most diverse intellectual traditions in unexpected ways.

The Autopoietic Turn in Social Theory

Following Humberto Maturana, Luhmann uses the concept of "autopoiesis" to characterize the recursive operations of self-referential systems. According to Maturana, such systems constitute "networks of productions of components that recursively, through their interactions, generate and realize the network that produces them and constitute, in the space in which they exist, the boundaries of the network as components that participate in the realization of the network."[36] What distinguishes autopoietic systems from machines and the closed systems of classical equilibrium thermodynamics is the recursivity of their operations: they "not only produce and change their own *structures*" but "everything that is used as a unit by the system is produced as a unit by the system itself" (*Au*, p. 3). Since autopoietic systems are incapable of operating beyond their own boundaries, they are "blind" with regard to their environment. At the same time, however—and this may at first sound paradoxical—they cannot "create a material world of their own." "Operational closure," in other words, requires the exteriority of "other levels of reality" (*Au*, p. 3); it cannot happen except under the ecological conditions of an environment that serves as the necessary correlate of the system's self-referential

operations. Once closure (on the level of the system's recursive operations) is redefined as a condition of structural openness, and vice versa, "(subsequently the classical) distinction between 'closed' and 'open' systems is replaced by the question of how self-referential closure can create openness" (p. 9, below), and the task becomes to formulate the limiting conditions under which the process of system formation takes place.

Although systems research is a relatively recent phenomenon—its disciplinary status is still debated among scientists—it does not "operate in a theoretical vacuum."[37] As Wolfgang Krohn et al. point out, the basic idea of self-organization is as old as philosophy, with roots reaching back well into antiquity. Speculations concerning the purposive finality of nature played an essential part in the metaphysical system of Aristotle, the *Monadology* of G. W. Leibniz, and Kant's *Critique of Judgment*. With the rise of bourgeois individualism toward the end of the eighteenth century, political theory, economics, and ethics began to explore the functional relationships between a given whole and its parts, and by the end of the nineteenth century, the problem of the emergence of organized structures was causing considerable "ideological turbulence." Despite nineteenth-century advances in experimental physiology and the theory of evolution, however, the problem of order remained shrouded in a veil of mystery, explicable only by way of a speculative appeal to teleological principles or occult forces.

General systems theory is the result of two subsequent paradigm shifts, which moved the problem of order from the fringes of metaphysical speculation to the center of scientific research. In the first of these shifts, initiated by the German biophysiologist Ludwig von Bertalanffy in the mid-1950's, the metaphysical distinction between part and whole was replaced by the distinction between system and environment. In consequence, the results of biophysiological research could be systematically related to developments in cybernetics (Norbert Wiener), information theory (Claude Shannon), and computer design (Alan Turing, J. von Neumann). In a second shift, the system/environment distinction was redefined within a general theory of self-referential systems. With insight into the recursive closure of systems that use their own output as input, cybernetics was forced to abandon the classical input/output model, together with its emphasis on mastery and control. In 1960,

Heinz von Foerster introduced the "order from noise" principle as the defining characteristic of self-organizing systems.[38] A driving force in innovative systems research, von Foerster created a unique institutional context for interdisciplinary exchange at the Biological Computer Laboratory in Urbana, where physicists, cyberneticians, logicians, and biologists compared the results of their research in view of possible analogies and worked toward a conceptual generalization of their findings. Today, general systems research continues to focus on globalizing its concepts and exploring the epistemological implications of what is beginning to establish itself as a genuinely transdisciplinary paradigm. If the "order from noise" principle can be confirmed in the behavior of subatomic particles, cells, weather patterns, insect colonies, and the stock market, then theoretical models of sufficient generality are needed to account for such similarities, while these models must at the same time be flexible and specific enough not to blur the differences between such diverse phenomena.

For several decades, Luhmann has been working at the frontier of these developments, and it is no exaggeration to say that *Social Systems* accomplishes in the social realm what Maturana and Varela have done for cognitive biology and Prigogine's work on non-equilibrium thermodynamics for physics. Contrary to initial expectations, however, the adaptation of the concept of autopoiesis to realms other than biology encountered considerable obstacles. If social theory wants to employ this concept in more than a loosely metaphorical sense, it must be prepared to deal with longstanding prejudices concerning the transfer of scientific models into the humanities, for example, the belief that there is a categorical distinction between human and non-human nature. Although cybernetic models were commonly used in the social sciences throughout the 1940's and 1950's, their adequacy remained in dispute,[39] and the emphasis on systems maintenance and social engineering often met with political and ethical suspicion. Such an emphasis was quite obvious, for example, in Parsons's attempt to deduce from invariant systemic structures the functions necessary to maintain these structures.[40] With the autopoietic turn in general systems theory, the problem of adequacy gained an unexpected new twist. On the one hand, the problem of systems maintenance was replaced by the question of how systemic structures can be described

as emergent orders. Consequently, Luhmann rejected Parsons's four-function schema, together with the classical input-output model on which it was based. On the other hand, the concept of autopoiesis seemed prima facie inapplicable at the social level, at least in the form in which it was originally developed by Maturana and Varela to characterize living systems (cells and complex organisms). If one accepts the proposition that the basic components of social systems consist in living systems (i.e., people), it is unclear how such systems can fulfill the fundamental condition of autopoiesis, namely, recursive self-(re)production. While social systems may be described in terms of functionally interrelated components, they do not, as Maturana points out, literally *produce* "the network of production of [their] components."[41]

In a brilliant move, Luhmann resolves this apparent dilemma by reconceptualizing the social in such a way that it does meet the condition of autopoietic closure. All we have to do, he proposes, is to give up the Aristotelian premise that social systems are living systems, and think of them instead as systems whose basic elements consist of *communications*, vanishing events in time that, in producing the networks that produce them, constitute emergent orders of temporalized complexity. Temporalization is, of course, not an exclusive characteristic of social systems. It can be observed in the reproduction of cells, simple organisms, brains, and psychic systems. But the features that distinguish these different types of autopoietic systems come into focus only when the concept of autopoiesis is abstracted from its biological connotations. The reproduction of cells is based on chemical processes, the brain works with neurophysiological impulses. By contrast, systems that operate on the basis of consciousness (psychic systems) or communication (social systems) require meaning (*Sinn*) for their reproduction. The concept of meaning plays a key role in Luhmann's theory of social systems. It is used, not in opposition to "meaninglessness" (*Sinnlosigkeit*), as in the hermeneutic tradition, but in its phenomenological sense: following Husserl, Luhmann defines meaning as the "horizon" of possibilities that is virtually present in every one of its actualizations. As the difference between the possible and the actual, meaning itself is a category "without difference" (*differenzlos*), which designates the medium through which social systems process world-complexity. Of course, the point of reference

for Luhmann is no longer the transcendental subject but the empirical operations of self-referential systems.

The conceptualization of the social in terms of a meaning-processing system of communication necessitates a revision of fundamental sociological and philosophical positions concerning, for example, the nature of social action, the role of language, the status of the subject, and the possibility of knowledge. In fact, much of the often-noted counter-intuitive quality of Luhmann's formulations can be credited to his striking combination of phenomenological and functional analysis. Yet precisely his attempt to bring together these two traditions opens up a space where traditional disciplinary configurations can be renegotiated in ways that may indeed lead the humanities beyond hermeneutics into the information age.[42]

The Autopoiesis of Communication

In the opening scene of *Danton's Death*, the nineteenth-century German playwright Georg Büchner dramatizes what is easily recognized as the primal scene of hermeneutic despair. In response to his lover's attempt to reassure herself of the bond of understanding between them, the protagonist makes a silent gesture toward her forehead and then replies: "—there, there, what lies behind this? Go on, we have crude senses. To understand one another? We would have to break open each other's skulls and pull the thoughts out of the fibers of our brains."[43] The encounter radicalizes the longstanding hermeneutic suspicion, thematized well before the beginnings of Romanticism, that "the individual is ineffable" (J. W. Goethe), that subjectivity remains inaccessible, not only to the social sphere of language and communication, but even to its own introspective desire: "We go around with a vivid but confused idea of ourselves as if in a dream of which we occasionally recall one piece or another, cut off, incomplete, without connection."[44]

The history of hermeneutics is a history of failed attempts to mute such doubts with ever more elaborate theoretical constructs. First, hermeneutics devised a set of procedures to recover a transparent interiority behind the corrupted surface of the written word (Schleiermacher, Dilthey). Then, it declared its universality by pointing to the primordiality of language as the ultimate horizon

of experience (Heidegger, Gadamer). And finally, to defend its ground against mounting attacks from genealogy (Nietzsche, Foucault), psychoanalysis (Freud), and deconstruction (Derrida), it retreated to the dubious position of a "communicative a priori" (Habermas, Apel), which, while being only counterfactually ascertainable, cannot be denied without performative self-contradiction. Post-structuralist interventions into the hermeneutic space have been frustrated by this difficulty: the critique of the idealizing assumptions of the hermeneutic tradition can always be shown to affirm, at least in a minimal sense, the practical validity of precisely that which it calls into question.[45]

Systems theory solves the problem of understanding by turning it on its head and, in doing so, displaces the entire hermeneutic tradition, together with its perpetual self-doubt. Instead of pondering the question of how understanding can take place *despite* the fact that the participating consciousnesses remain opaque to one another, Luhmann posits social and conscious systems as distinct, and then shows how autopoietic closure generates openness, or, to phrase the issue in evolutionary terms, how consciousness emerges together with and encourages the formation of social systems. For Luhmann, the intransparency of consciousness from the viewpoint of the social is no longer an obstacle to be removed but the very condition that makes communication possible.

What is at stake in the reformulation of the social in terms of communication is nothing less than the axiology of a philosophy of consciousness that has determined modernity's self-descriptions since the end of the eighteenth century. In a move that closely parallels the deconstructive decentering of Occidental metaphysics, Luhmann challenges this tradition at the level of its most fundamental presuppositions: (1) the principle of a unified, autonomous subject, (2) the idea of the social as a derivative sphere of intersubjectivity, (3) the corollary of communication as an interaction between subjects, (4) the notion of communication as a transmission of mental contents between separate consciousnesses, and (5) the corresponding idea of language as a representation of such contents.

The point of departure for Luhmann, as for Derrida, is the phenomenological tradition, and both search from within this tradition for tools to overturn it. But whereas Derrida attempts to

push Husserl's theory of language in the direction of a general theory of writing, Luhmann employs a systems-theoretical framework to rethink an analysis of consciousness that comes close to formulating the principle of autopoietic closure but refuses to draw the consequences of its own theoretical insights. For Husserl, the external world of material objects presents itself to consciousness in the form of a spatio-temporal field of unactualized perceptions that surround it like a "halo of *background intuitions*."[46] The flux of actual experience is constituted in a series of "intentional acts" that seize upon particular objects within this field. As a specific aspect of a given object is actualized, others recede to the periphery of the perceptual field, where they reside as a latent, yet constitutive part of its differential structure: "the *stream of mental processes can never consist of just actionalities* [*Aktualitäten*]",[47] which is to say, it exists as meaningful experience only in the form of the distinction between actuality and potentiality. It is easy to see how the phenomenological analysis of consciousness can be reconfigured in the language of information theory and second-order cybernetics. Meaning is an effect of the production of information via the creation of differences that, in Gregory Bateson's words, "make a difference."[48] No longer grounded in an external reality—as a representation or mirroring of that reality—meaning resides in the self-referential structure of a consciousness that consists solely in and through its autopoietic operations and that, in selecting from a self-generated horizon of surplus references, reproduces that horizon without ever exhausting its possibilities or transgressing its boundaries.

While borrowing from phenomenology in his analysis of the self-referential structure of meaning, Luhmann rejects its subject-centered frame of reference as incapable of accounting for the dimension of the social. For as long as communication is understood in terms of, and grounded in, the operations of a solitary consciousness, the "problem of 'intersubjectivity' thereby becomes insoluble" (p. 146, below), no matter whether one conceives of this consciousness as an empirical entity or a transcendental principle. Husserl can "solve" this dilemma only by way of a "transcendental theoretical enhancing of the psychic system" (ibid.), which obscures his best insights. Luhmann is fond of exploding the fiction of the transcendental subject by asking: "Which one of the five billion?"[49] The point is that from a systems-theoretical standpoint

there is no longer a privileged subject of cognition, nor can the principle of self-referential closure be attributed exclusively to consciousness. There are systems, and the directive is: observe the observer.

If Luhmann's critique of Husserl concurs with the Derridean objection that language cannot be grounded in the intuitive self-presence of a monadic subject,[50] his concern is not with the differential *structure* of language, but with the *function* of language within the self-reproductive economy of social communication systems. Since social systems cannot be derived from a subject, psychic and social systems must be considered as two separate autopoietic systems, each of which draws its boundaries on the basis of its own systemic operations and conditions of connectivity (*Anschlußfähigkeit*) and, in so doing, demarcates what constitutes the environment for that system. Luhmann defines communication as a synthesis of three selections: information (a selection from a repertoire of referential possibilities), utterance (a selection from a repertoire of intentional acts), and understanding (the observation of the distinction between utterance and information). The first two of these selections roughly correspond to what Husserl called "expression" (*Ausdruck*) and "indication" (*Anzeichen*),[51] with the qualification that for Luhmann the distinction between information and utterance is entirely immanent with regard to the autopoiesis of a system that employs this particular schema to process complexity in the form of meaning.

Communication can "observe" consciousness, but only from the outside, and from within the boundaries established by its specific selectivity. Likewise, consciousness can do its own thing while communication is going on. Both systems run simultaneously without interfering with each other or intersecting at the level of their respective autopoiesis, which is not to say that they operate completely independently of one another. On the contrary, once the levels of conscious and social autopoiesis are clearly separated, their relationship can be analyzed in terms of what Luhmann, following Parsons, calls "interpenetration," a concept which characterizes the interdependencies between systems that emerge together as the result of a complex co-evolution. No social system could exist without the environment of conscious systems, and a consciousness deprived of society would be incapable of develop-

ing beyond the most rudimentary level of perception. In the meantime, Luhmann has dropped the Parsonsonian term, mainly because of its spatial connotations, and speaks instead, with Maturana, of a "structural coupling" between systems that rely on each other's complexity to build up internal complexity. Consciousness can fascinate communication—by supplying its own complexity as a source of irritation or productive disorder—and can in turn be fascinated by it, but it can "participate" in communication only to the extent that it engages in the operations that delimit the autopoiesis of social systems as systems of communication.[52]

What distinguishes the systems-theoretical approach to communication from semiological, hermeneutic, and action-theoretical accounts is a probabilistic framework that subordinates structure to function and allows the former to be seen as an emergent order that is dynamic and constantly changing. With his explicit subordination of structure to function, which cannot be emphasized enough, Luhmann breaks not only with the conservatism of Parsons's "structural functionalism," but with all versions of linguistic structuralism as well. In accordance with the "order from noise principle," systems theory starts from the assumption that communication is contingent—that is, neither impossible nor necessary—and subsequently seeks to identify the conditions under which the improbable becomes probable. Luhmann locates the major obstacle to the formation of social order in what Parsons described in action-theoretical terms as the problem of "double contingency," a state of potential paralysis that results from a situation in which two black boxes make their own behavior contingent upon the behavior of the other. Luhmann agrees with Parsons that action is impossible unless the problem of double contingency is solved—the "pure circle of self-referential determination, lacking any further elaboration, leaves action indeterminate, makes it indeterminable" (p. 103, below)—but rejects the idea that this problem can be taken care of once and for all, for example, as Parsons believed, with reference to a prior social consensus concerning cultural norms and rules of conduct. In Luhmann's view, it is precisely the paradoxical indeterminacy of pure self-reference that makes any such consensus susceptible to fluctuations and the unpredictability of random events. In provoking "undecidable decisions," the problem of double contingency fulfills a catalytic func-

tion in the emergence of a constantly changing social order whose instability is the only source of its stability.

If communication is to solve the problem of double contingency, the tripartite selection of information, utterance, and understanding must be synthesized in an event that is capable of producing connections within the system. Only if the behavior of a given system is *observed* by another system in terms of the distinction between utterance and information does this behavior become relevant for the autopoiesis of communication in the sense that it yields further communications. Written texts that are not read, for example, are as lost for communication as a message accidentally erased from an answering machine. At the same time, understanding, while being an essential component of communication, is not its telos, as is the case in the hermeneutic concept of communication. Like any other autopoietic system, communication is autotelic, which is to say, it is primarily concerned with its own self-reproduction. Understanding, therefore, neither requires an accurate reconstruction of the "true" intention behind alter's behavior nor excludes the possibility of misunderstanding. A husband who responds to his wife's request for a late-night herring snack by wondering whether she is pregnant may find out in the course of subsequent communication that he missed the point.[53] From the perspective of the social system, however, the identity or nonidentity of the information, apart from being unverifiable, becomes irrelevant once we stop thinking of communication in terms of a transmission of a message from a sender to a receiver. What matters is solely the fact that the third selection—which never simply reiterates or repeats the first but creates a difference/deferral in the Derridean sense of *différance*—provokes a response and thus permits the continuation of the system's autopoiesis.

It follows from these considerations that communication is insufficiently understood in action-theoretical terms, for example, as consensus-oriented "communicative action" in the Habermasian sense. First of all, consensus can never be more than merely local and temporal because communication requires dissent in order to continue its operations. If universal consensus could ever be reached, it would terminate the system's autopoiesis—nothing more would be left to say. Second, the concept of action, central to the sociological tradition from Weber to Parsons, cannot ground a

social theory because it is an *effect* rather than a precondition of the social. The distinction between actions (purposive behavior of human subjects) and events (random behavior of objects) becomes relevant only at the level where the autopoiesis of communication requires self-observation, and the system faces the problem that communication—which in itself consists of nothing but a series of "subjectless" selections (p. 32, below)—cannot be observed as such. In order to observe itself, communication must simplify its operations with the help of conventions that protect the system, as it were, from its own complexity. From a functionalist perspective, then, the notion that "people communicate" is a mere convention, reflected in the subject-predicate structure of a language that, by attributing events to agents in the form of actions, enforces the habitual perception that the world consists of "things" and their characteristics. And yet, no matter how "misleading" this convention may be, it is indispensable, even if it is observed in its function as a necessary self-simplification of communication (pp. 84–85, below). To the extent that the systems-theoretical analysis of communication executes the very operations it observes, it too requires protection from its own latencies (*Latenzschutz*) even as it thematizes these latencies.

Toward a Posthumanist Conception of the Social

The insight into the conventional character of the subject position is, of course, nothing new. It figures as prominently in Nietzsche's critique of the Cartesian *cogito* as in Foucault's analysis of the "author function" as a conventional relationship of attribution that regulates the distribution of texts in the age of print culture.[54] There is a clear awareness, in both, of what Derrida describes as the "contradictory coherence" of a self-referential critique that cannot escape the conventions it criticizes.[55]

It is instructive to place Luhmann's social theory within a broader context in order to bring its "methodological anti-humanism" (Habermas) into sharper focus. The point where Luhmann parts with the subject-critical tradition of post-Enlightenment thought is the question of language. Genealogy and its contemporary post-structuralist variants perform the shift from a subject-centered to a linguistic frame of reference commonly associated

with the "linguistic turn" and radicalize the subject-critical implications of this turn to the point where they run up against the limits of a language that reinstates the God-Subject through the very act that proclaims its death. Nietzsche knew that we cannot get rid of God as long as we still believe in Grammar,[56] and that he had no choice *not* to believe in it, even as he traced the subject to a seductive convention "which conceives and misconceives all effects as conditioned by something that causes effects."[57] And once the "disappearance of man" was programmatically linked to a "return of language" as pure auto-referentiality,[58] the project of thinking "an end of man" that, in the words of Derrida, "would not be a teleology in the first person plural"[59] became inseparable from the task of moving, as it were, "beyond" language, toward an unnameable exteriority or a postmetaphysical concept of writing that would no longer be determined by the classical concepts of meaning as presence, representation, or truth.

Ironically, the pan-textualist assumptions underlying contemporary critical thought turned out to be one of the toughest obstacles to the formulation of a consistently posthumanist position. On the one hand, the framing of the deconstructive project as a critique of language favored a predominantly negative semantics to which traditional aesthetic, political, and utopian impulses could attach themselves in ways that permitted a re-normalization of deconstruction in terms of the humanist discourses it sought to displace. On the other hand, the linguistic turn and its subsequent problematization never seriously challenged the disciplinary boundaries between the sciences and the humanities. If Lyotard's assessment in *The Postmodern Condition* is correct and modern science has become self-legitimizing to the point where it no longer requires a grounding metadiscourse,[60] it is hard to see what, at least from the viewpoint of the sciences, should turn on the question of whether or not such a discourse is possible. At the same time, the exploration of potential convergences between the "two cultures" remains blocked as long as difference is modeled upon linguistic difference, and linguistic self-referentiality is considered the paradigm for self-referentiality in general.

Precisely such convergences constitute the vanishing point toward which the systems-theoretical ambition is headed. They come into view when the question of language is reinscribed within

the more general problematic of emergent order. Once the distinction between signifier/signified or language/world is replaced by the distinction between system and environment, the operations of language can be observed as events that produce and reproduce systems of communication, and the operational closure of such systems can be described as one specific instance of systemic self-referentiality among others.

The affinities between the theory of autopoietic systems and deconstruction are suggestive nonetheless—both move, in a sense, "beyond" language, albeit in reverse directions. Where Derrida problematizes language in order to formulate the infrastructural conditions of impossibility that prevent its formalization, Luhmann relativizes, one could almost say trivializes, language by rethinking it in information-theoretical terms: linguistically coded information constitutes one particular type of information, specific to systems that process complexity in the form of meaning, that is, conscious and social systems. For Luhmann, language itself is not a system. Neither consciousness nor communication are entirely dependent on it—we recall that consciousness can observe without language, just as social interaction can take place on a preverbal level. Instead of a unified notion of language-as-system, Luhmann proposes a number of operational concepts that designate functionally specific aspects of language: *meaning* (the unity of the difference between actuality and potentiality) and *communication* (the synthesis of information, utterance, and understanding) on the one hand, and, on the other, a notion of language as *medium*. Signs, whether verbal or nonverbal, facilitate the formation of social systems by regulating the difference between information and utterance via a process of "symbolic generalization." As a medium they serve as an interface between conscious systems and social systems and permit their structural coupling by encoding the difference between information and utterance in ways that stabilize the coordination between the two and in so doing increase their internal complexity.

Strictly speaking, there is of course no "beyond," and the proposal to move from a linguistic to a systems-theoretical paradigm should not be construed as an attempt to escape the problem of linguistic self-referentiality. The observation of communication as one type of system among others must discriminate between ob-

servation and language—that is, between the selection that produces information and its linguistic encoding—a distinction that turns paradoxical the moment it is applied to itself and re-enters what it distinguishes. The distinction between observation and language is, after all, a linguistic distinction in the sense that it must be made by someone and coded in language if it is to become part of the social system of communication. Communication is always the reference point, and communication uses language. In the words of Maturana and Varela: "Every reflection, including one on the [biological] foundation of human knowledge, invariably takes place in language, which is our distinctive way of being human and being humanly active. For this reason, language is also our starting point, our cognitive instrument, and our sticking point."[61] The Derridean paradox that "there is nothing outside the text," is not dissolved by systems theory but reemerges at the level of communication, where it can be reconceptualized in terms of the operational closure of a system that cannot operate beyond its own boundaries. In order to observe society and to discriminate it from other types of systems, a boundary must be drawn from within society across which it can observe itself *as if* from the outside, but the construction of this outside is, and always remains, an operation of the system. "Whoever observes participates in this system—or he does not observe. There are no exempt positions."[62] The question of what systems theory can accomplish in the realm of social theory thus ultimately hinges on the question of how it handles its own self-reference.

Constructivist Perspectives: Toward a Non-Foundational Epistemology

Luhmann's theory of social systems does not pursue the epistemological implications of its own circularity until the final chapter on "Consequences for Epistemology." Is it accidental that *Social Systems* should *end* with a chapter on epistemology? The answer to this question is both yes and no. On the one hand, the problem of the theory's own self-reference can be thematized at any time, and given the theory's autological design, any linear arrangement is, as Luhmann points out, to some degree arbitrary. On the other hand, self-reference becomes a problem for theory only when it has

become complex enough so that the distinction between system and environment can re-enter the system and is problematized in terms of a distinction between knowledge (*Erkenntnis*) and its object (*Gegenstand*). In Luhmann's theory of social systems, this distinction remains at first unused; the theory begins with the description of a reality that is gradually revealed as a constructed reality. In bracketing epistemological considerations until the theory encounters itself among its objects—again phenomenology serves as the model—Luhmann underscores the point that the theory of self-referential systems is no longer grounded in a theory of knowledge. Rather than supplying foundations in the tradition of the grand legitimizing metanarratives, it seeks to explain the cognitive operations of theory within an evolutionary framework.

An epistemology that has been "naturalized" in this way can be called "constructivist"—despite Luhmann's reservations about the term—in the sense that it recognizes all knowledge as contingent, including its own. Whatever is observed is observed by an observer, who cuts up reality in a certain way in order to make it observable. Whatever distinction is selected, others remain possible. Each cut highlights certain aspects of reality and obscures others. Reality as such, the unity of the observing system and its environment, the paradoxical sameness of difference, of inside and outside, remains inaccessible; it is what "one does not perceive when one perceives it," the "blind spot" that enables the system to observe but escapes observation.[63] An outside observer can make this blind spot visible by distinguishing the observed system's distinction as a form that contains both of its sides, but in doing so, any such second-order observation must rely on its own blind spot and is bound to reproduce the paradox of observation at the operational level of its own distinction. Difference is both irreducible and paradoxical: without distinctions there would be no observable reality, yet reality itself knows no distinctions.

Despite the highly abstract and formal nature of a theory of knowledge that draws on the second order-cybernetics of von Foerster and the mathematical calculus of Spencer Brown, Luhmann insists on its *post*-transcendental status, which is to say that the epistemological question of how knowledge of an external world is possible under the conditions of autopoietic closure is inseparable from the specific socio-historical conditions under which

it arises. Historically, the theory of science is a "belated product of science-in-operation" (p. 478, below), a subsystem within the social system of science created for the purpose of the self-observation of science. It established itself at a moment when in the course of modernization the relationship between knowledge and reality became problematic. A post-transcendental epistemology, in other words, presupposes and is inseparable from a theory of modernity that includes a systematic reflection upon its own place within modern society. The final chapter of *Social Systems* marks the "connecting point" (*Anschlußstelle*) for such a reflection, and thus the beginning of another book, a "book within the book," which, in the meantime, has appeared under the title *Die Wissenschaft der Gesellschaft* (*The Social System of Science*, 1990).

The key to understanding Luhmann's conception of modernity is the idea of systems differentiation, which links the theory of self-referential systems to a theory of evolution. Like any other autopoietic system, social systems evolve through time thanks to their capacity to transform unorganized into organized complexity. In order to cope with a hypercomplex environment, they must increase their internal complexity, and they do so by replicating the difference between system and environment within the system. Within this general evolutionary framework, Luhmann can distinguish different types of social organization on the basis of their primary form of differentiation. This allows him to conceptualize the process of modernization in terms of a transition from a primarily "stratified" to a "functionally differentiated" society. In the course of this structural transformation, which was essentially completed by the end of the eighteenth century, the hierarchically ordered, "monocontextural" universe of premodern society broke apart, and the reproduction of society was distributed among a plurality of non-redundant function systems such as the economy, art, science, law, and politics, each of which operates on the basis of its own, system-specific code. "Functional differentiation" means, among other things, that no function system can control, dominate, or substitute for any other. In a modern, "polycontextural" society, science has lost its authority as the sole purveyor of truth, and theory cannot prescribe norms or recommend courses of action any more than politics can dictate the direction of scientific research, at least not without subjecting itself to contestation. "The

theorist of cognition himself becomes a rat in the labyrinth and must consider from which position he observes the other rats."[64]

Luhmann's diagnosis of modernity resonates in a number of striking ways with the familiar configuration of problems currently debated under the general heading of "postmodernism." And in view of such resonances, one may ask: What is gained by theorizing as *modern* a state of affairs that seems almost indistinguishable from a condition which today is quite often described as *postmodern*? What is the advantage of recasting such familiar insights as the crisis of representation, the impossibility of totalization, or the loss of legitimation within a general theory of social systems? What does such a theory have to offer beyond the recommendation to resign ourselves to the inevitable and to embrace, for better or worse, the current philosophy of "anything goes"?

There is no straightforward answer to this question. Whether one focuses on continuities or discontinuities may in the final analysis amount to little more than a difference in emphasis or a matter of terminological preferences. Perhaps the question itself may not be very useful to begin with. If there is a significant difference between Luhmann's diagnosis of modernity and the contemporary discourse on postmodernism, it would have to be sought, it seems to me, in the theoretical rigor with which Luhmann thinks through and embraces the consequences of modernization—*not* because the society in which we live is the best of all possible worlds, but because an acceptance without nostalgia of the structural limitations of modernity is a precondition, and possibly the only way, of finding creative solutions to its problems.

Instead of a Preface to the English Edition: On the Concepts "Subject" and "Action"

This is not an easy book. It does not accommodate those who prefer a quick and easy read, yet do not want to die without a taste of systems theory. This holds for the German text, too. If one seriously undertakes to work out a comprehensive theory of the social and strives for sufficient conceptual precision, abstraction and complexity in the conceptual architecture are unavoidable. Among the classical authors, Parsons included, one finds a regrettable carelessness in conceptual questions—as if ordinary language were all that is needed to create ideas or even texts. But the problem proves to be a Hydra. Every explanation generates the need for further explanation, and at some point one must extricate oneself by means of a joke or some particularly elegant formulation. Fans of method will be put off by such admissions. But even the fans of method, faced with self-referential situations, cannot avoid creating a genuine appearance of truth.

Even when a theoretical edifice is offered under the brand name "systems theory," this does not mean that it is developed exclusively from the concept of "system." Many further conceptual determinations, which could have turned out differently, enter in, but must at least be compatible with the concept of system and with each other. Theory takes shape to the degree that combinatory leeway is narrowed down and loose coupling is transformed into tight coupling.

Translating the book into English multiplies the difficulties, because English, unlike German, does not permit one to transform unclarities into clarities by combining them in a single word. Instead, they must be spread out into phrases. From the perspective of English, German appears unclear, ambiguous, and confusing. But when the highest imperative is rigor and precision, it makes good sense to allow ambiguities to stand, even deliberately to create them, in order to indicate that in the present context further distinctions or specifications are not important.

Under these circumstances, what would be the task of a preface? Surely not once more an abstract recapitulation. Nor a subjective confession by the author, explaining how he came to write the book and what in it needs to be justified or excused. After one excludes such variants, however, many possibilities still remain. In what follows I would like to take up several points that have, up until now, stood out in discussions of the contemporary interpretation of systems theory. These concern the traditional themes of "subject" and "action," which heretofore seemed to offer an easy way of bypassing the difficulties. In particular, readers who have been inspired by the classics of sociology and see in them the essentials of all sociological analysis cannot forgive systems theory for setting aside something so important, so characteristic of humans and of such concern to them, and this just to be able to unfold its own theoretical acrobatics the more undisturbed.

One knows how "the subject" is endangered these days by French aerosols and the ozone hole of deconstruction. But what would there be to save? Is the nostalgia for the concepts "subject" and "action" more than the expression of an emotional attachment to the corresponding traditions? Have these concepts ever been precisely formulated? And what is their empirical reference anyway? Does the subject (in the singular) have teeth and tongues (in the plural)? Are consequences part of an action or not? And if not, what could interest us about an action besides its consequences?

Much depends on making an effort to reconstruct the concept "subject" with the precision that once gave it its meaning. One can find many forerunners—in the concept of the soul and its cognitive parts, in the form of thought as reflexivity (*noesis noeseos*), or in the Cartesian concept of the "I think," which designates a self-certainty given independently of whether one is in error or not. But not until

the end of the eighteenth century was man understood to be a subject in the strict sense, and thereby unlinked from nature.

The particulars of the philosophical theories of a Kant or Fichte need not interest us here. In every case, one encounters a double self-reference—a self-referential structure that can be found in the reflection of consciousness as a matter of fact. Under the heading "subject," the modern individual conceives himself as an observer of his observing, which always operates with self-reference and reference to others; thus he understands himself as a second-order observer. One could then designate the subject as a unity that, as it itself knows, lies at the foundation of itself and everything else. Or, if one prefers a dynamic, active, voluntaristic version, it lays the foundations for itself and everything else. There is nothing to object to in any of this. But if it is not one's meaning, then one should avoid using the word "subject."

The effects of this semantics of the subject were enormous. One consequence, for example, was that a concept of an opposite, relative to the subject, had to be invented. This was called *Umwelt*, and then later "environment," *environnement*. Before this time there had been no environment. Instead, the world was understood as the totality of things or as the support (*periéchon*, literally, "envelope") of all their particulars. The schema subject/environment dissolved the compactness of this conception of the world. One began to think in terms of differences, and systems theory could later join in this heritage.

But that too had consequences. For now, stimulated by progress in the sciences, it was possible to imagine a multitude of self-referential systems: individual cells, the brain, the living organism (all the basis for the discovery of "autopoiesis"), and finally also social systems. Should one call each and all of these unities a "subject"? The original meaning of the concept could have implied this consequence, but that would have taken away its historical limitation to the case of consciousness, broadening it to astronomical dimensions and thereby devaluing it. Whatever possibilities there might have been for a development in terminology, linguistic usage took a different course. The heading "subject" remained attached to the individual as a sobriquet without additional significance, but was still cultivated and protected against a "deconstruction" (however theoretically justified).

But, when it comes to theory, must one put up with the persistence in this way of speaking?

This question leads to a second analysis of the semantics of the "subject" and its place in the history of ideas, one inspired by the sociology of knowledge.

It is no accident that the modern concept of the subject, which describes the individual as self-reference, began its career at the historical moment when modern European society discovered that it could no longer describe itself in the old categories of a stratified society, its essential forms and essential hierarchy, but could not yet say what was the case instead. The experience of modernity available in 1800 was not sufficient. Instead, the concept of society was transferred to the domain of the economy to distinguish it from the "state"; one accepted or contested the ideas of the French Revolution; one noticed the first consequences of industrialization; or one observed the historicity of institutions to draw conclusions about the *Zeitgeist*. But all this created no concept and no security for a historical break of this magnitude. That may explain why stopgap concepts were accepted. One of these referred to the future. Contemporary society is what it is not yet: its own moral perfection, its unforeseeable material and mental progress. It is the (not yet) fully realized freedom and equality of all individuals. The other was called the subject. Modern society is the society of subjects.

Both cases concerned paradoxes, which were concealed by convenient distinctions or "unfolded," as logicians say. As far as time was concerned, one had to distinguish the present future from the (not yet determined) future presents—and then had to *think no more about this* distinction. At first, the assumption of a multitude of subjects was sustained by the theoretical and psychological impossibility of solipsism. This was fine so long as only a multitude of human beings, individuals, bodies, and conscious systems were involved. But when one tried to understand these individuals as subjects in the strict sense, one ran into difficulties. Because every subject conceives of itself as the condition for the constitution of all the others, those others could be subjects, but not real, so to speak, *subjective* subjects. From the perspective of each subject, every other one possesses merely a derivative, constituted, constructed existence. How could people have overlooked this for so long? Perhaps because one needed the concept? Or because, finally, one did not take it seriously but simply used it as an alternative expres-

sion for human being, individual, person, and so forth, without any more ado?

Husserl, in his famous "Fifth Cartesian Meditation," made it impossible to deny the problem of "intersubjectivity" any longer. His answer, that the social is an "intermonadological community," is theoretically so weak that it can be read as an expression of embarrassment, indeed as an admission of defeat. There can be no "intersubjectivity" on the basis of the subject. Husserl formulated the problem so sharply because in his transcendental phenomenology he had begun with a fundamental unity, indissoluble for consciousness, of self-reference and reference to others. Consciousness experiences itself as reference to phenomena. It is, in the same moment, knowledge of itself *and* grasp of phenomena *in one*, noesis *and* noema, and therefore, in precisely this sense, intentionality in its fundamental mode of operation. Ever since people have continually fiddled with the famous "problem of reference" without anyone noticing that, after Husserl, the problem must be posed differently—namely, as the problem of the operative processing of the difference between self-reference and reference to others.

The reader must pardon a sociologist such digressions into philosophical themes. But the staggering naïveté with which sociologists (Durkheimians, social phenomenologists, action theorists—it makes no difference) have been content with the statement that, after all, there are such things as subjects, intersubjectivity, the social, and socially meaningful action, without anyone seriously questioning this, should not be accepted any more. The significance of the figure of "the subject" (in the singular) was that it offered a basis for all knowledge and all action without making itself dependent on an analysis of society. Since empirical individuals experience and act very differently, this required a nonempirical, a transcendental concept of the subject. The subject knows itself and wills itself as general. But today there is little hope for a continuation of transcendental reflection, probably because the distinction between empirical and transcendental is no longer convincing. This, of course, does not mean that questions like "How is X possible?" must be abandoned, and thus that no one asks any longer, "How is social order possible?" Husserl has taught us, however, that this question cannot be answered by beginning with the concept of the subject.

The embarrassments of this dead-end way of thinking lead us

back to an analysis of the semantics of the subject inspired by the sociology of knowledge. Why did people believe in it for so long, and why, even today, can't they—whether out of intellectual weakness or against their better knowledge—let it go?

Our answer does not employ the theoretical apparatus of Marx and Mannheim. We do not appeal to social positions—in the context of a market economy, competition, career structures, or a beneficial egocentrism. Nor do we resort to the Edinburgh "strong programme" of a sociology of science, that is, we do not maintain that theoretical figures produce in their adherents an interest in their preservation. All this may be the case. What is decisive is that the subject (in the modern understanding) was a part of a semantics of transition that had to cope with a situation in which it was impossible to provide an adequate description of a society that was accomplishing the transition from a feudal society to modern structures. Such thorough-going breaks, "catastrophes" in the precise technical sense of system theory, cannot be observed while they are occurring, for where would be the standpoint from which the difference could, as it were, be formulated in a neutral way? In such cases, all that can function are formal descriptions like "conservative/progressive" (for actors) or "traditional/modern" (for observers), not descriptions that cannot be anchored either in the one (old) or the other (new) societal formation.

The hidden nonconstructability of "intersubjectivity" is the theoretical counterpart of the indescribability of society. And the incontestable evidence of the subject's logic of reflection initially gave sufficient support to this. Today, however, this situation has changed considerably. To be sure, we still have not been able to produce a theory of modern society. But we have experience enough with such things as: technology and ecology; the volatility of international investments; discrepancies in the progress and retardation of development; the indispensable yet problematic political differentiation into "states," with war as the result; the acceleration of structural change; the dependence of notions of society on highly selective mass media; the demographic consequences of modern medicine; careers as the main form of the (mobile) integration of individuals and society; the increasing dependence on decision making of future societal states, with the consequence that the future affects the present above all in the form of risk. The list could

easily be lengthened—only to make even clearer how helpless a sociology must appear that still attempts to reduce all of this to "subjects."

With the concept of the subject, it seems to me, goes sociology's preference for the concepts of action theory. In all narrative contexts (above all, of course, in the classical novel) action has the double function of characterizing actors and propelling the story forward. It produces information in two different contexts, specifies two different distinctions. While in the context of the person action refers to the distinction "event/identity" and thus is projected as personal identity (which one can never get at directly), in the context of the narrated story it refers to the distinction between before and after, transforming the former into the latter. One context guarantees identity, repeatability, and expectability. The other guarantees that the same thing will never happen again.

The mythologem of "action" seems to have been sustained by this double function until Max Weber's time. The novel in the meantime has abandoned it—whether because it renounced inferences about motives and returned to a "flat" characterization of persons, or because it concentrated the story in a single moment and no longer carried it forward, but only remembered. Sociology, by contrast, held fast to action, without heeding the signals that an art intellectually often in the vanguard (but not therefore necessarily "avantgardist") was transmitting everywhere. Why? Presumably only because one thought one could not forgo the empirically understood subject.

Of course, one can still say that human beings act. But since that always occurs in situations, the question remains whether and to what extent the action is attributed to the individual human being or to the situation. If one wants to bring about a decision of this question, one must observe, not the human being in the situation, but the process of attribution. Therefore actions are not ultimate ontological givens that emerge as unavoidable empirical elements that force themselves upon one in every sociological analysis. Anyone who ignores these warnings must work with imprecise concepts and seek to cover over their defects by forming ideal types (rational choice) or by methodological sophistication. Only by the inertia of tradition can one call this "empirical" and think that in this way one can gain access to reality.

Actions are artifacts of processes of attribution, the results of observing observers (or "Eigenvalues," in Heinz von Foerster's sense), which emerge when a system operates recursively on the level of second-order observation. The action theory preferred by contemporary sociologists is sustained by the *corpus mysticum* of the subject. It is also sustained by the empirical plausibility, the daily visibility of self-inspired actions by human beings. But conceptually as well as empirically these are superficial "frames." Progress in the development of sociological theory, especially in the direction of an adequate theory of modern society, depends on *implausible certainties*, which must be secured through protracted, conceptually controlled, theoretical work.

Or in any event that is the conviction out of which this book was written.

Bielefeld, May 1991

N. L.

Preface to the German Edition

Sociology is stuck in a theory crisis. Empirical research, though it has, on the whole, been successful in increasing knowledge, has not been able to produce a unified theory for the discipline. Being an empirical science, sociology cannot give up the claim that it checks its statements against data drawn from reality, no matter how old or new the bottles may be into which these data are poured. But it cannot use this principle of empirical scrutiny to account for the distinctiveness of its specific domain of research or its unity as a scientific discipline. Resignation about this is so widespread that no one even attempts such accounts any longer.

This dilemma has split the very concept of theory. On the one hand, theory means empirically verifiable hypotheses about relations among data, on the other, conceptual efforts in a broad, somewhat indeterminate sense. One minimum requirement, however, is common to both: a theory must make comparisons possible. Moreover, the question of which self-constraints permit one to call one's undertaking theory is still a matter of dispute. The ensuing debate and uncertainty are at once the cause and the effect of the discipline's lack of a unified theory, one that could be used as a model, a "paradigm," to guide it.

To a great extent, those interested in theory return to the classical authors. One constraint by which one earns a right to claim the title "theory" is recourse to texts that already bear this title or have been treated as if they have. Then the task becomes one of dissecting, criticizing, and recombining already-existing texts. What one does not trust oneself to do is assumed to be already at hand. The

classical authors are classical because they are classical authors; their use today is identified by self-reference. Reliance on illustrious names and specialization in them can then be proclaimed as theoretical research. On a more abstract level, this is how theory syndromes like action theory, systems theory, interactionism, communication theory, structuralism, and dialectical materialism arise: namely, as abbreviations for complexes of names and ideas. One then can expect new insights from combinations of those names and ideas. Systems theory is injected into Marxism. Interactionism and structuralism are, it turns out, not as different as had been expected. Weber's *Gesellschaftsgeschichte*, a concept acceptable even to Marxists, becomes systematized with the help of Parsons's cross-tabling method. Action theory is reconstructed as structural theory, structural theory as linguistic theory, linguistic theory as textual theory, and textual theory as action theory. Faced with such amalgamations, one can, indeed must, again concern oneself with reacquiring the true content of the classical authors. Every biographical detail spurs on the process and helps secure the classical authors vis-à-vis everything derived from them as theory.

All of this is not without interest and effect. But the further the classical authors recede into the history of a discipline, the more necessary it becomes to distinguish a theoretical from a biographical, an abstract from a concrete treatment of them. If one dismembers them in this way, however, can one manage without them? A sociology of sociology might say that, when analyzing tribal relationships, one cannot avoid a genealogical orientation. But then one might ask whether one must restrict oneself to tribal relationships that describe themselves as pluralism and whether the introduction of constraints via genealogy is the only way of justifying the claim to the title of theory.

As a result, the rapidly increasing complexity of the theory discussion confuses the observer. The better one knows the leading authors and the more one makes claims based on analyses of their texts within the secondary literature, the more one becomes involved in the play of combination and the more one changes the emphasis (e.g., de-subjectivization or re-subjectivization) from one theoretical context to the other—and the more complex becomes the knowledge that must carry research forward. The unity of sociology then appears, not as theory, and certainly not as the

concept of its object, but as pure complexity. The discipline not only becomes opaque, but it finds its unity in this opacity. Complexity can only be approached perspectivally, and every advance varies more than it can control. Even if, sooner or later, one could reckon on exhausting the body of thought left by the classic authors, the ensuing self-produced darkness still provides enough to work on.

The issue, then, is the relation between complexity and transparency. One could also say, a relation between opaque and transparent complexity. Even the refusal to establish a unified theory for the discipline does not escape this problem. It merely avoids raising it. But this is precisely where work on such a theory begins. Theory establishes its relation to its object as a relation of opaque to transparent complexity. It claims *neither* to *reflect* the complete reality of its object, *nor* to *exhaust* all the possibilities of knowing its object. Therefore it does *not* demand *exclusivity* for its truth claims in relation to other, competing endeavors. *But* it does claim *universality* for its grasp of its object in the sense that it deals with *everything* social and not just sections (as, for example, strata and mobility, particularities of modern society and patterns of interaction, etc.).

Theories that claim universality are easily recognized by the fact that they appear as their own object. (If they wanted to exclude themselves, they would have to surrender the claim to universality.) Thus it is—and this holds for all "global theories" (including, e.g., quantum physics)—that specific areas of the classical theory of science are suspended, in particular, everything having to do with independent confirmation of the theory's claim to truth. One could always say, then, that I had eaten of the wrong fruit—one that was not from the tree of knowledge. In this way, every dispute can be pushed into undecidability. But let us then ask that the critic develop adequate alternatives for the descriptions a theory renders and that he not be content merely with reference to his theory that there is no comprehension of reality in the ideological deformations of late capitalism.

Therefore, theories that make a claim to universality are self-referential. At the same time, they always learn something about themselves from their objects. Therefore they are forced, as if by their own logic, to accept a limitation of their meaning: for exam-

ple, to understand theory as a kind of praxis, as a structure, a problem solving, a system, or a decisional program. The difference from other sorts of praxis, structure, and so on must be established in the specific domain of research. Thus a universal theory, even and precisely as a theory of differentiation, can understand itself as the result of differentiation. The constraint that justifies *for it* the title "theory" lies in the nonarbitrariness of its involvement with self-reference.

This already says much about the theoretical program of this book. Its intention is to go beyond a kind of threshold, behind which contemporary theoretical discussions in sociology stagnate. This threshold is marked by three differences:

1. Not since Parsons has anyone attempted to formulate a universal theory for the discipline. The corresponding specific domain of research, however, is no longer assumed substantively as a section of the world (*faits sociaux*), which sociology observes from outside. Nor is it only a correlate of the formation of analytical concepts in the sense of Parsons's "analytical realism." Instead, it is conceived as the entire world, related to the system reference of social systems, that is, related to the difference between system and environment that is characteristic of social systems.

2. A further aspect is the difference between asymmetrically and circularly designed theories. A universal theory observes its objects, and itself as one of its objects, as self-referential relations. It does not presuppose any transcendental epistemological criteria. Instead, following recent philosophers and scientists, it relies on a naturalistic epistemology. Again, that means that its own epistemic procedure and its acceptance or rejection of validating criteria for this happens within its own domain of research, in a discipline of the scientific subsystem of modern society.

3. By now one might expect the usual reproach of "decisionism." And it would not be entirely unjustified. A system's capacity to evolve depends on its ability to decide what is undecidable. This also holds true for proposals concerning systems theory, indeed, even for logics, as we have been able to prove since Gödel. But this does not amount to the arbitrariness of some (or even all) individual decisions. That is prevented by negentropy or complexity. To wit, there is a third mark of the threshold. A sociological theory that wants to consolidate the conditions of the discipline must

not only be more complex, it must be much more complex than the classical authors and their interpreters—even Parsons—had thought. This requires different theoretical precautions in regard to validity and connectivity, internally as well as externally, and it requires, not least, building the reflection of complexity (and the concept of complexity) into the theory itself. Thus the threshold problem also resides in a much greater, self-reflecting degree of conceptual complexity. This greatly constrains the possibilities of variation and excludes any kind of arbitrary decision. Every step must be fitted in. And even the arbitrariness of the beginning loses its arbitrariness (like in Hegel's system) as the construction of the theory proceeds. Thus a self-supporting construction arises. It does not need to be called "systems theory." But if one wanted to keep the other aspects of the construction constant and eliminate the concept of system, then one would have to find something that would be able to fulfill its function, take its place in the theory. And this would be something very much like the concept of system.

These differences from what the discipline is accustomed to make clear why sociology dams up behind such a threshold, churns, and gathers complexity with no clear outlet. Progress is possible in these respects—and indeed in all respects, all being connected with each other—only if one strives for a new kind of theory design. Sociology has hardly any models for this. Therefore we will have to borrow successful theoretical developments from other disciplines, and for this we have chosen the theory of self-referential, "autopoietic" systems.

In contrast to the usual theoretical representations, which at best take some few concepts from the literature, define them in critical discussion with existing meanings, and then work with them in the context of these concepts' traditions, in the following we will try to increase the number of the concepts that are used and to determine them *in reference to one another*. This applies to concepts like: meaning, time, event, element, relation, complexity, contingency, action, communication, system, environment, world, experience, structure, process, self-reference, closure, self-organization, autopoiesis, individuality, observation, self-observation, description, self-description, unity, reflection, difference, information, interpretation, interaction, society, contradiction, and conflict. One may readily observe that conventional theoretical

designations like action theory and structuralism disappear in this collection. We will retain "systems theory" as our trademark because in the domain of general systems theory one finds the most important groundwork for the type of theory we strive for here.

We do not use these concepts without reference (and often, with contrasting reference) to an already-existing body of theoretical knowledge. But the concepts should also, insofar as possible, hone one another. Every conceptual determination ought to be read as a constraint on the possibility of further conceptual determinations. Thus the entire theory is interpreted as a self-limiting context. As the number of such concepts increases, it becomes impossible, at least in a single textual presentation, to connect each concept with every other one. At the same time, preferred lines of connection centralize specific conceptual positions—for example, action/event, event/element, event/process, event/self-reproduction (autopoiesis), event/time. The theory composes itself along such preferred lines, while not definitively excluding other combinatory possibilities. Thus the presentation of theory itself practices what it preaches: the reduction of complexity. Yet for it, reduced complexity is not excluded complexity, but rather "sublated" [*aufgehobene*] complexity. It retains access to other possibilities—provided its conceptual determinations are observed or else changed in a way that is adequate for this place in the theory. Of course, if this level of conceptual determination is abandoned, then access to other possibilities for drawing lines in the fog would disappear, and one might once again have to deal with indeterminate, unmanageable complexity.

This theory design pushes the presentation to unusually high levels of abstraction. Our flight must take place above the clouds, and we must reckon with a rather thick cloud cover. We must rely on our instruments. Occasionally, we may catch glimpses below of a land with roads, towns, rivers, and coastlines that remind us of something familiar, or glimpses of a larger stretch of landscape with the extinct volcanoes of Marxism. But no one should fall victim to the illusion that these few points of reference are sufficient to guide our flight.

Abstraction, however, should not be misunderstood as pure artistry or as a retreat to a "merely analytically" relevant, formal science. No one would deny that there are such things as meaning,

time, events, actions, expectations, and so on in the real world. All of this is both an actuality that can be experienced and a condition of possibility for the differentiation of science. The corresponding concepts serve science as probes by which the system controlled by theory adapts to reality; with them indeterminate complexity is transformed into determinable complexity, usable within science. Following Saussure, Kelly, and others, one could even say that concepts form science's contact with reality (including, here as anywhere else, contact with its own reality) as the experience of difference. And the experience of difference is the condition of possibility for acquiring and processing information. Correspondences between concept and reality can be drawn point for point: for example, between the concept of meaning and the phenomenon of meaning, without which no human world could persist. The decisive fact is, however, that in forming systems science goes beyond such point-for-point correspondences. It does not restrict itself to copying, imitating, reflecting, representing. Instead, it organizes experiences of difference, and with them the acquisition of information, and it develops a complexity of its own adequate to do so. In the process, a reference to reality must, on the one hand, be safeguarded. On the other, however, science, especially sociology, should not allow itself to be duped by reality.

Viewed in this way, abstraction is an epistemological necessity. It remains a problem in writing books and a demand on the reader. This is especially true if the theory reaches a degree of complexity that cannot be rendered in a linear fashion. Then every chapter actually would have to begin anew, and be rewritten within, every other. Dialectical theories nevertheless attempt linear exposition, as most recently, for example, did Sartre's *Critique of Dialectical Reason*. Then, however, they run into the problem of transitions and there are faced with the temptation simply to rely on action.

The following effort is aware of this pitfall and therefore must place special value on avoiding it. It develops a polycentric (and accordingly polycontextural) theory in an acentrically conceived world and society. It is not primarily concerned with harmonizing the forms of theory and presentation. The book must be read in the sequence of its chapters, but this is only because that is how it was written. The theory could have been presented in a different sequence, and it hopes for readers who will bring with them enough

patience, imagination, intelligence, and curiosity to try out what would happen within the theory through such transcriptions.

Thus the theory's design resembles a labyrinth more than a freeway off into the sunset. The sequence of chapters chosen for this book is surely not the only one possible, and this also holds for the choice of concepts to be emphasized as the themes of the chapters. I could also have made different decisions about the questions concerning which concepts should be introduced as metadisciplinary and system comparative and which not, or in which cases references to material from theory's history are important and in which not. The same is true for the degree to which anticipations and cross-references are mindful of the nonlinear character of the theory, and for the choice of the necessary minimum of these.

Whereas the theory, with regard to the content of its conceptual frameworks and statements, wrote itself, the problem of arrangement cost me much time and deliberation. Thanks to the support of the *Deutsche Forschungsgemeinschaft*, I was able to dedicate a year to this problem. I hope that my solution is satisfactory.

Bielefeld, December 1983

N. L.

SOCIAL SYSTEMS

INTRODUCTION

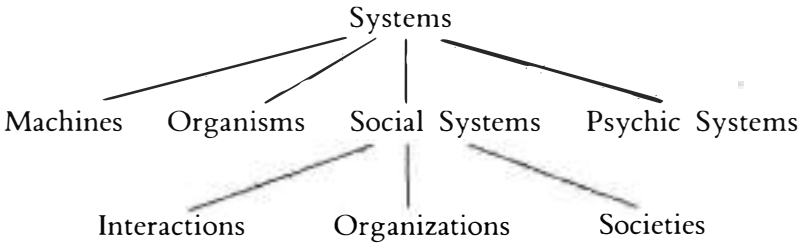
Paradigm Change in Systems Theory

Today "systems theory" is a catchall concept for very different denotations and very different levels of analysis. The word refers to no unambiguous meaning. When one introduces the concept of system into sociological analyses without further clarification, then an illusory precision arises that lacks any basis. Thus controversies arise in which one can only suppose or infer from the argumentation that the participants have different ideas in mind when they speak of systems.

At the same time, one can observe how rapidly the field of research designated "general systems theory" is developing. In contrast to the sociological theory discussion, which adheres to the model of the classical authors and subscribes to pluralism, one finds profound changes in general systems theory and associated interdisciplinary efforts, almost "scientific revolutions" in Kuhn's sense. The ongoing construction of sociological theory could profit greatly if it could link up with this development. Changing configurations in general systems theory, above all in recent decades, mesh very nicely with sociology's theoretical interests, as one can, in general, assume. They also entail, however, a degree of abstraction and complication that has not been usual in theoretical discussions thus far. In the present work we will try to make this connection, to fill in this gap.

As an initial orientation, it may suffice to distinguish three levels of analysis and raise the question: How would a "paradigm

change" on the level of general systems theory affect the general theory of social systems? The accompanying diagram shows what we have in mind.



One can talk of a system in general as long as one keeps in view features whose absence would call into question an object's status as a system. Sometimes the unity of the totality of such features is also designated as a system. A general systems theory thus unexpectedly becomes a theory of the general system.[1] This problem repeats itself on all levels of concreteness, with corresponding constraints. In the following we will avoid this way of speaking. We will not, in turn, call the concept (or model) of a system a system because we don't want to call the concept (or model) of an organism, machine, or society an organism, machine, or society, either. In other words, even in the highest registers of theoretical abstraction we don't allow ourselves to apply to the means of knowledge (concepts, models, etc.) the terminology of objects—precisely because such a decision couldn't endure in more concrete domains of research. Thus the statement "there are systems" says only that there are objects of research that exhibit features justifying the use of the concept of system, just as, conversely, this concept serves to abstract facts that from this viewpoint can be compared with each other and with other kinds of facts within the perspective of same/different.

This kind of (theoretically directed) *conceptual* abstraction should be carefully distinguished from the (structurally directed) *self-abstraction* of the object. Conceptual abstraction makes comparisons possible. Self-abstraction enables the reapplication of the same structures within the object itself. One must keep the two strictly separate. Then, and only then, can one tell if there is any overlap. There can be systems that use conceptual abstraction for self-

abstraction: namely, those that acquire structure by comparing their features with the features of other systems. Thus one can also ascertain to what degree conceptual abstractions rest on self-abstractions within the objects and to what degree they amount to structural comparison.

We will use the abstract scheme of the three levels of system formation as a conceptual schema. Basically, it helps compare different possibilities of system formation. But in working out this comparison one encounters self-abstractions within the objects themselves. Systems can and do apply features of the concept of system—for example, the difference between internal and external—to themselves. Insofar as they do so, more than an analytical schema is involved. Rather, the comparison of systems helps us test the extent to which systems are founded in self-abstraction and are thereby the same or different.

The distinction between the three levels of system formation immediately clarifies typical "mistakes," or at least obscurities, in the discussion until now. Comparisons among different types of systems must restrict themselves to one level.[2] The same is true for negative delimitations. This rule already eliminates many unproductive theoretical strategies. It makes little sense, for example, to say that societies are not organisms or to distinguish, in the sense of the scholastic tradition, between organic bodies (composed of interconnected parts) and societal bodies (composed of noninterconnected parts). The attempt to construct general theories of the social on the basis of theories of interaction is equally "lopsided." The same is true of the recent tendency, stimulated by the invention of the computer, to apply the machine concept on the level of the general systems theory (a move that provokes an equally unjustified rejection).[3] The distinction between levels ought to establish fruitful perspectives for comparison. Statements about similarities can then be examined on the next higher level. For example, social systems and psychic systems are alike in being systems. But similarities between them may hold only for a subdomain of the level of comparison. Psychic and social systems, unlike machines and organisms, can be characterized by their use of meaning, for example. From the perspective of problems posed by a general theory, one must then ask what machines and organisms use as the functional equivalent of meaning.

Specific types of systems may at first be assigned to specific levels more or less intuitively. Such assignments can be corrected as required by research results. This also holds true for the list of system types, which is initially acquired inductively. But such corrections can be carried out only if the difference between levels remains intact. If the difference between levels collapses—as, for example, when one applies "life" as a basic concept and not as the specific property of organisms—then a regression to simpler theoretical forms is unavoidable.

The following investigations hold strictly to the level of a general theory of social systems. They do not, for example, offer a theory of society—society understood as a comprehensive social system and thereby as one case among others.[4] Nor is general systems theory presented for its own sake. Nevertheless, adequate attention must be paid to it because we are guided by the question of how a paradigm change that becomes apparent on the level of general systems theory affects the theory of social systems.

A rough orientation will suffice to define what we have so far called a "paradigm change." We need not concern ourselves with finding out what Kuhn had in mind when he introduced the concept of paradigm. That is a pointless task today. What matters to us is a distinction:[5] namely, that between *supertheory*[6] and *guiding difference*.

Supertheories are theories with claims to universality (that is, to including both themselves and their opponents).[7] Guiding differences are distinctions that steer the theory's possibilities of processing information. These guiding differences can acquire the property of a dominating paradigm if they organize a supertheory in such a way that in practice all information processing proceeds according to them. Thus, for example, Darwin and his successors channeled the supertheory evolution into the difference between variation and selection. Previously, one had attempted to understand the totality of evolutionary consequences through their corresponding unities, through a beginning (*arché*, ground) or through a super-intelligent Providence, thus understanding evolution, in short, as development, or creation. Since Darwin, however, these interpretations of unity, which allow a distinction only from something indeterminately other, have been replaced by the unity of a difference (variation/selection, then variation/selec-

tion/restabilization, and in part also accident/necessity, order/disorder). If a supertheory achieves a significant centralization of difference, then a paradigm change also becomes possible.

Systems theory is a particularly impressive supertheory. Disputed though it may be, one cannot deny it a certain process of maturation. We attribute this to the fact that it can look back upon a history characterized by supertheoretical ambitions, centralizations of difference, and paradigm change. Whether and to what extent this development can be designated as "progress" or has led to the accumulation of knowledge is a question more difficult to determine.

If one looks back about a hundred years, two fundamental changes become apparent in what one would come to call systems theory. In neither case can one simply declare the concepts that have been handed down to be wrong or useless; they are extended by deliberate changes, transferred into the new theory and thus "sublated" (*aufgehoben*). The new theory then becomes richer in content than the previous one; it achieves greater complexity. This is why it has gradually become more capable of dealing with social phenomena.

A tradition stemming from antiquity, older than the conceptual use of the term "system,"[8] speaks of wholes that are composed of parts. The problem with this tradition is that the whole had to be understood in a double sense: as the unity and as the totality of its parts. One could then say that the whole *is* the totality of its parts or *is more* than the mere sum of its parts. But this does not explain how the whole, if it be composed of its parts, plus something else, can count as a unity on the level of parts. Since in the realm of social relationships one conceived of society as being composed of individual persons like a whole out of parts, one could conveniently formulate the answer in terms of insights into human beings' living together. Persons had to be able to recognize the whole in which they live, and they had to be ready to lead their lives according to this knowledge. This could be viewed as the condition of their being parts, as condition of their taking part, their participation, and thus of their nature. The risk of this pointing to knowledge (which can err) and to will (which can will the wrong thing) could be understood as a feature of the general corruption or imperfection of nature, which, in turn, necessitates the differentiation of domi-

nating and dominated parts. Accordingly, for the dominant parts the problem took on a special point: they had to have the correct insight and the correct will to be able to "represent" the whole within the whole.

The social conditions and the epistemic foundations of this concept have undergone a profound change in the transition to modern society. The most recent account, developed in the eighteenth century, used the concept of the universal. The entire world or the totality of humanity as the universal had to be present, it claimed, in man. The ensuing discussion concerned the *form* in which the world or humanity had to be present in man. The answer was sought in the concept of reason, the moral law, or similar apriorisms, in the concept of education, or in the concept of the state. The old sense of the insufficiency, of the corruptibility, of all things beneath the moon was overcome by idealization. Thus one could abstract to the greatest extent from social phenomena, postulating eventually even "freedom from domination" as the basic condition of the unrestricted presence of the universal in man. The universal was conceived as pure, free of risk, and in no need of compensation—and this in spite of all the counterevidence the French Revolution offered. The universal could appear with a claim to realization. Spirit or matter would have to take the long route of realizing the universal in the particular.

Today all of this is remembered with more or less admonitory overtones.[9] In fact, the intellectual gesture has not really been replaced; it has merely gone limp. Moreover, it is hard to see how one could surpass an effort of this type. If we are correct in assuming that all this was motivated and conditioned by the schema of the whole and its parts, then one must see whether this schema would not first need to be replaced before one could seek a guiding semantics capable of replacing the figure of the "universal within the particular." This is the historical background against which one must ask the question whether and how the systems theory that tries to do this separated itself from the paradigm of whole and part.

The first move in this direction was to replace the traditional difference between *whole and part* with that between *system and environment*. This transformation, of which Ludwig von Bertalanffy is the leading author, enabled one to interrelate the theory of

the organism, thermodynamics, and evolutionary theory.[10] A difference between open and closed systems thereupon appeared in theoretical descriptions. Closed systems were defined as a limit case: as systems for which the environment has no significance or is significant only through specified channels. The theory concerned itself with open systems.

What had been conceived as the difference between whole and part was reformulated as the theory of system differentiation and thereby built into the new paradigm. System differentiation is nothing more than the repetition within systems of the difference between system and environment. Through it, the whole system uses itself as environment in forming its own subsystems and thereby achieves greater improbability on the level of those subsystems by more rigorously filtering an ultimately uncontrollable environment. Accordingly, a differentiated system is no longer simply composed of a certain number of parts and the relations among them; rather, it is composed of a relatively large number of operationally employable system/environment differences, which each, along different cutting lines, reconstruct the whole system as the unity of subsystem and environment. Thus differentiation is handled according to the general model of system formation, and the question in which forms and to what degree of complexity system differentiation is possible can itself be tied back into the initial difference that constitutes the whole system.

A central problem of the schema of the whole and its parts can now be solved more satisfactorily. One had always demanded that parts be homogeneous with respect to the whole. Rooms, not cinder blocks, were called the parts of a house, and chapters, not letters of the alphabet, were termed parts of a book. Yet individual human beings counted as parts of societies. There were hardly any theoretically proven criteria for homogeneity, if only because it was very difficult, in this way of thinking, to distinguish between the concepts of part and element.[11] Besides, according to this paradigm, one division of reality excluded other (equally likely) ones. Thus a stratified society could not be understood any other way than as split up into strata (and not, e.g., or at least not with the same reality-value, as split up into city/countryside or into main focuses of function).[12] In all these respects, the theory of system/environment differentiation offers better possibilities for anal-

ysis, specifically, both a more accurate understanding of homogeneity and an understanding of the possibilities of simultaneously using varying viewpoints within subsystem differentiation.

The advantages we have indicated for a transposition to the guiding difference between system and environment can also be detected in sociology. Classical sociology has been characterized with good reason as having an "intra-unit orientation"[13]—specifically, in its concept of differentiation. More recent theoretical developments, especially in organizational research, insofar as they are oriented toward systems theory at all, prefer by contrast, concepts of a system related to an environment. The transposition to "open systems" has not, however, come to sociology without its own bias. It has promoted a critique of the "status quo" of social phenomena and has allied itself with tendencies toward the "reform" of social structures, toward planning, management, and control—not least because its main field of application lay in the domain of organized social systems.[14] Environmental relations were understood in terms of the input/output schema; structures, as rules of transformation; and functions, as the transformations themselves, which one hoped to be able to influence by varying the structures.[15]

While this open-systems paradigm has been asserted and accepted within systems theory, a surpassingly radical further step has been taken in the discussions of the last two decades. It concerns contributions to a *theory of self-referential systems*. At present there are neither adequately developed nor generally perceived (not to mention generally accepted) theoretical foundations for this theory; enough is apparent, however, for us to assess the consequences for a theory of social systems. Besides, this open situation invites work in the domain of social systems to contribute to a general theory of self-referential systems.

Initial efforts in the development of such a theory employed the concept of self-organization and attained a high point in the early 1960's in three large symposia.[16] But the concept of self-organization referred—in hindsight, one must say "only"—to the structures of a system. Structures' change via their own operations was viewed, at the time understandably, as a particularly difficult and therefore particularly stimulating problem within systems theory. But this did not come close to what is understood today by self-

reference. In the meantime, reference to unity—be it that of the system or of its elements—has supplanted reference to structure (although, of course, it has not excluded it).

The theory of self-referential systems maintains that systems can differentiate only by self-reference, which is to say, only insofar as systems refer to themselves (be this to elements of the same system, to operations of the same system, or to the unity of the same system) in constituting their elements and their elemental operations. To make this possible, systems must create and employ a description of themselves; they must at least be able to use the difference between system and environment within themselves, for orientation and as a principle for creating information. Therefore self-referential closure is possible only in an environment, only under ecological conditions.[17] The environment is a necessary correlate of self-referential operations because these out of all operations cannot operate under the premise of solipsism[18] (one could even say because everything that is seen as playing a role in the environment must be introduced by means of distinction). The (subsequently classical) distinction between "closed" and "open" systems is replaced by the question of how self-referential closure can create openness.

Here too one comes to a "sublation" [*Aufhebung*] of the older basic difference into a more complex theory, which now enables one to speak about the introduction of self-descriptions, self-observations, and self-simplifications within systems. One can now distinguish the system/environment difference as seen from the perspective of an observer (e.g., that of a scientist) from the system/environment difference as it is used within the system itself, the observer, in turn, being conceivable himself only as a self-referential system. Reflexive relationships of this type don't just revolutionize the classical subject-object epistemology, don't just de-dogmatize and "naturalize" the theory of science: they also produce a very much more complex understanding of their object via a very much more complex theory design.

Relatively simple theoretical constructions were still possible within the context of system/environment theory. The theory could be interpreted, for example, as a mere extension of causal relations: you had to consider internal as well as external factors in all causal explanations; system and environment would come to-

gether in a kind of co-production. The theory of self-referential systems bypasses this causal model. It considers causality (as well as logical deduction and every kind of asymmetrization) as a sort of organization of self-reference, and it "explains" the difference between system and environment by saying that only self-referential systems create for themselves the possibility of ordering causalities by distribution over system and environment. Such a theory requires formal concepts established at the level of relating relations.

In order to work out a theory of self-referential systems that incorporates system/environment theory, a new guiding difference, and thus a new paradigm, is necessary. The difference between identity and difference serves for this.[19] Self-reference can be realized in the actual operations of a system only when a self (whether as element, process, or system) can be identified through itself and set off as different from others. Systems must cope with the difference between identity and difference when they reproduce themselves as self-referential systems; in other words, reproduction is the management of this difference. This is not a primarily theoretical but a thoroughly practical problem, and it is relevant not only for meaning systems.[20] A science that wants to live up to such systems must construct concepts on the corresponding level, and only for such a science is the difference between identity and difference a guideline for theory formation, a paradigm.

In general systems theory, this second paradigm change provokes remarkable shifts—for example, from interest in design and control to an interest in autonomy and environmental sensitivity, from planning to evolution, from structural stability to dynamic stability. In the paradigm of the whole and its parts one had to accommodate inexplicable properties somewhere—whether as properties of the whole (which is more than the sum of its parts) or as the properties of a hierarchized apex that represents the whole.[21] By contrast, in the theory of self-referential systems everything that belongs to the system (including any possible apex, boundaries, or surpluses) is included in self-production and thereby demystified for the observer.[22] This admits developments that can make systems theory interesting for sociology in new ways.

The initiatives for neither of these moves have come from within sociology. The stimulus initially came from thermodynamics and biology as a theory of the organism, later from neu-

rophysiology, histology, computer science, and further, of course, from interdisciplinary amalgamations like information theory and cybernetics. Not only was sociology excluded from cooperative research, it proved incapable of learning within this interdisciplinary context. And because it lacks basic theoretical preparatory work of its own, it cannot even observe what is happening.[23] Therefore it remains dependent on working with the data that it produces itself, and, where theory is concerned, on working with the classical authors that it has itself produced. The example shows, by the way, that not every kind of self-referential closure enables a more complex view of the environment. As is always the case in contexts of intensification, one will have to look for the specific conditions under which systems realize such intensification and thereby can participate in evolution.

Against this background in the actual history of science, the following considerations see themselves as an attempt to reformulate the theory of social systems via the current state of the art in general systems theory. General systems theory should be tested in an encounter with sociological material, and in this way the advances in abstraction and the new conceptual formations that already exist or are emerging in interdisciplinary contexts should be made usable in sociological research. One of the most important results of this encounter, from which I hope both sides will profit, resides in the radical temporalization of the concept of element. The theory of self-producing, autopoietic systems can be transferred to the domain of action systems only if one begins with the fact that the elements composing the system can have no duration, and thus must be constantly reproduced by the system these elements comprise. This goes far beyond merely replacing defunct parts, and it is not adequately explained by referring to environmental relationships. It is not a matter of adaptation, nor is it a matter of metabolism; rather, it is a matter of a peculiar constraint on autonomy arising from the fact that the system would simply cease to exist in any, even the most favorable, environment if it did not equip the momentary elements that compose it with the capacity for connection, that is, with meaning, and thus reproduce them. Different structures may exist to accomplish this, but only ones that can withstand the radical trend toward immediate (and not merely gradual, entropic) dissolution of the elements.

CHAPTER 1

System and Function

I

The following considerations assume that there are systems. Thus they do not begin with epistemological doubt. They also do not advocate a "purely analytical relevance" for systems theory. The most narrow interpretation of systems theory as a mere method of analyzing reality is deliberately avoided. Of course, one must never confuse statements with their objects; one must realize that statements are only statements and that scientific statements are only scientific statements. But, at least in systems theory, they refer to the real world. Thus the concept of system refers to something that is in reality a system and thereby incurs the responsibility of testing its statements against reality.

For the time being, we should retain this reference to reality merely as a position-marker. When compared with the level on which problems are discussed in epistemology or in scientific methodology, this reference gives only rough tips. They merely indicate the way by which we must return to the formulation of epistemological problems, namely, by analyzing the real systems of the real world. Thus we must first work out a systems theory that has a real reference to the world. Because it claims universal validity for everything that is a system, the theory also encompasses systems of analytic and epistemic behavior. It therefore itself appears within the real world as one of its own objects, among many others. It is forced to treat itself as one of its objects in order to compare itself with others among those objects. Such a com-

parison functions as a control: systems theory must be suited to carrying out such a comparison and, if necessary, to learning from it. This results in systems theory's taking charge of epistemology, as it were, and, in return, in a kind of test of systems theory's suitability: among other things, it must solve this task of taking charge of epistemology.

These requirements necessitate establishing systems theory as a theory of self-referential systems. The presentation sketched above already implies self-reference in the sense that systems theory must always keep in mind the admonition to take itself as one of its objects, not only in the sense of treating this special object of systems theory as a work-program of the scientific system, but in that it must take its own applicability or inapplicability into consideration throughout its entire research program. By contrast, classical epistemology is characterized by the intention to avoid self-references as mere tautologies and as openings for anything whatsoever. If a unified scientific program has ever been given from the viewpoint of "epistemology," then this is its hallmark. The reasons for this are to be taken very seriously. But they are reasons that likewise emerge from within general systems theory. They are connected to the difference between system and environment, and they mean that neither an exclusively self-referentially created system nor a system with an arbitrary environment can exist. These conditions would be unstable in the sense that any possible event would acquire an ordering value (namely, a possible event that releases order out of noise, then becomes a value for everything that follows) within them.[1] It follows that self-reference can occur only as a mode of dealing with a nonarbitrarily structured environment. This is not something that concerns knowledge in particular, but rather a more general fact, and the systems specializing in knowledge could perhaps learn by analyzing other kinds of systems how to adjust to these facts. This concerns, not least, the controversial possibilities of a logic of self-referential systems.

Our thesis, namely, that there are systems, can now be narrowed down to: there are self-referential systems. This means first of all, in an entirely general sense: there are systems that have the ability to establish relations with themselves and to differentiate these relations from relations with their environment.[2] This thesis

encompasses the fact of systems and the conditions of their description and analysis by other (similarly self-referential) systems. But it says nothing about the level of abstraction of the theoretical analysis possible within the scientific system. One must distinguish system references here, too. The scientific system can analyze other systems from perspectives that are not accessible to them. In this sense, it can discover and thematize latent structures and functions. Conversely, one often finds—especially in sociology—the situation that in dealing with themselves systems develop forms of access to complexity that are not accessible to scientific analysis and simulation. Then one speaks of "black boxes." The degree of the relative inferiority or superiority of the possibilities of other- or self-analysis varies historically. It depends on the state of scientific theories' formation, and in view of the rapid development of theories, especially in general systems theory, at present it is difficult to pin this down.

Relatively reliable indications can be obtained if one begins with the fact that systems theory can be applied to very different kinds of systems. Accordingly, there are distinct levels of generality for "the" systems theory. In addition to a general systems theory, theories pertaining to specific system types can be developed. In what follows, we will restrict our investigation to a theory of social systems. We therefore will exclude the (highly controversial) direct analogy between social systems and organisms or machines, but not, however, an orientation toward a general systems theory that seeks to address more encompassing demands. Thus, viewed methodologically, we do not choose the shortcut of analogy, but rather the longer path of generalization and respecification. Analogy would mislead us into believing similarities to be essential. The longer path of generalization and respecification is more neutral; in any event, it increases the sensitivity of analysis to differences among system types. Above all, we will have to emphasize the nonpsychic character of social systems.

But one should not believe that reverting to the most general level of statements that hold valid for systems provides the best possible abstraction of premises for further analysis. That would mean trusting unreflectingly in a sort of logic of generic concepts that holds the conceptual requirements of the construction of genus to be the characteristics of things themselves. There is, however, no

guarantee immanent to things of a coincidence of generalities and essentialities. Generalities can be trivial. If one wants to check the fruitfulness of generalizations, one must position the concepts used at the most general level of analysis, not as concepts describing possibilities but as concepts formulating problems. Thus general systems theory does not fix the essential features to be found in all systems. Instead, it is formulated in the language of problems and their solutions and at the same time makes clear that there can be different, functionally equivalent solutions for specific problems. Thus a functional abstraction is built into the abstraction of generic forms that guides comparison of different system types.[3]

In this sense, we orient the general theory of social systems to a general systems theory and thereby justify the use of the concept "system." We advance a claim to universality for the theory of social systems as well, which is why we speak of a "general" theory of social systems. That is to say, every social contact is understood as a system, up to and including society as the inclusion of all possible contacts. In other words, the general theory of social systems claims to encompass all sociology's potential topics and, in this sense, to be a universal sociological theory. Such a universal claim is a principle of selection. It means that one accepts bodies of thought, ideas, and critique only if and insofar as these make this principle their own. That cuts peculiarly across the grain of classical sociological controversies: such as static versus dynamic, structure versus process, system versus conflict, monologue versus dialogue, or, projected onto the object itself, Gesellschaft versus Gemeinschaft, work versus interaction. Such contrasts force each side to abandon claims to universality and to self-assess its own option—at best, to makeshift constructions that build its opposite into that option. Such theoretical accounts are not only conceived undialectically, they also, rashly, do without the full scope of systems-theoretical analyses. This has been apparent ever since Hegel and Parsons.

Yet a claim to universality is not a claim to exclusive correctness, to the exclusive validity, and thus necessity (noncontingency), of one's own account. If a universalistic theory were to succumb to the error of self-hypostatization—and this is a danger because such a theory must presuppose the principles with which it works—it would quickly learn better through self-reference. As

soon as it rediscovered itself among its own objects, as soon as it analyzed itself as a research program of a subsystem (sociology) of a subsystem (science) of the societal system, it would necessarily experience itself as contingent. The necessity and contingency of its "self" then would become visible to it as a difference that articulates self-reference. To take this into consideration right from the start is part of the point of the research program just sketched out. One can do this by distinguishing between claims to universality and claims to exclusivity, or by recognizing that structural contingencies must be employed as an operative necessity, with the consequence that there is a constant contingency absorption through successes, practices, and commitments in the scientific system.

II

Today one cannot present general systems theory as a consolidated totality of basic concepts, axioms, and statements deduced from these. On the one hand, it serves as a collective designation for quite different kinds of research efforts, which are general to the extent that they do not specify their domain of application and its boundaries. On the other, such research, like research specific to a certain type of system (e.g., in the domain of data-processing machines), has led both to encounters with new problems and to attempts to consolidate such experiences conceptually. These encounters, together with corresponding efforts to formulate the resulting problems, are beginning to change the map of science, resulting in the new foundations that we set out in the Introduction. To them we append what follows.[4]

The state of research does not allow us to begin with a report of assured results and to incorporate these results as "applied systems research" into sociology. It does enable us, however, to intensify the basic concepts beyond what is common in the literature and at the same time to introduce them into a context that takes into consideration the problems that interest sociological research and the experiences it has encountered.

1. There is agreement within the discipline today that the point of departure for all systems-theoretical analysis must be the *difference between system and environment.*[5] Systems are oriented by their environment not just occasionally and adaptively, but structurally,

and they cannot exist without an environment. They constitute and maintain themselves by creating and maintaining a difference from their environment, and they use their boundaries to regulate this difference. Without difference from an environment, there would not even be self-reference, because difference is the functional premise of self-referential operations.[6] In this sense *boundary* maintenance is system maintenance.

But boundaries do not mark a break in connections. In general, one cannot maintain that internal interdependencies are greater than system/environment interdependencies.[7] The concept of boundaries means, however, that processes which cross boundaries (e.g., the exchange of energy or information) have different conditions for their continuance (e.g., different conditions of utilization or of consensus) after they cross the boundaries.[8] This also means that contingencies in the course of a process, openness to other possibilities, vary depending on whether, for the system, the process occurs in the system or in its environment. Boundaries and systems exist only insofar as this is so. We will come back to this in more detail under point 7, below.

The environment receives its unity through the system and only in relation to the system. It is delimited by open horizons, not by boundaries that can be crossed; thus it is not itself a system.[9] It is different for every system, because every system excludes only itself from its environment. Accordingly, the environment has no self-reflection or capacity to act. Attribution to the environment (external attribution) is a strategy of systems. But this does not mean that the environment depends on the system or that the system can command its environment as it pleases. Instead, the complexity of the system and of the environment—to which we will later return—excludes any totalizing form of dependence in either direction.

One of the most important consequences of the system/environment paradigm is that one must distinguish between the *environment* of a system and *systems in the environment* of this system. The importance of this distinction cannot be overemphasized. Thus one must distinguish the relations of dependence between environment and system from those among systems. This distinction blows apart the old thematic of domination/oppression. Whether and to what extent one system comes to dominate another finally

depends not least on the extent to which both the systems and the system of their relations depend on the respective environment. In this sense, even the "absolute" domination assumed in older models of kingship was never extreme, never determining, but more a mode of system-description that articulated a certain power of disposal by the system over itself.

The systems in a system's environment are oriented to their own environments. No system can completely determine the system/environment relations of another system, save by destroying them.[10] Therefore the environment of any system is given to it as a confusedly complex structure of reciprocal system/environment relations, though at the same time it also appears as a unity constituted by the system and requiring a specifically selective observation.

2. As a paradigm, the difference between system and environment forces systems theory to replace the difference between the whole and its parts with a theory of system differentiation.[11] System differentiation is nothing more than the repetition of system formation within systems. Further system/environment differences can be differentiated within systems. The entire system then acquires the function of an "internal environment" for these subsystems, indeed, for each subsystem in its own specific way. The system/environment difference is therefore duplicated; the entire system multiplies itself as a multiplicity of system/environment differences. Every difference between subsystem and internal environment is the entire system—but only from different perspectives. Therefore system differentiation is a process of increasing complexity that greatly affects what can be observed as the unity of the entire system.

In part, the meaning of differentiation can be viewed as a unity as a *unitas multiplex*. In a certain way, difference holds what is differentiated together; it is different and not indifferent. To the extent that differentiation is unified in a single principle (e.g., as hierarchy), one can determine the unity of the system from the way in which its differentiation is constituted. Differentiation provides the system with systematicity; besides its mere identity (difference from something else), it also acquires a second version of unity (difference from itself). It can attain its identity as the primacy of a specific form of differentiation (e.g., as the equality of its sub-

systems), as a mere series, as an order of rank, as the difference between center and periphery, or as the differentiation of function systems. Moreover, more demanding (improbable) forms of system differentiation are evolutionary achievements that, when achieved, stabilize systems on a higher level of complexity.

Since the 1960's, system differentiation has tended to be described as "hierarchy." This does not mean official channels or a chain of command from the top down. Instead, in this context hierarchy means only that subsystems can differentiate into further subsystems and that a transitive relation of containment within containment emerges.[12] The advantages of hierarchization for rationality are obvious. They depend, however, on further subsystems being formed only within subsystems. This is an unrealistic assumption.[13] It may hold to a large extent for organizations because in them it can be guaranteed by formal rules. For systems relating to the whole of society, one can indeed start with a basic schema of differentiation—whether as segmentary, stratificatory, or functionally differentiated—but this surely does not mean that further system formations are possible only within the rough division thus established.[14]

Therefore one must distinguish conceptually between differentiation and hierarchization on the level of the general theory of social systems. Hierarchization is then a specific case of differentiation,[15] a kind of self-simplification of the system's possibilities for differentiation.[16] In addition, it facilitates observation of the system[17] (including scientific analysis). If an observer can assume a hierarchy, then he can regulate the scope of his observation and description according to how many hierarchical levels he can distinguish. But one cannot assume that evolution more or less inevitably brings complexity into the form of a hierarchy. Obviously, other forms with quite chaotic differentiation have found it possible to emerge and survive.

3. The switch to the difference between system and environment has profound consequences for understanding causality. The line that separates system and environment cannot be understood as isolating and combining the "most important" causes in the system. Instead, it cuts through causal connections. The question is: From what perspective? System and environment constantly collaborate, producing every effect—if only because in the domain

of social systems no communication can be achieved without the consciousness of psychic systems. Therefore we must clarify why and how causality is distributed over system and environment.

Without prematurely offering criteria for such a distribution, we can at least formulate the problem more precisely and connect it to other aspects of systems theory. We can do this via the concept of *production* (and its derivatives: reproduction, self-reproduction, and autopoiesis). We will speak of production if *some* but *not all* causes that are necessary for specific effects can be employed under the control of a system. What is essential to the concept is not the technical possibility of being calculated or even executed by machines (although this can be a point from which selections can be made for system formation), but rather this "some, but not all." This difference makes selection possible, and selection makes retention possible. Therefore a complex of "productive causes" can come together as a result of evolution (or subsequently, with the help of planning) and, once together, be in a position to assemble appropriate environmental causes. Think of the possibilities suggested by population concentration in settlements and later in cities, and the accompanying mythology of feasibility.[18]

To understand production, one should not begin with natural laws, but rather with the advantages of selection. Only when, and precisely because, one refuses to "lord it over" some totality of causes can abstractions that are self-organizing and auto-reproductive be realized; this is the only way a surplus of productive *possibilities* can emerge—for example, a surplus of possibilities for propagating organic systems, in respect to which selective factors may trigger further evolution.

4. The difference between system and environment must be distinguished from a second, equally constitutive difference: namely, the difference between *element* and *relation*. Here, as previously, we must conceive the *unity* of the difference as *constitutive*. Just as there are no systems without environments or environments without systems, there are no elements without relational connections or relations without elements. In both cases the difference is a unity (in fact, we say "the" difference), but it operates only as a difference. Only as a difference can it connect processes of information processing.

Despite this formal similarity it is important (and, among other

things, a condition for the concept of complexity) that one carefully discriminate between the two distinctions.[19] Therefore there are two different possibilities for viewing the decomposition of a system. One aims to form subsystems (or, more precisely, internal system/environment relations) within the system. The other decomposes systems into elements and relations. In the former, rooms compose a house; in the latter, cinderblocks, beams, nails, and so forth do. The first kind of decomposition is carried out as a theory of *system differentiation*. The other ends up in a theory of *system complexity*. Only this distinction makes it meaningful and nontautological to say that system complexity increases with an increase in differentiation or with a change in the form of differentiation.[20]

Elements can be counted and the number of possible mathematical relations among them can be determined on the basis of their number. The enumeration reduces the relations among the elements to a quantitative expression, however. The elements acquire quality only insofar as they are viewed relationally, and thus refer to one another. This can occur in real systems of a (relatively small) size only selectively, that is, only by omitting other equally conceivable relations. Thus quality is possible only through selection—but selection is necessary because of complexity. We will come back to this in the discussion of the concept of complexity.

Elements are often described as if they could be identified only analytically, as if their unity were a unity only for the purpose of observation, planning, or design. This way of speaking, however, has not been sufficiently reflected epistemologically (nor has the accompanying talk of "merely analytical" systems, structures, etc.). It seems to revert to the mathematical world picture of the early-modern period, within whose framework units of measurement, standards, and aggregates could be chosen arbitrarily and only for the purpose of application. As soon as one goes beyond quantitative theory toward qualification, one can no longer forgo considering that and how systems qualify as elements the elements that compose them.

The position that has been traditionally opposed is equally unacceptable, however: namely, the idea of the ultimately substantial, ontological character of elements. In contrast to what the ordinary language and the conceptual tradition suggest, the unity

of an element (e.g., an action in an action system) is not ontically pre-given. Instead, the element is constituted as a unity only by the system that enlists it as an element to use it in relations.[21] In modern science, this de-ontologizing and functionalizing of the description of elements was initiated in the mathematization of the natural sciences. One can count and always further analyze so long as an operative need for this exists. Even action theory has accepted this perspective, although it has not enlisted mathematics as a theoretical technique. Actions, too, owe their unity to the relational structure of the system in which they are constituted as actions.[22] We will return to this later.

By contrast to the scholastic concept of relation, which was considered to have little value because relations referred to things other than themselves, this change leads to a reassessment of the ordering value of relations. Above all, however, it relativizes the concept of element. If one were to ask what elements (e.g., atoms, cells, or actions) "are," one would always come upon highly complex facts that must be attributed to the system's environment. Then an element would be what functions for a system as a unity that cannot be further dissolved (even if, viewed microscopically, it is a highly complex compound). When one says "cannot be further dissolved," this also means that a system can constitute and change itself only by interrelating its elements, not by dissolving and reorganizing them. One need not accept this limitation, which is constitutive for the system itself, in observing and analyzing systems. But if one bypasses it and, for example, aims for a neurophysiological analysis of actions, then one must sublate the system/environmental difference that holds for the system and move to a different level of system formation.

Whether the unity of an element should be explained as emergence "from below" or as constitution "from above" seems to be a matter of theoretical dispute. We opt decisively for the latter. Elements are elements only for the system that employs them as units and they are such only through this system. This is formulated in the concept of autopoiesis. One of the most important consequences is that systems of a higher (emergent) order can possess less complexity than systems of a lower order because they determine the unity and number of the elements that compose them; thus in their own complexity they are independent of their material

substratum. This also means that the complexity that is necessary or sufficient to a system is not predetermined "materially," but rather can be determined anew for every level of system formation with regard to the relevant environment. Thus emergence is not simply an accumulation of complexity, but rather an interruption and new beginning in the constitution of complexity. Accordingly, we take the unity of an action to be not a psychological, but a sociological fact; it does not emerge through the decomposition of consciousness into the smallest unities that cannot be dissolved further, but rather through the social process of attribution.[23]

5. Out of the relation among elements emerges the centrally important systems-theoretical concept of *conditioning*. Systems are not merely relations (in the plural!) among elements. The connections among relations must also somehow be regulated.[24] This regulation employs the basic form of conditioning. That is to say, a determinate relation among elements is realized only under the condition that something else is or is not the case. Whenever we speak of "conditions" or "conditions of possibility" (in the epistemological sense), this is what we mean.

In this sense, relations among elements can condition themselves reciprocally; one occurs only when the other also occurs. Conditioning can also concern the availability of specific elements, the presence of catalytic agents, or the realization of higher-level relations among relations: for example, "forms" in the sense employed by Marxist theory. Thus the minimal system is a mere collection of relations among elements. This is conditioned by a rule of inclusion or exclusion, as well as by the conditions of denumerability—for example, of holding the series constant during the denumeration. We assume, without being able to provide a secure theoretical justification, that systems must at least be collections of relations among elements, and that they typically distinguish themselves through further conditionings and therefore through greater complexity.

Successful conditionings, which are achieved by the emergence of what they enable, work as *constraints*. Even if they are introduced contingently, one cannot reject them without destroying what they make possible.

6. Next, we would like to introduce the problem of *complexity* and then resume the analysis of system/environment relations to-

gether with the enrichments that result from considering this concept.[25]

Complexity is the perspective from which the problems experienced by contemporary systems research can perhaps be expressed most forcefully.[26] In its function of catalyzing these experiences, it often is used without proper definition.[27] This hinders one from working with the concept in a way that can be controlled. We choose, not without suggestions from the literature on the subject, a problem-oriented concept and define it using the concepts element and relation.[28] This enjoys the advantages of making the concept applicable to what is not a system (environment, world) and, because the term is defined without using the concept of system, of enriching systems-theoretical analyses with additional perspectives. But the connection with systems theory is retained through the premise sketched above, that whatever functions at any time as an element cannot be determined independently of systems. This includes the familiar thesis that "organized complexity" can come about only through system formation, because "organized complexity" means nothing more than complexity with selective relations among its elements.[29]

If one starts out from this basic conceptual (but systems-related) difference between element and relation, then one immediately sees that, when the number of elements that must be held together *in a system* or *for a system as its environment* increases,[30] one very quickly encounters a threshold where it is no longer possible to relate every element to every other one.[31] A definition of complexity follows from this: we will call an interconnected collection of elements "complex" when, because of immanent constraints in the elements' connective capacity, it is no longer possible at any moment to connect every element with every other element. The concept of "immanent constraint" refers to the internal complexity of the elements, which is not at the system's disposal, yet which makes possible their "capacity for unity." In this respect, complexity is a self-conditioning state of affairs: the fact that elements must already be constituted as complex in order to function as a unity for higher levels of system formation limits their connective capacity and thus reproduces complexity as an unavoidable condition on every higher level of system formation. Leaping ahead, we may hint at the fact that this self-reference of complexity is then "internalized" as the self-reference of systems.

Complexity, in this sense, means being forced to select; being forced to select means contingency; and contingency means risk. Every complex state of affairs is based on a selection of relations among its elements, which it uses to constitute and maintain itself. The selection positions and qualifies the elements, although other relations would have been possible. We borrow the tradition-laden term "contingency" to designate this "also being possible otherwise." It alludes, too, to the possibility of failing to achieve the best possible formation.

The obligation to make selections and the conditioning of selections permit one to explain how very different kinds of systems can be formed out of a substratum of very similar units (e.g., a few types of atoms, or very similar human organisms). Thus the complexity of the world—of its species and genuses, its system formations—emerges through the reduction of complexity and through the selective conditioning of this reduction. Furthermore, this is the only way to harmonize the duration of what functions as an element with the self-regeneration of the system.

With this, the abstract theory of complex interconnections arrives at the point where it must engage evolutionary and systems-theoretical explanations. One cannot deduce from complexity alone which relations among elements are realized; that results on each level of system formation from the difference between system and environment and from the conditions under which that difference proves itself evolutionarily. From the reverse perspective, however, the concept of complexity can help to clarify the system/environment difference. Establishing and maintaining the difference between system and environment then becomes the problem, because for each system the environment is more complex than the system itself. Systems lack the "requisite variety" (Ashby's term) that would enable them to react to every state of the environment, that is to say, to establish an environment exactly suited to the system. There is, in other words, no point-for-point correspondence between system and environment (such a condition would abolish the difference between system and environment). This is why establishing and maintaining this difference despite a difference in degree of their relative complexities becomes the problem. The system's inferiority in complexity must be counter-balanced by strategies of selection. The system's own complexity already forces it to make selections; the order the sys-

tem chooses in relating its elements results from the difference in complexity between it and its environment. Both aspects can be analytically broken down in this way. But they form two sides of the same fact, because a system can become complex only by selecting an order.[32]

The premise that for each system the environment is more complex than the system itself does not require a constant difference in the degree of complexity. In general it is true, for example, that evolution is possible only when a sufficient complexity of system-environments exists, and in this sense evolution is the co-evolution of systems and environments. Greater complexity within systems is possible because the environment does not manifest random distribution but is structured selectively by systems in the environment.[33] Thus one must interpret the relationship of complexity between system and environment as one of intensification and investigate the factors on which intensification and new balancing depend.

To combine the problem of complexity and systems theory, as we propose here, requires a renewed treatment of the concept of complexity. In what sense can one speak of difference in complexity, difference in degree of complexity, and reduction of complexity if complexity is defined as the necessity of making selections?[34] The literature focuses on the difficulties of measurement produced by an obviously multidimensional concept.[35] Our problem, however, concerns the more basic question of how to relate the in itself complexly constructed concept of complexity to systems.

Measurement and comparison can start with the number of elements or with the number of the relations in effect among them. One can always speak of greater or lesser complexity (difference in complexity, difference in degree of complexity) if lesser complexity exists in both respects. This is so for the relationship between a system and its environment. In a narrower sense, one should speak of a reduction in complexity if the framework of relations forming a complex nexus is reconstructed by a second nexus having fewer relations.[36] Only complexity can reduce complexity. This can occur either in a system's external or in its internal relations. Such reduction explains how a myth, constrained by the possibilities of oral narration, can preserve the world and the situational orientation of a tribe.[37] The loss of complexity must then be counterbalanced by a

better-organized selectivity (e.g., heightened demands for credibility). The reduction of complexity, like all instances of relating, starts with elements. But the concept of reduction only designates an instance of relating relations.

Viewed from the perspective of the history of theory, this complicated version of the problem of reduction became necessary because one had to give up the ontological concept of the element as the simplest unit of being (the atom), one that could not be further decomposed into smaller components. As long as such a unit (taking Being for granted) was accepted, one could interpret the reduction of complexity as a tracing back to such units and their relations. This is the sense in which today much of the dispute about "reductionism" is conducted. But its theoretical foundation disappeared when one was forced to admit that elements are always constituted by the system that is composed of them and owe their unity exclusively to the complexity of this system.[38] One then also had to give up the assumption of an ontological asymmetry between "simple" (nondecomposable, indestructible) and "complex" (decomposable, destructible). The questions accompanying this—for example, How is a "whole" composed of "parts"? and Where in this is the "more than the sum of its parts" to be found?—are replaced by a completely different understanding of complexity, one that must be formulated entirely as a difference in complexity. One must distinguish the incomprehensible complexity in a system (or its environment) that would result if one connected everything with everything else, from determinately structured complexity, which can only be selected contingently. And one must distinguish environmental complexity (in both forms) from system complexity (again in both forms); the system complexity is always lesser and must compensate by exploiting its contingency, that is, by its pattern of selections. In both cases the *difference* between two complexities is the real principle compelling (and therefore giving form to) selection; and if one does not speak of states, but rather of operations, then both cases are the *reduction of complexity*, namely, the reduction of one complexity by another.[39]

From the viewpoint of this necessity for reduction (which follows from complexity), a second concept of complexity has been developed. In this second sense, complexity is a measure for indeterminacy or lack of information. Viewed in this way, it is the

information that the system lacks fully to grasp and to describe its environment (environmental complexity) or itself (system complexity).[40] From the perspective of individual elements—for example, specific actions or information processing by systems—complexity is relevant only in this second sense, thus only as a horizon within which selections are made. And this second version can be used in meaning systems to re-introduce the system's complexity within the system: as a concept, as an unknown and therefore effective quantity, as a factor of anxiety, as the concept of uncertainty or risk, as problems of planning and decision, or as an excuse. The distinction between both concepts of complexity points to the fact that systems cannot grasp their own complexity (even less that of their environment) and yet can problematize it. The system produces and reacts to an unclear picture of itself.

It is worth remembering Kant at this point. Kant started with the assumption that plurality (in the form of sense data) is given and that unity must be constituted (synthesized). Only separating these aspects, thus posing complexity as a problem, makes the subject into a subject—indeed, into a subject of the connection between plurality and unity, not only into a producer of synthesis. Systems theory breaks with Kant's point of departure and therefore has no need for a concept of the subject. It replaces it with the concept of self-referential systems. Then it can say that every unity used in this system (whether as the unity of an element, the unity of a process, or the unity of a system) must be constituted by the system itself and cannot be obtained from its environment.

7. This amalgamation of the problematic of complexity and systems analysis is confirmed by a more precise interpretation of the function of system boundaries.[41] Systems have boundaries. This is what distinguishes the concept of system from that of structure.[42] Boundaries cannot be conceived without something "beyond"; thus they presuppose the reality of a beyond and the possibility of transcendence.[43] In common understanding, they have the double function of separating and connecting system and environment.[44] This double function can be clarified by means of the distinction between element and relation, a clarification that at the same time returns us to the thematic of complexity. As soon as boundaries are defined sharply, elements must be attributed either to the system or to the environment. Yet relations between

system and environment can exist. Thus a boundary separates elements, but not necessarily relations. It separates events, but lets causal effects pass through.

This long-established and indisputable concept of boundary is the prerequisite for newer developments in systems theory, which no longer interpret the distinction between open and closed systems as an opposition of types but rather regard it as a relationship of intensification.[45] Using boundaries, systems can open and close at the same time, separating internal interdependencies from system/environment interdependencies and relating both to each other.[46] Boundaries are thus an evolutionary achievement par excellence; the development of all higher-level systems, above all the development of systems with internally closed self-reference, presuppose them.

Boundaries can be differentiated as specific mechanisms with the specific purpose of separating yet connecting. They assume this function via particular performances of selection. The eigen-selectivity of boundary mechanisms, boundary zones, and boundary lines reduces not only the external but also the internal complexity of a system,[47] with the result that a contact mediated by boundaries cannot convey to any system the full complexity of another, even if its capacity for processing information would otherwise be sufficient.[48] A system's internal organization for making selective relations with the help of differentiated boundary mechanisms leads to systems' being indeterminable for one another and to the emergence of new systems (communication systems) to regulate this indeterminability. Given the abstract concept of boundary, the concept of the difference between system and environment, one cannot decide whether the boundary belongs to the system or to the environment. Viewed logically, the difference itself is something third.[49] If one includes the problem of the difference in degree of complexity as an aid to interpretation, however, then one can relate boundaries to the function of stabilizing this difference in degree, for which only the system, not the environment, can develop strategies. Viewed from the system's perspective, they are "self-generated boundaries"[50]—membranes, skins, walls and doors, boundary posts and points of contact.

Next to systems' constituting their own elements, boundary determination is the most important requirement of system dif-

ferentiation. Boundaries count as adequately determined if problems concerning their location or the assignment of events as being inside or outside of them can be solved using the system's own means—for example, if an immune system can use its own modes of operation to discriminate, in effect, between internal and external, or if the societal system, which is composed of communications, can decide by communication whether something is communication or not. For a (scientific) observer, where the boundaries lie may still remain analytically unclear, but this does not justify viewing the bounding of systems as a purely analytical determination.[51] (The situation is quite different, naturally, if it is a question of bounding research objects!) An observer interested in reality remains dependent here on the system's operative possibilities of determination.

From the perspective of the dynamics of development, boundaries are performances that can be intensified. We have indicated this aspect with the concept of system *differentiation.* The formation of boundaries interrupts the continuity of processes that connect the system with its environment. The intensification of boundary performance consists in multiplying the ways in which this occurs. The discontinuities thereby created can be thoroughly regulated, and they enable a system to calculate its contacts with the environment. Given clearer differentiation, system observers can perceive more continuities between system and environment and more continuous processes (e.g., acts determined by socialization) than the system itself lays down as the basis of its own praxis.

The distinction established above, between the environment as a whole and the systems in a system's environment, explains how boundaries are put under pressure to improve their performance, that is, explains how a more exacting determination and preservation of boundaries becomes necessary. System boundaries always separate out an environment, but the requirements for this vary if the system must distinguish other systems (and their environments) within its own environment and adjust its boundaries to this distinction. In the simplest case, the system treats its environment as another system. Thus national boundaries are frequently conceived as boundaries with another nation. But this becomes increasingly illusory when relations with an economic, political, scientific, or educational "abroad" no longer correspond to these

same national boundaries.[52] Under such circumstances, the boundary definition moves inside; this is confirmed in self-referentially closed systems, which determine their boundaries by their mode of operation and mediate all contact with the environment through other levels of reality.

8. The conceptual distinction between (the concept of) system and (the concept of) complexity is central to the following analyses, because they concern complex systems. Anyone who cannot distinguish between system and complexity is denied access to the domain of ecology. Ecology has to do with a complexity that is not a system because it is not regulated by a system/environment difference of its own.[53] This is why it is so difficult, in this case, to understand the *unity* of the plurality, a unity that is not produced as a self-referential system but rather is constituted by observation and intervention. We will return to this in Chapter 10.

Here we would like to introduce some examples, especially the concept of *adaptation*, to illustrate how the interplay of system analysis and complexity analysis restructures the classical conceptual arsenal of systems theory and leads up to a theory of self-referential systems. Originally this concept designated a simple system/environment relationship. According to it, a system had to adapt to its environment in order to survive. The impulse to reverse this was irresistible: the environment could also be adapted to the system; at the least, it had to be suited to the development of systems.[54] On the theoretical level this reversal immediately led to a tautology: systems could adapt to the environment if the environment were adapted to the system, and vice versa.

Once the productive tautology reached this stage, one had to look around for a remedy. Understanding of the problems of structured complexity had increased at almost the same time so that was what one fell back upon. This theoretical development then gave impetus to the transition from the paradigm of system/environment to the paradigm of self-reference.

Complex systems must adapt not only to their environments but also to their own complexity. They must cope with internal improbabilities and inadequacies. They must develop mechanisms that build precisely on those failings, such as mechanisms that reduce deviant behavior, behavior that becomes possible only when there are dominant basic structures. Complex systems are forced to

adapt to themselves, in the double sense of adapting to their own complexity.[55] This is the only way to explain why systems cannot seamlessly follow the changes in their environments, but rather must make allowances for different adaptive viewpoints and ultimately collapse because of self-adaptation.

The concept of *selection* also changes when one considers complex systems. Selection can no longer be conceived as carried out by a subject, as analogous with action. It is a subjectless event, an operation that is triggered by establishing a difference. Here Darwin is again the most important forerunner, because he conceived of evolutionary selection, not as occurring out of a will to order, but as occurring out of the environment. The philosophy of contingency and pragmatism built on this insight gave the greatest possible ontological scope to this understanding of selection, and even sociology has not escaped its influence.[56] Ever since, selection has been a basic concept of every theory of order, and one has thereby avoided reverting to a system that explains the existence of order on the grounds of its own overriding power to order.[57] We replace this reduction with the reduction to difference. All selections presuppose constraints. A guiding difference arranges these constraints, for example, from the viewpoint useful/unuseful, without specifying the selection itself. Difference does not determine what must be selected, only that a selection must be made. Above all, the system/environment difference seems to be what obliges the system to force itself, through its own complexity, to make selections. Thus the theory of self-referential systems has been prepared for in the semantic range of "adaptation" as well as in that of "selection."

9. The next central theme to be addressed is *self-reference*. It has attracted rapidly growing attention in the most recent systems research, where it has also gone under the names self-organization and autopoiesis.[58] Corresponding concepts have even found their way into sociological theories that do not go by the name of systems theory.[59] Here the concept of self-reference (reflection, reflexivity) is detached from its classical location in human consciousness or in the subject and transferred to the domain of objects, namely, to real systems as the object of science.[60] One thereby gains a certain distance from the purely logical difficulties of self-reference. These difficulties merely signify that there are systems in

the real world whose description by other systems leads in those systems (!) to undecidable logical contradictions.[61]

The concept of self-reference designates the unity that an element, a process, or a system is for itself. "For itself" means independent of the cut of observation by others. The concept not only defines, but also contains a significant statement, for it maintains that unity can come about only through a relational operation, that it must be produced and that it does not exist in advance as an individual, a substance, or an idea of its own operation.

The concept can and must be understood very broadly—in accordance with what one means by "self" and how one interprets the reference. One can, for example, speak of self-intending acts (in which intending is what constitutes the act) or of self-contained sets (in which containing is what constitutes the set). The reference then uses precisely the operation that constitutes the self and under this condition is either superfluous or paradoxical. It becomes paradoxical if the possibility of negation is added and one can relate the negating either to the referring or to the self that is referred to, yet cannot decide between these two possibilities on the basis of self-reference. Becoming paradoxical means losing determinacy, thus connectivity for further operations. Self-reference is in itself nothing bad, forbidden, or to be avoided[62] (or, more precisely, something that is permissible only in a subject and that must remain locked up inside it), but when self-reference leads to paradoxes, additional precautions must be taken to ensure connectivity.

This problem points directly to system formation. At the same time, it enlarges the analytical instrumentarium of systems theory beyond the problem of complexity. Self-reference possesses indeterminable complexity in the form of paradox. Self-referentially operating systems can become complex only if they succeed in solving this problem and thus in de-paradoxicalizing themselves.

One can call a system self-referential if it itself constitutes the elements that compose it as functional unities[63] and runs reference to this self-constitution through all the relations among these elements, continuously reproducing its self-constitution in this way. In this sense, self-referential systems necessarily operate by self-contact; they possess no other form of environmental contact than this self-contact. The theory of recurrence is contained herein as the thesis of the elements' indirect self-reference: the elements enable a

relation through other elements back to themselves, such as an intensification of neuronal activity or a determination of actions via expecting those actions. On the level of this self-referential organization, self-referential systems are *closed* systems, for they allow no other forms of processing in their self-determination. Thus social systems have no use for consciousness, and personal systems no use for frequency changes in the neuronal system (which, of course, does not deny that what is not used is a condition of possibility for the system, namely, the infrastructural condition of possibility for constituting its elements).

In order to clarify how much this concept of basal self-reference differs from an earlier discussion of "self-organization," Maturana and Varela have proposed the designation "autopoiesis" for it.[64] The scope of this conceptual reshuffling and its connection to problems that have been discussed in the philosophy of consciousness and in *Lebensphilosophie* (Fichte, Schelling) cannot at present be assessed with certainty. In any event, for systems theory it is a far-reaching conceptual cut, which transfers self-reference from the level of structural formation and structural change to that of the constitution of elements.

Autopoiesis does not necessarily presuppose that the environment of a system is completely devoid of the types of operations by which the system reproduces itself. In the environments of living organisms there are other living organisms, in the environments of consciousnesses, other consciousnesses. But in both cases the system's own process of reproduction can be used only internally. One cannot use it to knit together system and environment, to tap another life or another consciousness and transfer it into one's own system. (Organ transplants are a mechanical intervention and not a case that we exclude here, namely, one in which life procures life, as life, for itself.) With social systems, this situation differs in two ways. On the one hand, there is no communication outside the communication system of society. This system is the only one employing this type of operation, and to that extent it is, as a matter of fact, necessarily closed. On the other, this does not hold for all other social systems. They must define their specific mode of operation or determine their identity by reflection to be able to regulate which internal meaning-units enable the self-reproduction of the system and thus are repeatedly to be reproduced.

Taking this important distinction into consideration, one may ask whether it makes any sense to bridge it on the level of general systems theory with the help of a general concept of autopoietic systems. We believe that this general concept is possible, indeed necessary—in part because it enables one to combine a significant number of statements about such systems, in part because it points to an evolutionary connection within which the special position of the societal system, on the one hand, and its internal problems of delimitation, on the other, have developed.

One of its most important consequences lies in the domain of epistemology: even if the elements that compose a system are constituted as units by the system itself (however complex the "substructure" may be in terms of energy, material, or information), there is no fundamental common ground among systems. Whatever functions as a unit cannot be observed from outside, only inferred. Every observation must hold to difference schemata that enable it to draw conclusions about what, in distinction to other things, functions as a unit. No system can decompose another analytically to arrive at final elements (substances) in which knowledge could find an ultimate foothold and secure correspondence with its object. Instead, every observation must employ a difference schema whereby the unity of difference is constituted in the observing system and not in the observed one. This by no means excludes self-observation, but self-observation must be carefully distinguished from the unity of the reproduction of the system's units (autopoiesis).

Reproduction that is self-referential, "autopoietic" on the level of its elements, must adhere to the type of element that the system defines. To this extent, it is *re*production. Thus action systems must always reproduce actions, not cells, macromolecules, ideas, and so forth. This is what the self-reference of the elements guarantees.[65] Certain limits are thereby placed on variation. Ashby has spoken in this sense of a system's "essential variables."[66] But only complexes that have not yet been fully determined by those limits to variation, that is, complexes for which there is not just one design, come into consideration as elements of complex systems. Only by adequate openness within a given framework can structures be developed that further constrain which position and which function individual elements observe.

For the entire domain of environmentally open (e.g., psychic or social) systems, the basic problem to which theory refers changes with the transition from "self-organization" to "autopoiesis." As long as one begins with the problem of structural formation and structural change and sees a system's dynamics therein, one will accord fundamental theoretical rank to approaches within a theory of learning.[67] The problem then will lie in the particular conditions under which the *repetition* of a similar action or the *expectation of the repetition* of a similar experience is likely. For a theory of autopoietic systems, by contrast, the pre-eminent question is: How does one get from one elemental event to the next? Here, the basic problem lies not in *repetition* but in *connectivity*. The differentiation of a self-referentially closed network of reproduction proves to be indispensable exactly in view of this problem of connectivity; and it is possible to formulate problems of the formation and change of structure only in respect to a system formed by such a network. It is structures, in other words, that must make possible the connectivity of autopoietic reproduction if they do not want to give up the basis for their own existence, and this limits the domain of possible changes, of possible learning.

An important structural consequence that inevitably results from the construction of self-referential systems deserves particular mention. This is *abandoning the idea of unilateral control*. There may be hierarchies, asymmetries, or differences in influence, but no part of the system can control others without itself being subject to control. Under such circumstances it is possible—indeed, in meaning-oriented systems highly probable—that any control must be exercised in anticipation of counter-control. Securing an asymmetrical structure in spite of this (e.g., in power relationships internal to the system) therefore always requires special precautions.[68]

In part, this problematization of control is counterbalanced by accentuating *self-observation*. In this context, namely, on the level of general systems theory, observation means nothing more than handling distinctions.[69] Only in psychic systems does the concept presuppose consciousness (one could even say that observations occasion the emergence of the systemic medium consciousness). Other systems must acquire their own possibilities of observation. Accordingly, self-observation is the introduction of

the system/environment distinction within the system, which constitutes itself with the help of that distinction; self-observation is thus the operative factor in autopoiesis, because for elements to be reproduced, it must be guaranteed that they are reproduced as elements of the system and not as anything else.

The concept of a self-referentially closed system does not contradict the system's *openness to the environment*. Instead, in the self-referential mode of operation, closure is a form of broadening possible environmental contacts; closure increases, by constituting elements more capable of being determined, the complexity of the environment that is possible for the system. This thesis contradicts both the classical opposition of closed and open systems[70] and the concept of autopoiesis developed by Maturana, which requires an observer as another system in order to produce system/environment relations.[71] If one formulates the concepts of observation and self-observation on the level of general systems theory and, as suggested, combines them with the concept of autopoiesis, then self-observation becomes the necessary component of autopoietic reproduction. On this basis, one can then distinguish between, on the one hand, organic and neurophysiological systems (cells, nervous systems, immune systems, etc.) and, on the other, psychic and social systems, which are constituted by the production and processing of meaning. The fundamental law of self-reference holds for all these levels of system formation, but for the former group it holds in a more radical, more exclusive sense than for meaning systems. Meaning systems are completely closed to the extent that only meaning can refer to meaning and that only meaning can change meaning. We will return to this in Chapter 2. But unlike nervous systems, structures and processes that employ meaning can include system boundaries and environments, which take on meaning within the processes of a self-referential system (not in themselves!), so that such systems can operate internally with the difference between system and environment. For all internal operations, meaning enables an ongoing reference to the system itself and to a more or less elaborated environment; the choice of the main focus of orientation can thereby be held open and left to the connecting operations that reproduce meaning through internal and external references. Here one can see clearly the evolutionary advance provided when "meaning" was achieved as the basis of a

self-referentiality in system building for which there was then no stopping. It resides in a new way of combining closure and openness in constructing systems, in other words, in the combination of the system/environment difference and self-referential system building.

Within the special domain of meaning systems that will interest us in what follows—though only in one instance, social systems—assigning meaning to the environment (e.g., external attribution of causality) can solve the problem of circularity inherent in all self-reference. Self-reference and the ensuing interdependence of all elements of meaning are preserved; however, reference to the environment is employed internally to interrupt interdependence.[72] The system asymmetricizes—itself!

10. Self-reference presupposes a principle that one could call *multiple constitution.* We will treat this idea in more detail from the perspective of "double contingency," and so here we will restrict ourselves to a few remarks outlining its foundations in general systems theory.

In the literature, one speaks of dialogue or of mutualistic (and as such, "meaning-tight") systems[73] or of conversation.[74] These mean that (at least) two complexes with divergent perspectives are required to constitute whatever functions in the systems as a unity (unit or element). In reverse, this means that, for analysis of the system, such a unity cannot be dissolved into the divergent complexes constituting it. To be sure, one can investigate the repercussions of this mutualistic-dialogical, conversational unity and its "language" on the complexes constituting it, can, for example, investigate to what extent and within what boundaries these repercussions allow their "individualization." One feels distantly reminded of "dialectics," but this is definitely not to say that the unity's constitution requires the negation of a contradiction between perspectivally different complexes—it can just as easily be a matter of complementary expectations of different kinds of behavior, as Parsons set down in the general theory of action systems.

In systems theory the thesis of multiple constitution has the effect of making the concept of communication more basic and consequently of determining the concept of complexity differently from the sociological tradition. This change away from earlier ways of thinking is so important that we must go into it in more

detail.[75] One can speak of communication, however technical the trappings of the process may appear, only if a change in the state of complex *A* corresponds to a change in the state of complex *B*, even if both complexes had other possibilities for determining their states. To this extent, communication means limitation (placing oneself and the other within limits).[76] This concept of communication can be built into a theory of complex systems only if one gives up the long-established idea that systems exist as elements *and* relations among these elements. It is replaced by the thesis that, because of complexity, carrying out the process of relating elements requires selections, and thus relationship cannot be simply added onto the elements. With those selections, the process of relating qualifies elements by cutting off some of their possibilities. In other words, the system contains, as complexity, a surplus of possibilities, which it self-selectively reduces.[77] This reduction is carried out through communicative processes, and therefore the system needs a "mutualistic" basic organization—that is, attribution of its elements to complexes that are capable of communication.

Furthermore, this requirement that self-referentially processible unities be multiply constructed complicates anew the system/environment thematic. What we cautiously and indeterminately named "complexes with divergent perspectives" must be presupposed in the constitution of elements and of relations among the elements of systems; thus it cannot be conceived as the combination of such elements and relations. Nor can it be a part of the system; instead, it belongs to the system's environment. This holds for brain cells in the nervous system and for persons in social systems.[78] We will return to this special problematic from the perspective of "interpenetration" in Chapter 6.

11. One of the most important consequences of the transition to a theory of self-referential systems concerns the operative level, or system processes. On the level of elements, self-reference means that these connect up by referring back to one another and that interconnections or processes thereby become possible. But this can occur only if the types of element are sufficiently similar. Therefore, to cite an extreme case, no system unity can exist between mechanical and conscious operations, between chemical operations and those that communicate meaning. There are ma-

chines, chemical systems, living systems, conscious systems, and (social) systems that communicate via meaning; but no system unities encompass all these at once. A human being may appear to himself or to an observer as a unity, but he is not a system. And it is even less possible to form a system out of a collection of human beings. Such assumptions overlook the fact that the human being cannot even observe what occurs within him as physical, chemical, and living processes.[79] The living system is inaccessible to the psychic system; it must itch, hurt, or in some other way attract attention in order to stir another level of system formation—the consciousness of the psychic system—into operation.

Thus autopoietic reproduction depends on an adequate homogeneity of system operations, and these define the unity of a determinate type of system. Of course, one can comprehend and observe things from other perspectives; but one cannot observe self-referential system constitution if one does not hold to the type of process and system thus given.

12. From self-referential system relationships, an immense extension of the boundaries of structural adaptability and of the corresponding scope of system-internal communication can be induced. The principle of this extension can best be conceived by starting with the concept of information. Information occurs whenever a selective event (of an external or internal kind) works selectively within the system, namely, can select the system's states. This presupposes a capacity for being oriented to (simultaneous or successive) differences that appear to be bound to a self-referential operational mode of the system. "A 'bit' of information," as Bateson says, "is definable as a difference which makes a difference."[80] This means that the difference *as such* begins to work if and insofar as it can be treated as information in self-referential systems.

Therein lies an immense extension of possible causalities and a displacement of the structural problematics under their control. The extension goes in two directions. On the one hand, given the capacity to process information, things that are not present can also have an effect; mistakes, null values, and disappointments acquire causality insofar as they can be grasped via the schema of a difference. On the other, not just events but facts, structures, and continuities stimulate causalities insofar as they can be experienced as differences. Remaining unchanged can thus become a cause of

change.[81] Structural causality makes self-determination possible. Systems can store up possibilities of affecting themselves and, with the help of schemata that employ differences, can retrieve these at need.[82] It should be noted, however, that structure does not operate as such, on the basis of a force dwelling within it. It merely enters into the experience of difference, which makes information possible, without necessarily determining what will take place there. Thus a system creates its own past as its own causal basis, which enables it to gain distance from the causal pressure of the environment without already determining through internal causality what will occur in confrontations with external events. One realizes the scope of this evolutionary achievement when one considers that living systems depend on genetic determination for the autonomy of life.

As a result of all this, the operational mode of self-referential systems changes into forms of causality that to a large extent reliably prevent it from being steered from outside. All the effects that one wishes to achieve *ab extra* either in the system or with it assume that the system can perceive impulses from without as information—which is to say, as the experience of difference—and can in this way bring about an effect. Such systems, which procure causality for themselves, can no longer be "causally explained" (except in the reductive schema of an observer), not because their complexity is impenetrable, but on logical grounds. They presuppose themselves as the production of their self-production.[83]

III

We have not yet considered a further theme, which multiplies all problems: time.

Every systems theory that claims to relate to reality must begin with the fact that nothing remains as it is. There is change. Systems are especially sensitive to changes, and therefore for some systems time exists as an aggregate designation for all change. We willleave open what time "is," because probably no concept of time that goes beyond the mere fact of changing can be determined without a system reference. A mere chronological concept of time, in the sense of a measure of motion with respect to a before and an after, is not adequate either, because it cannot satisfactorily reconstruct the

problems that systems have in time and with time. Therefore we will begin with these problems and rely on the perspectives of the system/environment difference, complexity, and self-reference to guide us.

1. The connection between complexity and selection with which we begin does not describe a state. It already implies time; it comes to be only through time and in time. In complex systems, time is the basis of the pressure to select, because if an infinite amount of time were at one's disposal, everything could be brought into tune with everything else. Viewed in this way, "time" symbolizes the fact that whenever anything determinate occurs, something else also happens, so that no single operation can ever gain complete control over its circumstances. Furthermore, selection itself is a temporal concept: it is imminent, is required, is performed, and finally is past. Selection enlists time in order to maintain itself in an already temporalized environment. One could say that selection is the dynamic of complexity. Every complex system must adapt itself to time—in whatever operatively graspable form this requirement takes for the system.

2. In this fundamental, operative approach to the temporality of systems, everything that can be designated "change" is already a special, derivative problem. It concerns structures alone. The concepts of reversibility and irreversibility have meaning only in reference to change. Changes can be either *reversible* or *irreversible*. The boundary between them cannot be drawn sharply, since reversal requires an expenditure of time, tradeoffs, and the acceptance of certain irreversibilities. But the problem that *both* reversibility and irreversibility occur is not affected by, but rather confirms, this indeterminacy. Whatever time may "be," it does not require irreversibility.

To the extent that time initially is given only as change, it is given as reversible and irreversible. The irreversibility of time, which today we so often assume, is an abstraction from a space/time continuum encompassing what is reversible and irreversible; as an abstraction, it is not only a concept, but also a fact of the macroscopic order of nature.[84] But time itself (and, as we will see later, "the present") is originally given in a fuzzy manner and leaves room for a transformation of irreversibilities into reversibilities of a higher order and vice versa.

Nevertheless, because of the way in which the macrophysical world is ordered, the presentation and experience of time via the metaphor of irreversibility is preferred. This has led to the idea of a second world with a time running opposite to ours, a world inaccessible to us because everything that wants to come into our world from that one is returned to it because of our time.[85] Obviously, time must be asymmetricized through evolution to make order possible.

In any event, time does not present itself from every temporal point as indifferent to a forwards and backwards. The possibility of return or restoration does not contradict time, but rather superimposes itself on an "in itself" irreversible temporal course. Only to the extent that time appears to be irreversible can it be interpreted as an ongoing present with respect to a difference between the future and the past. This then leads to a differentiation (not valid for all systems) of a specific temporal dimension, to which further evolutionary achievements can connect. Seen from our point of departure, this preference for irreversibility appears to need explanation, and systems theory and evolutionary theory can explain the function of the one-sided irreversibility of time.

3. Given the difference in degree of complexity between it and its environment, a complex system, seen temporally, cannot rely on point-for-point correspondences with the environment. It must *give up the idea of full synchronization with the environment* and must be able to compensate for the risk of momentary noncorrespondence that this entails. "The processes which maintain this distinctiveness cannot simply presume to involve instantaneous adjustment, but *take time*."[86] Thus it must be possible to set up time shifts within the relationship of system and environment: the mutual adjustments, corrections, or supplementations need not necessarily occur at the same time or follow one another continuously. Systems can prepare reactions and store them for when they are needed; they can react to momentary opportunities or disturbances with longer-term processes or even defer the reaction without breaking down in the meantime. Solving the problem of time is possible only under determinate structural conditions, which systems that want to exist in an environment rich in variation must satisfy; they must above all limit internal interdependencies.[87] This directly affects complexity and self-reference.

The necessity of this differentiation results from the complexity of large systems' combinatory possibilities. No system can realize the logical possibility of connecting every element to every other one. This is the point of departure for any reduction of complexity.[88] If a system wants to hold open all combinatory possibilities or even to realize them at the same time, either it must remain very small or it must order and reinforce its selective relations. This occurs through the *reflexivity of the process of selection.* The process addresses itself before finally making a concrete choice, that is, one on the level of the ultimate elements of the system. Two different forms are available for this: *structure* and *process.* Both mutually presuppose each other, because under increasingly demanding conditions (i.e., those not determined purely by chance), structuring is a process, and processes have structure. They differ through their relation to time.

The actual temporality of structures and processes requires a more precise determination. It would be wrong simply to understand structures as atemporal and processes as temporal. The oppositions of static versus dynamic or constant versus changing are equally unsuitable.[89] The difference between structure and process reconstructs the original (= environmentally conditioned) difference between reversibility and irreversibility within a time that is ordered irreversibly.[90]

Structures capture the reversibility of time because they hold open a limited repertoire of possibilities for choice. One can negate structures, or change them, or with their aid gain security for changes in other respects.[91] Processes, by contrast, mark the irreversibility of time. They are composed of irreversible events.[92] They cannot run backwards. Both arrangements serve, though in different ways, to amplify selectivity in a material respect; that is, to preselect possibilities for choice. Structures comprehend the open complexity of the possibility that every element could be connected with every other one, in a narrower model of relations that are "valid," customary, predictable, repeatable, or whatever is preferred. Through this selection, they can instruct further selections, by reducing the constellations that can possibly be surveyed at any moment. Processes (and this defines the concept of process) result from the fact that concrete selective events build upon one another temporally, connect with one another, and thus build pre-

vious selections or predictable selections into individual selections as premises for selection. The preselection of what can be chosen is experienced as validity in the case of structure, but as the sequence of concrete events in the case of processes. Both arrangements of reflexive selection therefore direct the selection into domains that are relatively presupposed, thus relatively improbable, and *for this* they enlist time. Individual systems can attain more than minimal size and trivial complexity only if they possess both possibilities for amplifying selectivity, both structural and processual arrangements, and if enough time is at their disposal to do so.[93]

A system that controls its own structures and processes can assign *all* the elements that it produces and reproduces to these forms of amplifying selectivity. It can thereby regulate its own autopoiesis. Yet all possible elements cannot be included within the forms that amplify selectivity because of environmental conditions. Any attempt to include them functions merely as a difference schema. This means that, with regard to structures, one must reckon with conforming and deviant events, and, with regard to processes, with probable and improbable events. The gain in order here lies in that the system can orient itself to these differences and adjust its operations to them.

4. In particular, there are very different ways to solve the problem of gaining time. In relation to each other they are functionally equivalent; under complicated structural preconditions, they can reciprocally support as well as supplement one another. Each form has its own immanent developmental limits, but the combination of forms enables unforeseeable evolutionary advances.

First, there are mechanisms that make it possible to store up successful "experiences" for reuse. The structures (e.g., memory) that enable this abstract from points in time when danger or chance occurs. They react to the problem of time on the level of *whenever*. The simplest early forms of such mechanisms exist in systems that possess adequate complexity of their own for further development but can realize this prospect only in combination with a favorable environment.[94] Their possibilities are, so to speak, shut down until further notice and kept in store for a point in time when a chance combination of system and environment will give them the prospect of realizing themselves.

Second, there is *speed*: mechanisms that enable the system to

increase the tempo of its own processes vis-à-vis relevant environmental processes. Superior speed can be used for very different purposes—for example, to stimulate possible environmental processes and to prepare for eventualities, to retreat and recoup, or to avoid specializing in a way that is too sharply defined and thus too dependent on the environment. One who is faster can do something else in the meantime.

A third way to solve the problem could be called the *aggregation and integration of temporal relations.* It presupposes the capacity for a selective grasp of extremely complex states of affairs, which we will return to in the next chapter under the title "Meaning." It can be anticipated only in psychic and social systems, which are able to bring their relationships of complexity into the form of meaning. In principle, it concerns the capacity for actualizing what is temporally not actual, with the risk of remembering or anticipating incorrectly. The construction of such possibilities produces as a frame condition an aggregate idea of time, an interpretation of irreversibility in the sense of the difference between past and future and an exploitation of the present to integrate discrepancies that are grasped temporally. The classical title for this, *prudentia* as the feature that distinguished man from the animals,[95] also signified that there are strict limitations on the correct uses of this potential for actualizing what is not actual. Equally important is that on the one hand it conserves speed and on the other presupposes speed on other levels of systems and processes. The hedgehog and its mate, in their fake race with the hare, showing up in alternation at the turning points instead of actually running, possess, as a social system, *prudentia* in comparison with the hare: they can communicate quickly in a very selective way, while the hare can merely run quickly. Earlier societies seemed satisfied with such *prudentia.* Only in highly complex societies, only in the modern period, is interest in a time-transcending *prudentia* overtaken by interest in acceleration: the eighteenth century discovered that taste can judge more quickly than reason because it can individualize its criteria and can legitimate them by self-observation.

5. If the relative temporal autonomy of a system is secured by one or another combination of distancing mechanisms, then a system can use the temporal dimension to better solve the problems of its own complexity (as distinct from problems in connec-

tion with its environment) and, above all, to increase its own complexity through the use of time. We will call this the *temporalization of complexity.*[96]

The system adapts to the irreversibility of time by temporalizing its own complexity. By decreasing the temporal duration of its own elements or even reducing them to evanescent events, the system can join in the irreversibility of time. No longer at the mercy of such irreversibility, the system can copy it and internally allow only structures in a position to connect elements that are coming into being or passing away. In other words, a temporalized system forces itself, by the way in which it constitutes its elements, to observe the irreversibility of time.

Temporalization of complexity leads to a selective ordering of the connection between elements in temporal succession. In a more abstract formulation, the capacity to make selective relations can be greatly expanded if a system can establish an ordered difference between connections in temporal succession, a change of relational models according to internal and external demands. On the one hand, this requires abstraction of the structures that make it possible: they cannot be identical with the elementary relations themselves. On the other, it requires a temporalization of the ultimate elements of the system: they must be identified with reference to points in time, as events, information, or actions, and must thereby become subject to the irreversibility of time. The abstraction of structures makes possible, and the temporalization of elements requires, a constant change in relational models. An action does not remain an information; an event does not remain an event. Temporalized elements cannot be reinforced by repetition; they are determined from the outset to connect to *something different.* They can only actualize "current" connections, and therefore from moment to moment they create new situations, in which the system must choose between repetition and change. Systems of this kind are immanently restless, exposed to an endogenously generated dynamic and compelled precisely by this dynamic to themselves learn structures compatible with it.

As has already been mentioned, the temporalization of complexity comes about from the temporalization of a system's elements. The system is formed out of unstable elements, which endure only for a short time or even, like actions, have no du-

ration of their own but pass away in their very coming to be. Viewed chronologically, every element, of course, takes up a certain amount of clock time. But the system itself determines the length of time during which an element is treated as a unity that cannot be further dissolved; that period has a conferred, not an ontological character. Accordingly, an adequately stable system is composed of unstable elements. It owes its stability to itself, not to its elements; it constructs itself upon a foundation that is entirely not "there," and this is precisely the sense in which it is autopoietic.[97]

Nevertheless, such a system *exists* via its elements, thus via events. Outside of the elements, it has no basis for continuing (which is why we inevitably experience the present as so brief). Therefore one cannot separate the elements from the system, nor ever meaningfully distinguish them from the system; the event "is separate not from the whole, but in the whole."[98] The theoretically proper distinction is not element(event)/system, nor even element(event)/process, but element(event)/relation.

The theory of temporalization's most impressive consequence is that a new *interdependence of the disintegration and reproduction* of elements results. Systems with temporalized complexity *depend on constant disintegration.* Continuous disintegration creates, as it were, a place and a need for succeeding elements; it is a necessary, contributing cause of reproduction. Moreover, it supplies freely available material as a result of disintegration, for example, a labile chemical or physical combinatory capacity. As Zeleny so fortunately puts it, "Putting aside the notion of origin and examining an ongoing system, observe that disintegration 'produces' the substrate necessary for production, production 'produces' the catalyst necessary for itself and the links necessary for bonding, and bonding 'produces' the stuff necessary for disintegration."[99]

It follows that temporalized systems must be fast ("hot"), that they must bring about closure and a capacity for discrimination (self-observation), and that what will be preserved is just this closure and capacity for discrimination—in forms that can achieve the tempo required. One could even say that true system performance resides in *conditioning the interdependence of disintegration and reproduction.* A structure is then what can unfold, that is, extend yet constrain, this interdependence.

Thus *reproduction* is a continuous problem for systems with temporalized complexity. This theory is not concerned, like the classical theories of equilibrium, with returning to a stable state of rest after the absorption of disturbances, but with securing the constant renewal of system elements—or, more briefly, not with static but with dynamic stability. All elements pass away. They cannot endure as elements in time, and thus they must constantly be produced on the basis of whatever constellation of elements is actual at any given moment. Reproduction thus does not mean simply repeatedly producing the same, but rather reflexive production, production out of products.[100] To emphasize that we do not envision the unchanged preservation of a system, but rather an occurrence on the level of elements, which are indispensable for the preservation and change of the system, we will call the reproduction of eventlike elements *operation*. Below, whenever we speak of the "operations" of a system, this is what we mean.

6. The foregoing remarks on autopoietic reproduction under the condition of temporalized complexity lead to the concept of system-immanent *entropy*. For an observer, a system is entropic if information about one element does not permit inferences about others. The system is entropic for itself if in the process of reproduction, thus in the replacement of elements that have passed away, any possible successive element is equally probable. In other words, in entropy connectivity is not straitened and time is not won by the fact that not everything comes into consideration. Thus the concept indicates the limit case, in which the system reproduces itself out of itself purely by chance.

7. Systems with temporalized complexity have properties that one cannot find on their underlying levels of reality. They compel themselves to change their states constantly to minimize the duration of the elements that compose them. Thus, viewed temporally, they combine stability and instability and, viewed factually, determinacy and indeterminacy. Every element (event, action, etc.) is then *determinate and indeterminate at the same time*: determinate in its momentary actuality and indeterminate in its connectivity (which must, however, also be actualized in the moment). Insofar as this *combination is guaranteed* by the differentiation of a corresponding system, orderings *that are based on them* become possible.

Thus, for example, a system that forces itself to change its states

constantly must infer information from its environment, thus enabling itself to determine connecting states (*internally* connecting states!). If all elements are only events, self-reference alone does not provide adequate bearing for this. Certainly this is true of "purpose," of the drive to self-preservation, or of whatever else theories have advanced to derive an answer to this question from the description of systems themselves. The history of theory demonstrates that such answers end up tautologies. In the place of this history, we would like to set a system/environment theory. This means that the temporalization of complexity signifies dependence on a more exacting internal arrangement and, at the same time, increased dependency on information from the environment. The differentiation of the system is thereby intensified. It becomes, via an endogenously produced "irritability," more sensitive to selected aspects of its environment.

A second emergent characteristic concerns the system's internal orientation toward its own instability. Temporalization is possible only in self-referential systems. But this also means that the effects of temporalization must be built into self-reference. Not only is the system restless, but its own restlessness allows it no rest.[101] And restlessness about restlessness may increase restlessness. This raises two questions: Are there bounds to self-destabilization, such that a system could, in transgressing them, turn out to have evolved itself to the point of its own destruction? and How, when need be, are these bounds controlled? One can clarify the problem (including the accompanying one of how such bounds are replaced) by looking at the prices according to which exchanges in the economic system are carried out. Prices must, to a certain extent, be destabilized. They must be capable of changing from one moment to the next in order to make fluctuations in supply and demand generated outside the system communicable within it. If it had a rigid price structure (and the internal reaction to precisely this rigidity as a self-created certainty), the system would be locked into its own operational foundations in a way increasingly estranged from its environment. Yet the admission of instability raises the problem of its limits, especially if one also adds into the calculation internal reactions to instability. At first, the formulation of such limits availed itself of direct reference to moral values, thereby orienting itself according to the system reference of society. Prices ought to

be "just." This way of thinking had to be abandoned when the societal differentiation of the economic system increased. Both a purely economic solution ("a market economy") and a political one have been favored as a replacement. The two share a tendency to enlist the instabilities of other system levels and/or other systems —such as the cost of money or collectively binding decisions— thereby shifting the system's internal reactions to stability or instability accordingly.

If temporalization leads to the compression of determinacy and indeterminacy in momentary elements, to the internal processing of basal instability, to disturbance through restlessness and to structures that bridge time and thus presuppose change, then time is not the only thing that acquires a new kind of relevance for the system. The connections between temporal sequences and material differences raise new demands. We have already said that one basic aspect of temporality appears to be that somewhere else something different is always happening. And sequence is perceptible only if what comes after differs from what went before. This reciprocal ordering of temporal and material references seems to intensify as complexity is temporalized and as elements are taken to be momentary events. Temporal difference and material variety at once separate themselves more distinctly and become more interdependent. Presumably, this is an evolutionary takeoff point, a situation in which, initially as a superb simplification, meaning takes shape and arrives at the point where references in both material and temporal directions must, constrained by form, be joined together in anything that can become an operation.

The Old-European tradition designated this "motion." Its physics was, until Newton, a physics of motion, and even Hegel's system cannot do without that concept. Thus a single phenomenon was, via a single concept, so valorized that it blocked more precise analyses of the interdependence of temporal and material conditions for system operations. Today, one can—to the extent that one has developed other possibilities for conceptualizing temporal complexity—discern the problematic that arose when the metaphor of motion was borrowed to solve the problem.

We cannot develop this any further here. The structural significance of temporalization cannot be overestimated, and the state of sociological research into it is greatly deficient. From the inside,

restless systems are the precondition of higher levels of system formation. The temporalization of complexity begins far below the human world. Anything that can be built on such a restless foundation must be able to change fluctuation into stability. But this is not the only problem. The systems that then become possible (naturally, we think above all of social systems) require a dynamic environment with its own necessary presuppositions as the condition for the establishment and maintenance of a system's own complexity. We will come back to this in our discussion of "interpenetration."

IV

In our remarks so far we have given precedence to formulating problems and carefully avoided a structural determination of the theory itself. We have not presented any "models" to avoid the appearance of a theory that is already on its way to determining structures. We have limited ourselves to enriching an understanding of the problems confronting systems theory. This is a consequence of the concept of self-referential systems. At the same time, it secures points of departure for *functional analysis*.

The method of functional analysis that we will assume throughout is based on the concept of information. This method serves to obtain information. (Whether this also pertains to "explanation" depends on the account of the concept that one gives.) It regulates and specifies the conditions under which differences make a difference. In other words, we are concerned with a particular horizon of the lifeworld that is established with specific purposes and that subjects everything that normally happens in the processing of information (namely, the scanning of differences) to specific conditions and thereby gives it determinate form. Functional analysis is a kind of theoretical technique, like mathematics; it would fall under Husserl's verdict concerning mathematics,[102] had we not already eliminated the grounds for this verdict, namely, the assumption of a subject that underlies and supports meaning.

As with any choice of methods, indeed with any epistemology, there are clear affinities for specific theoretical conceptual dispositions. Here the affinity concerns the epistemological interests indicated in concepts like complexity, contingency, and selection.

Functional analysis uses relations to comprehend what is present as contingent and what is different as comparable. It relates what is given, whether that be states or events, to perspectives on problems and seeks comprehensibly to enable a problem to be solved in one way or another. The relation between the problem and its solution will thus not be grasped for its own sake; rather, it serves as a connecting thread to questions about other possibilities, as a connecting thread in the search for functional equivalences.

Problems are problems only if they cannot be isolated, worked on, and solved one piece at a time. This is precisely what constitutes their problematicity. Problems exist only as problem-systems (or as system-problems).[103] Therefore all functional orientation is directed toward a complex that cannot be dissolved, but can only be destroyed. We will have much to say about the "differentiation" of functional mechanisms. This never means, however, a detachment or separation from the original complex, but merely the establishment of functionally specific differences within the system, to whose problems the functional mechanisms relate. The differentiation of functional subsystems means, for example, the establishment of new system/environment differences within the original system. The functional orientation thereby retains the "holistic" aspect of older systems theories but combines it with the capacity to specify problems more precisely. This holds both on the level of concrete systems, which structure themselves by orientation to functions, and on the level of the scientific analysis of such systems.

The fruitfulness of the functional method and the explanatory value of its results depend on how the relation between problems and their possible solutions can be specified. Specifying means setting increasingly restrictive conditions of possibility. For empirical science, this means an appeal to causality. To be sure, the functional method does not consist merely in discovering law-governed causal relations, with the goal of being able to explain that, when specific causes occur, specific effects are inevitable (or sufficiently probable). The insight of functional method lies, so to speak, athwart causalities: it resides in comparing them. One can attain it even if causalities are assumed, for the moment, to be merely hypothetical and not yet adequately researched.[104] One must, therefore, not only keep in mind the purely hypothetical

status of causal assumptions, but actually bring them into the comparison. Then one comes to statements like: if (it is really the case that) inflation solves problems of distribution in a relatively conflict-free way (with whatever side effects), inflation is a functional equivalent for a national planning that is politically riskier, because it is richer in conflict.[105] Only on the underpinnings of a scaffolding composed of such statements does it seem worthwhile to investigate underlying causalities empirically.[106] In this sense, then, the functional method is finally a comparative one, and introducing it into reality serves to open up what lies at hand for a sidelong glance at other possibilities.[107] In the end, it ascertains relations among relations: it relates something to a viewpoint on a problem in order to be able to relate this to other problem solutions. Accordingly, "functional explanation" can be nothing other than the ascertainment (in general) and exclusion (in particular) of functional equivalents.

Here, it has often been objected that the relation among functional equivalents, on which everything depends, remains unclear or amounts to mere addition: "*A* is a possible problem solution, and likewise *B*, and likewise *C* . . ."[108] This objection does not hold, however. What is decisive is that the addition is bounded by a given viewpoint on the problem, so that not anything at all, but only very specific instances, and often only a very few, come into consideration. If, for example, one needs light and darkness to make a film, one need not wait on the sun. One can use artificial light—but further possibilities are not readily apparent, or at least not available in great numbers. What the functional orientation achieves resides in the broadening and limiting of what is possible.

Accordingly, the real theoretical achievement provided by the introduction of functional analysis resides in the construction of problems. This yields the conjunction of functional analysis and systems theory.[109] The classical account of this conjunction interpreted the ultimate problem as that of the system's permanence, or stability. This is not incorrect, but it is inadequate. The above-mentioned themes of the difference between system and environment, complexity, self-reference, and the temporal combination of irreversibility and reversibility (process and structure) can be interpreted from the methodological viewpoint as an articulation of the problem of permanence—as an articulation with the goal of open-

ing up better and, above all, more complex possibilities of analysis and comparison.[110] But one must pre-eminently observe the change brought about by the concept of self-referential, autopoietic systems. No longer are we concerned with a unity possessing specific properties, about whose permanence or impermanence a global decision is made. Instead, we are concerned with the continuation or breaking off of the reproduction of elements through the relational arrangement of those very elements. Here, preservation is preservation of closure and of the incessant reproduction of elements that pass away in their very emergence.

But specified as a directive for comparison, the concept of function indicates something beyond the mere continuation of self-referential reproduction (maintaining permanence). For organisms, this concept implies more than just "life."[111] It indicates an intention to compare, an expansion of contingency, a perspective of observation. In this way it leaves open whether and to what extent self-referential systems are capable of observing and describing themselves and thereby discovering functional references.

A "systems *theory*" and a functional *methodology* locate functional analysis primarily within the system reference of the scientific system. This is empirically as well as historically correct. What one calls "functional analysis" actually occurs there. Functional analysis is by no means the only method used by the scientific system, but since the seventeenth century the scientific system has entertained the hypothesis that functional relation might be the truly fruitful principle of selection (!) for scientifically relevant data.[112] In this system reference, we call the rules that are valid for doing so "functional method." The system reference of the scientific system does not exclude functionalistically oriented self-analyses by personal, and, above all, by social systems (including the scientific system), nor does it exclude "conversation" between the scientific system and other systems about functional analyses and their results. Its transition to self-analysis can also partly succeed. It can, for example, grasp precisely the relation between a problem and its solution and avoid the uncertainty resulting from comparing what exists with functionally equivalent other possibilities or block this uncertainty by fixing values. It can bring functional equivalents into the form of "impossible alternatives" and then use them to legitimate the course of action always already

being followed.[113] The abstraction inherent in problem identification also poses a problem for adopting the analytical technique. To the extent that the problem references of functional analysis are abstracted and radicalized, it becomes more difficult for other systems to apply those references to themselves. And at present science itself is shielded from functional self-analysis by the dogmatics of "epistemology."

A system like science, one that observes other systems and analyses them functionally, uses an incongruent perspective in relation to them. It does not simply trace how these systems experience themselves and their environment. And it does not simply duplicate the view of the self it observes. Instead, the system being observed is covered over with a procedure of reproducing and increasing its complexity that is impossible for it. In its analysis science uses conceptual abstractions that do not do justice to the observed system's concrete knowledge of its milieu or to its ongoing self-experience. On the basis of such reductions—and this is what justifies them—more complexity becomes visible than is accessible to the observed system itself. As a technique of scientific observation and analysis, the functional method allows its object to appear more complex than it is for itself. In this sense it overburdens its object's self-referential order. It undermines its object's intuitive evidences. It irritates, unsettles, disturbs, and possibly destroys, if the natural lethargy of its object does not adequately protect it.

This overburdening is immanent in every observation.[114] Within interaction systems, for example, it is counteracted by techniques of self-presentation and by tact. Brakes of this sort are lacking for scientific analysis. Difficulties in communication step into their place. This general problem of overburdening takes on a specific character in the case of functional analysis, indeed, it does so in two respects. On the one hand, functional analysis can clarify "latent" structures and functions—that is, it can deal with relations that are not visible to the object system and perhaps cannot be made visible because the latency itself has a function.[115] On the other, functional analysis shifts what is known and trusted—namely, "manifest" functions (goals) and structures—into the context of other possibilities. That exposes them to comparison and treats them as contingent, without consideration for whether the object system itself

is capable of comprehending such a reorganization or not. Thus in both regards—latency and contingency—the analysis overburdens its object. The conceptual apparatus of systems theory makes this possible.

Self-reference, as well as the self-thematization of systems, then appears against the backdrop of functional analysis as a self-simplification of the object system,[116] which, for its part, fulfills the function of a necessary (but not unconditional, not necessarily in this way and no other) reduction of possible complexity. The need for reductions has its basis in the structure of the problem of complexity, namely, in that complexity forces a selection of preferred relational models. Insofar as it thematizes object systems, functional analysis apparently releases itself from this necessity. It reconstructs the system's contingencies, although these cannot be exploited as such. It supposes for its object a degree of freedom that it itself does not possess. But it compensates for this overestimation of reality by seeing therein its ultimate problem. It reflects the unreasonable demands its analysis contains in the very conceptuality of that analysis. The difference between self-reference in the object and self-reference in the analysis, between the observed and the observing system, comes to be reflected in the problem of complexity.

This justifies orienting functional analysis in systems theory to the problem of complexity instead of to the problem of maintaining continuances. Consequently, in dealing with problems functionalism rises toward the level required by the paradigm change discussed in the Introduction, namely, in the direction of a system/environment concept and a theory of self-referential systems. Functional analysis thereby also self-referentially grounds the choice of the ultimate problem that serves as its reference—namely, orientation to a problem that on the one hand can be thought of as immanent in the object, but on the other to a high degree becomes a problem through the analysis itself. By choosing a problem that formulates the unity of the difference between knowledge and object, the functional method goes beyond a mere methodological decision and claims to be an epistemology.

To be sure, there are no absolute guarantees that functional analysis will result in gaining knowledge—either in theory or in the method of correct procedure.[117] But at least there is an important

clue. One might suppose that insights possess greater epistemic value the more different are the facts that confirm them. Therefore functioning in spite of heterogeneity is itself a kind of proof. Fascinated by the assumption of a parallelism between the structure of statements and the structure of objects, the dominant epistemology and methodology have neglected this method of securing knowledge.[118] That has led to a widespread skepticism about the methodological results of functional analysis. But if one revises epistemological premises that are obsolete in other regards in light of a transition to an epistemology guided by a theory of evolution, then one can also assess the methodological performance of analysis by functional comparison.

According to an old, insightful rule, truths emerge conjointly, but error in isolation. If functional analysis succeeds in demonstrating connections, despite greater heterogeneity and diversity in phenomena, then this can be a valid indicator of truth, even if the connections are evident only to the observer. In any event, for this technique of gaining insight it becomes more and more difficult to hold on to the conviction that results can be put down to erroneous method, to error, or to pure imagination. But this is in no way to say that the semantic form in which the results are presented "corresponds" to reality, merely that it "grasps" reality, that is, proves itself to be a form of ordering vis-à-vis a reality that is also ordered.