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Niklas Luhmann ranks as one of the most important sociologists and social theorists of the twentieth century. Through his many books he developed a highly original form of systems theory that has been hugely influential in a wide variety of disciplines.

In *Introduction to Systems Theory*, Luhmann explains the key ideas of general and sociological systems theory and supplies a wealth of examples to illustrate his approach. The book offers a wide range of concepts and theorems that can be applied to politics and the economy, religion and science, art and education, organization and the family. Moreover, Luhmann's ideas address important contemporary issues in such diverse fields as cognitive science, ecology, and the study of social movements.

This book provides all the necessary resources for readers to work through the foundations of systems theory – no other work by Luhmann is as clear and accessible as this. There is also much here that will be of great interest to more advanced scholars and practitioners in sociology and the social sciences.

Niklas Luhmann
was Professor of Sociology at the University of Bielefeld

ISBN 978-0-7456-4572-8
9 780745 645728

LUHMANN Introduction to SYSTEMS THEORY
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Niklas Luhmann
INTRODUCTION TO
SYSTEMS THEORY

Translated by Peter Gilgen

First published in German as *Einführung in die Systemtheorie*

Reprinted 2013 (twice) 2014 (twice), 2015, 2016, 2017

We are very grateful to The Holcombe Academic Translation Trust for the provision of a grant to finance the translation of this work.

Polity Press
65 Bridge Street
Cambridge CB2 1UR, UK

Polity Press
350 Main Street
Malden, MA 02148, USA

ISBN-13: 978-0-7456-4571-1
ISBN-13: 978-0-7456-4572-8 (pb)

A catalogue record for this book is available from the British Library.

Typeset in 10 on 11.5 pt Palatino
by Servis Filmsetting Ltd, Stockport, Cheshire
Printed and bound in Great Britain by Clays Ltd, St Ives plc

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Translator's Note and Acknowledgments

In the winter semester of 1991–2, Luhmann taught a lecture course entitled *Introduction to Systems Theory*. The present volume is the translated version of these lectures. Transcribed and edited by Dirk Baecker, they were originally published in 2002. By April 2009, Luhmann's *Introduction* was in its fifth edition.

Luhmann presented his lectures without the use of a manuscript. He merely jotted down a few of the key points. The taped version of his *Introduction to Systems Theory* had a discernible oral character, which Dirk Baecker tried to preserve by keeping his editorial interventions to a minimum. The resulting text did not always lend itself to a straightforward translation into English. In order to offer the reader an idiomatic and grammatically sound text it was necessary at times to restructure some of Luhmann's run-on sentences, which did not pose problems in German but would have become close to incomprehensible in English. In addition, a few obscure and elliptical passages required more interpretive interventions on the part of the translator than is customary. Finally, it seemed advisable to add some translator's notes to the text as well as a brief list of further readings for each chapter. This list can be found at the end of the volume. I wish to acknowledge Michael King's invaluable expertise and help in preparing it. I also wish to thank Samantha Zacher, Michael King, and Caroline Richmond for numerous stylistic suggestions that have greatly improved this translation. Of course, I am solely responsible for any remaining errors.

Peter Gilgen

touch with the common jargon of sociology. Besides the ideological critique of the theory, which never made contact at the argumentative level and thus never really engaged with the theory, this rather fine-grained self-disciplining of the work that contributes to his theory is, it seems to me, one of its main difficulties and, in fact, *the* primary difficulty that hampered or even substantially reduced the circle of Parsons's disciples, who saw themselves confronted with the requirement of concentrating on individual boxes or special problems of his theory; otherwise they were not in a position to contribute at all.

To be sure, it does not make sense to claim that the Parsonian theory has failed or to say that fundamental mistakes had been built into the theory – mistakes that we could recognize today. But, in a certain sense, this theory was a dead end in the development of a specific sociological systems theory. Neither before nor later was so much sociological knowledge brought together within such a thoroughly structured framework. Yet the hermeticism of the theory indicates that, from this particular position, it is no longer possible to follow, and relate to, the interdisciplinary progress of systems theory in general.

Like no other sociologist of his time, Parsons managed to integrate non-sociological theoretical achievements. This is true for the theory of economics as much as for Freud. It is equally true for the input/output language of systems theory, for certain aspects of linguistics and cybernetics, and so forth. But, in direct correspondence to systems theory's switch to self-reference, Parsonian theory appeared to be no longer capable of being received and transmitted productively. For this reason, it seems to me that, in this case, we are probably witnessing the end phase of one independent development of sociological theory. This gives us all the more reason to begin to examine the interdisciplinary space more closely.

II

General Systems Theory

1 The Theory of Open Systems

Third Lecture

I begin this lecture with an attempt to bring together some thoughts about a general systems theory. The word or concept "general systems theory" aims far beyond the actual state of affairs. To be precise, there is no such general systems theory. It is indeed the case that in sociological scholarship there have been, time and again, references to systems theory, as if this concerned something that exists in the singular. But, as soon as one examines the matter more closely and looks beyond sociological scholarship, it becomes difficult to find an object – that is, a theory – that would correspond to this way of speaking. There are several general systems theories. There are attempts to generalize systems theoretical approaches – that is to say, to transcend the limits of a particular discipline. But, generally speaking, even these attempts still betray quite clearly the discipline from which their abstractions in each case originated. In general, there are also considerable obstacles between different disciplines or theory models that attempt to formulate generalizations from their particular vantage points. Perhaps this situation is historically determined. The attempt to formulate a general systems theory originated in the fifties. The corresponding terminology had its beginning in this period. Back then, a society for "general systems research" was founded.[1] A *General Systems Yearbook* was created as the focal point for publications dedicated to this direction in scholarship. And there was this idea that, taking one's departure from different starting points, one could collect and combine different thoughts in order to produce something like a general systems theory. This enterprise was not without success. It is, however, most worthwhile to start by going back to the sources of these considerations and to line up the different points of departure in order to locate in each case the critical focus as well as the problems of such generalizations. We can then also

see why a certain threshold of systems theoretical development was never crossed.

In this lecture, it is my intention first of all to reconstruct this development and to mark its limits, so as to arrive at a new approach that allows us to formulate individual perspectives of a sort of second generation – that is, of "second-order cybernetics," a "theory of observing systems," and related conceptions.

Therefore let us start by getting to the points of departure of general systems theory. One line of development can be seen in the metaphor or the models that worked with the concept of an equilibrium or balance. To begin with, this approach had a mathematical foundation insofar as one worked with mathematical functions. But the metaphor itself is also of interest, independent of its mathematical connections, since it belongs, after all, to the oldest sources of systemic thinking. It had already been in use for a long time before the word "system" rose to a certain prominence and, of course, long before one could speak of a "systems theory" in the proper sense. I do not know when exactly this metaphor took root, but by the seventeenth century it was already taken for granted and used in the idea of the "balance of trade." Moreover, by the end of the century it also motivated the idea of an international, specifically a European, balance of power between nations (or political factors). In addition, the metaphor was used in a more general and relatively indeterminate manner.

If one surveys this development in retrospect, one can say that it can be characterized by means of a distinction: namely, the distinction between a stable state and a disturbance. Normally, the emphasis is put on stability. One imagines a balance or equilibrium as something stable that reacts only to disturbances and, in fact, reacts in such a way that either the old balance is re-established or a new state of equilibrium is reached. Thus, the metaphor presupposes a certain mechanics, a certain mode of implementation, and a certain infrastructure, all of which ensure that the equilibrium is maintained. It is this viewpoint that coincides with the dominant idea that theories of equilibrium are theories of stability. However, if one examines the matter more closely – and such hints were already present in the seventeenth century – this assumption becomes questionable. If we take our lead from the image of scales with their two sides in balance, it should be clear immediately that this equilibrium can be disturbed very easily. Just placing a small weight on one of the pans suffices to throw the scales off balance.

This means that the idea of equilibrium can be understood as a theory that marks and locates a system's sensitivity to disturbance: one knows what is to be done if one wants to disturb the equilibrium. From a certain point of view – one that will recur time and again in this lecture course – this theory is a theory of a specific distinction and not so much the theory of a desirable state or of a particular type of objects. The concept of balance or equilibrium contains a theory that is interested in finding

out how the relation of disturbance and stability can be turned into order. Perhaps one might even say – although this exceeds what can be found in the literature – that it is interested in finding out how the relation between disturbance and stability can be increased in such a manner that a system, despite being severely affected by disturbance, is still stable. The interesting question for us, in terms of mathematics, is from which mathematical equations we can derive such a relation. Yet, although this moment of disturbance has been noticed time and again in the tradition, and in more recent applications, of equilibrium theories, the emphasis has clearly been on stability. It is as if keeping a system stable amounted to a value all by itself! Furthermore, it is as if the devices that are responsible for establishing a state of equilibrium in fact had a duty to keep the system stable! These observations apply especially to the theory of economics, with its concept of a balance or equilibrium between different economic factors. And it is here, as well, that the first doubts took root as to whether it is appropriate after all to speak of balance or equilibrium as a stable state, particularly if one factors in reality – which is to say, if one does not just look at mathematical functions but tries to imagine how real systems, such as economic and production systems, manage to be stable.

All of this led to the thought that perhaps the opposite was true: namely, that imbalance or disequilibrium might function as a condition of stability. According to this view, an economic system can be stable only if it produces too many goods in order to have something to offer in case a certain market demand arises, or else if it produces, on the contrary, too many buyers and not enough goods so as to have buyers at its disposal who will purchase the goods on offer if the supply is sufficient. János Kornai, a Hungarian economist, developed such anti-equilibrium concepts.[2] It is apparent that the two versions of economic disequilibrium that I have cited represent the Western and Eastern economy, respectively, in terms of the controversy between capitalism and socialism. Either the scarcity of goods has to be maintained while buyers or, rather, demand must be available in abundance, which is the case in the socialist system; or, conversely, there must be a scarcity of buyers and an abundance of goods, which is the case in the capitalist system. Be that as it may, we are dealing here with a version of anti-equilibrium theory that distinguishes itself from classical and neo-classical economic theories by shifting the state of stability from equilibrium to disequilibrium.

In any case, the equilibrium or balance model was at the root of one strand of developments that aimed at a general systems theory. This was no new discovery in the fifties. Rather, it was merely a variant that one could deploy if needed. What was new were two different problem areas that eventually influenced the further development of systems theory much more strongly than equilibrium theory did. The most novel issue arose with a question derived from thermodynamics: namely, how systems can be maintained at all if one must assume that physics, at least

the physics of closed systems, tends to produce entropy – which is to say, to dissolve all distinctions and thus bring about a state without distinctions or, to put it in the terms of physics, a state in which no usable energy is left, no energy that could in any way still produce distinctions. If this is a general physical law, how is it at all possible to explain the facts of the physical, chemical, biological, and social world? How is it possible to explain that there is order and that, if one limits one's perspective to a few billion years, it cannot be discerned that such a development towards entropy is indeed in the making? To put it differently, how can negentropy be explained as a deviation from entropy, if it is indeed the case that the laws of physics point to entropy? Asking this question, one acknowledged that the laws of entropy presuppose a closed system, and one imagined, for example, the world as a closed system into which nothing can be introduced from the outside and from whose inside nothing can be removed.

As a model of the world, this model may have validity. But it does not apply to the conditions within the world. What we have here is the model of a closed system. Such systems are not to be found in the world, at least not as far as living systems, psychic and social systems, are concerned, and are therefore of no relevance in the area that is of interest in the present lecture series. For this reason, the notion of a closed system was rejected in the fields of biology and sociology, and in its stead a theory of open systems was developed. These systems were called "open" because they were meant to explain why entropy does not occur in them and why order is created instead. In all cases, openness means that an exchange with the environment takes place. But, depending on what kind of system one has in mind – biological, organic systems or meaning-directed systems [*sinnorientierte Systeme*] – that is, social systems (communication systems) and psychic systems (consciousness) – the conceptualization of this exchange takes on different forms. In the case of biological systems, the consumption of energy and the excretion of useless energy are primarily at issue. In the case of meaning systems [*Sinnsysteme*], it is predominantly the exchange of information. A meaning system obtains information from its environment. One might say that it interprets surprises. In turn, this particular information processing system is integrated into a network of other systems that reacts to it. The basic condition that accounts for negentropy[3] is the same in both instances: namely, the exchange relationship between system and environment. This is what is designated by the term "open system."

At this point in the course, I place special emphasis on this concept, precisely because later we will talk about a counter-theory, the theory of operationally closed systems, which does not, however, revoke the concept of openness but gives it a makeover. In any case, open systems are the answer to the provocation that originated with the law of entropy.

In this context, one should also pay attention to the region of contact

between systems theory and the theory of evolution. Ever since Darwin, the theory of evolution saw it as its task to explain structural variety, which in the field of biology is the variety of the species. How can it be explained that the one-time biochemical invention of life led to so many different forms, to worms and birds, mice and men, and so forth? The same could of course be said for social systems. How can it be explained that, once linguistic communication developed, there could already be so many different languages, and further, from a historical perspective, that so many different cultures – developed cultures and less developed cultures – have existed simultaneously? How does the multiplicity of tokens and the variety of types come about on the basis of a relatively simple one-time invention of evolution – namely, the biochemistry of life, on the one hand, and communication, on the other? In all of these cases, one needs a theory of open systems if one wants to venture an explanation. In other words, one needs a theory that describes how environmental stimuli can have an effect on systems that changes their structure. The question is how an event that was merely contingent to begin with and was not planned for or even expected within the system – for instance, a mutation at the cell level or some irritating, disturbing information – can be noticed as such in the system and lead to a structural change – that is, to the selection of new structures and to testing whether these structures can actually be stable or not. This means that the Darwinian distinction between variation, selection in the sense of structural change, and stabilization or restabilization also rests on a theory of open systems. But, over and above the general theory of open systems, Darwinian evolution also accounts for the historical dimension or the dimension of the development of structural complexity that runs counter to those expectations that might be entertained solely on the basis of the law of entropy.

If we presuppose this general theory of open systems, we must acknowledge that secondary, subsidiary theories, and especially a conception of the input/output model, are attached to it. At the level of the general concept of the system, the theory of open systems does not determine what kinds of relations exist between system and environment. Instead, it works with a general idea of the environment and not exactly with the idea that, in the environment, specific conditions and also specific other systems exist that might become especially relevant for a particular system. At this level one ought to distinguish between, on the one hand, the system-environment paradigm – which is to say, the general thesis that systems can prevent entropy only if they exist within an environment and are in contact with this environment – and, on the other hand, system-to-system relations – which is to say, questions concerning a certain dependence on ecological conditions or a certain dependence within a social order on certain other systems (for instance, the dependence of a political system on a functioning economy in relation to both the submission of taxes and the willingness of the population to elect a certain

government). In more general terms, we speak of a difference between the system-environment distinction, on the one hand, and the system-to-system relations, on the other. Now, the input/output model concerns the latter. It presupposes that a system can afford a high degree of indifference in relation to its environment and that, by and large, the environment is of no importance to the system. It also presupposes, however, that, under such conditions, specific environmental factors gain all the more importance. Obviously it is not the environment that is in a position to decide which factors are important but rather the system itself. In this sense, a system possesses relative autonomy insofar as it can decide itself (and thereby make this decision dependent on internal conditions and on its own system type) on what it has to rely as its input, and what it passes on to its environment as its output – which is to say, its waste but also its positive results [*Leistung*], its readiness to be of benefit to other systems.

Such input/output models come, roughly, in two different varieties. The first is a rather ideal or mathematical model that is based on the notion that there are certain inputs and that the system performs a transformational function that leads to certain results. This transformational function is structurally determined. It is customary to speak of "machines" in this context, either in the real sense or in the sense of a mathematical function that transforms certain inputs into certain outputs. We are dealing here with a highly technical model, a machine or production model that presupposes, among other things, that one may repeatedly produce the same output with the same input. Such ideas were the reason for the criticism that systems theory is a technical theory and does not do justice to the realities of social life. It is certainly possible to complicate this transformational functional theory [*Transformationsfunktionstheorie*]. Thus one could come up with a system that simultaneously includes several transformational functions or even a system that internally is differentiated into further systems so that the different input/output relations within one system could be linked together. But the basic idea was still the same transparent transformational function that can be recognized by the systems analyst. And this has as its supposition and leads to the prediction, respectively, that, with the same inputs, the same outputs can be produced and that one is dealing with a reliable system.

But the attempt to transpose such models into social reality or to re-enact them at the psychic level – that is to say, to conceive of the psychic system as working with inputs and outputs – ran into difficulties. Thus, for instance in psychology, the behaviorist conception of a stimulus-response model was already in place. It had already put the same idea into action without working with the terminology of input and output. In the field of psychology, it had been recognized by the thirties that a simple transformational function would not do and that one would have to work with an intermediate variable, which in those days was commonly formulated by means of the concept of generalization. A psychic (conscious)

system often generalizes its relations to the environment so that different inputs can be grouped under one type and produce the same output; or, conversely, a system may react differently to the same inputs, depending on its own affective state [*Befindlichkeit*]. Such complications make it necessary to dissolve the simple mathematical function and to examine the system more closely.

The same applies to the attempted sociological realizations of input/output models, which even assumed this very same terminology. I have in mind, for instance, David Easton's attempt to transpose the input/output analysis to social systems, particularly the political system, and to formulate a corresponding model that provides for several inputs: on the one hand, there is the official allocation of support, the support of the government by means of general elections; and, on the other hand, we have the input of specific interests by organizations that represent stakeholders, by lobbies, and so forth.[4] Politics is itself viewed as a transformational mechanism, and the output is described by Easton as the "allocation of values" – that is, as the distribution of politically determined advantages or values among the population. The next stage of this circulation is reached when the population in turn reacts to this politics by recalibrating its electoral preferences or interest claims. In this model, it was not possible either to implement quantification or to provide a mathematical formula that would show whether and how politics always acts the same way under the same circumstances.

The reaction to this explanatory gap, this gap in the ability to articulate the internal workings of systems, was a theory of the black box, which was at least in part imported from cybernetics yet found a precise application in these cases. "Black box" means that the inside of a system cannot be recognized because it is too complex and therefore cannot be analyzed either. Only from the regularities of the external relations of the system can the conclusion be drawn that there must be some kind of mechanism that can explain the reliability of the system and the computability and predictability of its outputs if certain inputs are given. The fact that the internal workings are orderly can be derived only from the external regularities of a system. This model still leaves space for specific structural investigations of internal processes. It is therefore no coincidence that the concept of the black box works well with a more or less structuralist systems theory. For example, one could think through what it means, in the input–transformation–output process of politics, that political parties came into being at the end of the nineteenth century, and that subsequently parliament no longer had its moorings in the institutionalized freedom of its representatives making up their minds on their own [*Willensbildung*], as was originally intended, but that instead a sort of advance bundling of political issues by political parties took hold – parties that were themselves competing for electoral approval. It is easy to imagine that this shift instigated developments that led from the classical

state, which was based on law and reacted to disturbances, imbalances, and social problems, to what nowadays is called the welfare state – that is, a state that actively changes social conditions and conducts politics by offering or promising such changes.

In the first place, the black-box model is merely a model that provides a frame and does not in principle exclude the possibility of subsequent more detailed analyses. But it does, above all, dissolve the notion of a rigid, machine-like or mathematical coupling of input and output.

It may be quite useful in this context also to consider the legal system, for it is here where the input/output analysis actually appears to work. There is a surprising dearth of efforts to apply this theory to the legal system. The few studies I know of that are important in this sense all date only from the late sixties.[5] To begin with, the thought itself is pretty obvious, because one can easily imagine that the law is in principle an input-oriented program: whenever certain information arrives, certain decisions must be made. On some occasion I actually coined the term "conditional program"[6] for this state of affairs, and this terminology has in the meantime become customary. It is a conditional program in the precise sense that the system always orients itself by means of the input boundary and produces certain decisions as a consequence of certain inputs, regardless of the consequences. Requests that are justified by law are judged positively, and requests that are not justified by law are judged negatively. Complaints are upheld if they are justified according to their legal status, and if they are not then they are not upheld. The legal system would thus, if it functioned in this way in practice, be nothing short of an ideal case for the application of input/output analyses and thus for a machine that, seen from outside, functions in a calculable, predictable manner. But, to be sure, this machine is enormously complicated: because there are many legal rules and so many possible points of entry; because many different possible inputs can be presented, there are very different possible types of complaints through which one can try to obtain legal redress; and also because there are many different possible justifications that can be deployed, and which will indeed be deployed in a mechanical manner whenever such a prospect of redress presents itself.

However, in the course of a more precise analysis, it has become apparent that purposive orientations increasingly enter into the law, which is to say that the law – or, as one might say, a good lawyer – always also reflects on the consequences when it presents a certain legal viewpoint and declares a certain interpretation of the laws to be correct or incorrect. Thus, a good lawyer in our contemporary understanding must always also consider the output boundary. It is this fact that makes the legal system in its model form and also, I believe, in reality rather unpredictable, at least in a certain sense. The consequences of a legal decision are different from case to case. They are conditioned by further empirical terms and thus unpredictable for those who would like to think of the

legal system as a machine. Moreover, if one follows legal history and the history of legal doctrine in the twentieth century, one recognizes an increase in the tendencies to transform the law in consideration of interests. The point is not merely to deduce conceptually or legally the result that the law requires in this or that case, but instead always also to take into consideration which interests should be supported in the process and the likelihood of the furtherance of these interests being realized. Alternatively, allowance is made in the individual case for conflicts of interests that were not taken into consideration by the legal norm itself, so as to show how *concrete cases* can be decided in accordance with the law – and that means, with regard to sentiments of justice and fairness [*Gerechtigkeitsempfinden*] on the part of the judge and, presumably, equally on the part of the population at large. This tendency increases to the same degree that we put public law into action in the service of the goals of the welfare state. Today, even the Constitutional Court[7] considers the weighing of different values and interests as one of its tasks and, in the process, interferes to a considerable degree with politics.

I described all of this in some detail to point out what has to be kept in mind when input/output models are transposed into the theory of social systems, and how little information sociological theory stands to gain from general systems theory assisted by the terminology of input, transformation, and output. Perhaps this is one of the reasons why the orientation towards input, transformation, and output lost much of its importance in the seventies. On the one hand it was suspected, and also imputed on ideological grounds, that this theory was a mechanical theory, a purely technical theory. And it must be said that there was this element at the mathematical level or the level of model design. But, on the other hand, there was also the question as to what could be gained concretely if the system boundaries were marked in terms of input and output. In other words, one posed the question of what a system *is*, if it is capable of transforming input into output. What is the basis of this transformation or selection that is performed in order to fit in important, relevant inputs and to produce relevant outputs? What kind of machine would this be? What kind of arrangement of structures and operations would this entail? In terms of the input/output model, this was exactly the question that was assumed to have an answer. But it was never really answered.

At this point, let us pick up the third strand of the development of general systems theory, its third ray of hope [*Hoffnungsträger*], namely cybernetics.[8]

This theory emerged at a relatively recent date. It arose in the forties on the basis of technical considerations regarding the possibility of keeping systems, system states, and system outputs stable under changing environmental conditions. The answer to the question I cited was to be found in the well-known feedback model, which is to say, in the idea that there is some apparatus that measures certain distances – that is, information

from the environment – in relation to a desirable system state and, depending on whether this distance translates into satisfactory or unsatisfactory values, turns the mechanisms of the system either on or off. You are familiar with the example of the thermostat. In fact, this example has been adduced in the literature time and again as a "paradigm" in the most basic sense: namely, as an example or prototype. But there were many other problems in the forties that one attempted to solve with corresponding models – not the least of which were in the field of war technologies. Whereas in an earlier period, when one wished to take aim at an airplane, one had to deal with a mechanical device – namely, a ring though which one had to aim at the target, and by means of which one directed guns, and so forth – all this was now automated, and the distance to the target could be measured and directly calculated. As a consequence, the accuracy increased independently of the gunner's eye. This fulfilled one of the tasks at that time. But it was understood immediately that there was a general principle at the root of all this, which also played a role in biology, for instance, where a possible task may be to keep blood temperature or blood-sugar levels constant. Thus, there are appliances that are not continuously at work but function only when certain defects, distances, or differences reach a value that is too high.

Why, then, is this model of such great importance? To begin with, it can be generalized. That is the first point. One of its attractions was that it could be tried out in one new field after another. In the second place, there was the belief that, in this manner, the old teleology – that is, the old theory of purposes – could be reformulated.[9] Within the Old European frame of reference, teleology signified the notion that there are certain purposes that attract causal processes and thus enter themselves into the respective process as its cause in spite of the fact that such purposes are actually future states. Already in early modernity this mode of thinking was abandoned and replaced by the notion of mental states. That is to say, now one conceived of purposes as real and present representations of future states that were themselves determined by past experiences. Moreover, the fact that these representations were present implied that they could mechanically trigger certain motor activities. Taking its lead from the mechanization of teleological causalities, as one might call it, cybernetics managed to explain somewhat better than before how it was possible, or what kind of devices had to be presupposed to exist, if one wanted to keep certain system states stable. There were hopes not only for a comprehensive generalization but also for the reconstruction of a classical way of thinking with the help of modern means that were, shall we say, capable of technical realization. Finally, and this was the reason for the name, notions of steering and control [*Steuerungsvorstellungen*] also played a role. *Cybernetes* is the helmsman of a ship, and it was easy to imagine that, in order to keep a ship on a straight course, one had to correct for the intervening wind and wave conditions. If need be, additional

countervailing steering maneuvers had to be performed in order to stay on course. *Cybernetes* is the helmsman, the man at the wheel, and cybernetics is the science of the art of steering and controlling [*Steuerungskunst*] technical, possibly also psychic (conscious), and certainly social systems.

That was the idea. It is noteworthy that what remained of this idea was the notion of steering, social guidance, and so forth. Time and again, this notion thereafter led to the illusion that it was possible to control and guide a system with the help of cybernetic techniques, or perhaps by means that are nowadays conceived of more in terms of the theory of action. But what exactly does "steering" or "guidance" mean in this context? Clearly, it does not mean that the future state of a system can, to use the Old European terminology, be determined in all concrete details, or even in its general outline, so that it would already be possible in the present moment to predict how a system will look in the future. Rather, it is merely a matter of making sure that certain differences do not become too large and, if need be, reducing them. The task is one of reducing deviations from the intended course, deviations from the desired state, deviations from a certain temperature at which one wants to keep a building, and so forth. If it is possible to keep the temperature in a building constant, this does not mean, however, that no burglars will stop by, that the furniture will stay in the house, that the rugs will not be ruined, or that the electricity in the kitchen actually works. In the first place, cybernetics always refers only to specific constants and specific differences. It is necessary to invent a very complicated system of multiple and variable steering mechanisms and even of a steering mechanism for the steering mechanisms – that is, a network of cybernetic circuits – if one intends to approach the position from which one would be able to predict the state in which a system will be in the future.

The transposing of the theory of steering and control from cybernetics to action theory, as it has become customary to call it in today's political science circles, shows, in my opinion, that the problem was underestimated. The evident need for political control and guidance was taken to mean that such guidance must be possible in one way or another. I do not want to deny that the reduction of differences can still be practiced successfully. Thus, if certain diseases are spreading, and we can provide vaccines, it is clear that a vaccination campaign that is promoted by the state and endorsed by the medical establishment will reduce the extent of the epidemic. Corresponding examples can be found for the modern financial control of the economy by means of monetary policies. But, even in these cases, it would be better to stick closely to the original cybernetic meaning of the terms "steering" and "control." This would imply that one always imagines a certain difference that must be reduced – a difference that can precisely not be completely controlled by the system but is subject to external influences and must then be adjusted by the system.

The corresponding discussion has taken place under such headings as "negative cybernetics" and "negative feedback." In the late fifties and sixties, the counter-concept of "positive feedback" was invented and juxtaposed with these notions. Positive feedback means the amplification of deviations.[10] The cybernetic circuit is used to change a certain state that was produced by the system itself in a certain direction that amounts to a deviation from the original state and has a specific tendency. What is at issue is not the reduction of difference but, on the contrary, its increase. This amplification of deviation or positive feedback creates entirely different problems than negative feedback. What is at issue here has nothing to do with the stability of the system and with keeping certain values stable. Instead, it is a matter of changing the system and, more precisely, of change in specific directions. In this context one very soon stumbles upon the question of how far a system can push certain amplifications without endangering itself. In other words, if there are mechanisms of positive deviation amplification, how far can we let them run without finding ourselves in problematic situations? I believe that, in light of certain ecological problems of modern society, this question hardly needs any further comment. It is also possible, however, to address within society the question of how long certain expenditures can be increased in the political program of the welfare state so that increasingly more people's income is used for these purposes. The discussion of positive feedback turns our attention to the question of how far the increase of certain variables can progress if these variables are always merely variables among other variables. For how long can an ever increasing number of people study at university? For how long can an increasing number of people become state employees? For how long can the population continue to grow? And so on. The key question is whether a system has braking mechanisms at its disposal, or whether only catastrophic developments will finally block the positive feedback that was introduced at an earlier point and thus bring to an end the tendency to amplify deviations.

Another, equally important application of the idea of positive feedback can be found in the context of evolutionary theory. Here it is possible to explain by means of the mechanism of deviation amplification how certain small, more or less accidental beginnings can lead to big effects that increasingly determine the structure of a certain system and are, in historical terms, hardly revisable. For instance, what are the reasons for Mexico City to be situated in its relatively unfavorable location? Why do we find this city of about 20 million inhabitants in a place where founding a city is not very expedient on account of the climatic conditions, the traffic situation, and many other issues, including the quality of the soil? Could the reason for this be found in the fact that, when the Aztecs immigrated into this area, they happened upon an uninhabited stretch of land where they decided to settle? Or could it be that the Spaniards encountered an established culture and center of power here, which they could occupy and transform? Is the reason perhaps that the Spanish Empire depended on such centers? And so on.

This theory has no predictive power. It does not explain why Mexico City is located where it is located. Rather, it explains merely how it is possible that certain developments happen by means of a mechanism of self-amplification and cannot be controlled with regard either to their consequences or to their expedience. Compared with the classical theory of evolution, we can discern a skeptical moment in this theory. Thus, it is indeed the case that, recently, one has begun again to speak of "attractors" when one tries to describe how certain system states attract further changes, and it is also the case that starting from a certain system state reinforces this very state and makes it quasi-indispensable. But nowadays "attractors" no longer have the old positive meaning. Rather, they are seen as dangerous factors, or at least as factors that must be kept in mind if there is any possibility at all of controlling the evolution of a system.

I have now come to the end of my description of the generalizing tendencies that were brought together, or were meant to be brought together, in the fifties as a general systems theory. I hope that I have succeeded in showing how full of expectations, how promising, but also how limited these efforts were. What I said refers largely to the fifties and sixties. Extensive criticism of systems theory set in after the kind of results that can and cannot be obtained on this basis became apparent. This criticism also has some ideological roots. It is directed at the assumed connection between, in the first place, system and technology, or system and mechanics, and, in the second place, system and the preferences for stability. I believe that I have made clear that these criticisms are not necessarily justified. Perhaps one could say that they are understandable but not really well founded. But, if one truly wants to judge a certain critique, the best way of going about it is not to observe simply the object of criticism. It is much more advisable to observe the critics, in order to see which kinds of systems actually practice such criticism. With this in mind, however, I have already anticipated developing this issue further in the course of these lectures by introducing the notion of observing the observer.

In sum, I would just like to show that, within this entire development, certain limits or certain unanswered questions became apparent. A case in point is that the question as to what kind of object might be called a "system" went unanswered. We spoke of open systems, and this included transformational mechanisms, the possibility of transforming input into output, and the possibility of keeping certain variables constant or uniformly changeable by means of cybernetic mechanisms. But all this does not say much about what a system actually is or what kind of system can perform all of these functions. And this gap could not really be closed simply by referring to mathematical functions, equations or technical tricks, and technical mechanisms, for instance in the area of cybernetic infrastructures. In particular, these references did not lead to results that

a sociologist would expect and welcome: namely, the reformulation of general systems theory in such a manner that it would become sociologically usable in terms of a theory of social systems or even a theory of society. There were, to be sure, important and even lasting insights into the performative modes of systems. But there was no answer forthcoming to the question What kind of system can perform the functions that it actually performs? What is the basis of all this? It is this question that provides the starting point for practically all further developments of systems theory.

Taking this question as my starting point, what I will try to outline in the next few lectures is the attempt made to describe with more precision the meaning of the term "system." I mean this in at least two respects, both of which I will discuss in some detail. The first hinges on the shift from the question concerning the system as an object to the question of how the difference between system and environment comes about, if we locate the system on one side of the difference and the environment on the other. How is it possible to reproduce a difference of this kind, maintain it, and perhaps develop it in an evolutionary fashion by making it possible for its own ever increasing complexity to be available within the system, on just the one side of this difference? The second point concerns the question of how, or on the basis of what kind of operations, the system can reproduce such differences. The answer to this question was provided by the theory of closed systems. At first glance, this may look like a regression to the old theory of closed systems; it is as if one had gone back to the start. But that is not the case. As I will show in more detail, the deciding factor is closure – that is, operational recursiveness, self-reference, and circularity – which has to be seen as the condition of openness. This means that one must ask more precisely how a system refers to itself, which is to say, how it can distinguish itself and its environment in such a manner that its own operations can be connected with the help of this distinction to an increasing number of its own operations.

From one question – namely, What does this open system consist of? – we have thus derived two statements of specific problems. On the one hand, there is the problem of how the difference between system and environment is produced and reproduced. On the other hand, there is the problem of what type of operation can bring this about and how it can be linked internally within a network of operations. How can a type of operation recognize internally that certain operations belong to the system and that others do not? Since the late sixties, this problem has become important in, for instance, immunology, the theory of the immune system.

With the problem of how a system recognizes that an operation belongs to the system and not to the environment, we have already mentioned a further critical point that in a similar manner provided the instigation for further developments: namely, the question of observing or of drawing distinctions. Does one have to assume in general, or at least in

the case of certain systems, that systems have operations at their disposal that are capable of observing, assuming that one understands the term "observing" in the general sense of drawing distinctions? Does one have to impute observational capacities to the system, and, if so, which kinds of operations within the system are able to perform these observations? In close connection with these questions, another question arose: namely, whether within a system, by means of whatever processes of differentiation, observers who observe the system can actually develop – that is to say, observers who draw yet another distinction within the system and thereby can distinguish themselves from that which they observe, namely the system. Thus, a nervous system, to cite one example, must be capable of distinguishing itself from the organism it observes. Are there larger systems that internally differentiate their observational performance in order to increase their capacity in relation to their environment? Are there biological, psychological, and sociological examples of such systems? Who or what would be the observer of a social system, if one did not merely mean to say that every individual operation, every action, every communication must know what it is doing – or, in other words, must actualize its cognitive capacity – but, in addition to all this, one tried also to imagine that there are reflective entities and reflecting units that, although they constitute parts of the system, have a higher capacity for reflection than the entire system? These are novel types of questions. I intend to base the following considerations and, furthermore, the evaluation of systems theory in terms of sociological purposes on these kinds of theory concepts.

For the time being, however, it is perhaps useful to consider once again the development in the fifties and sixties and to see how the theory of the observer solved the problem back then. It seems to me that, in those days, the scientist or science itself was tacitly assumed to be an external observer with cognitive capacities – for example, in the form of a subject or as the overarching, scientific research community [*wissenschaftlicher Forschungszusammenhang*] that remains outside the systems it observes. Science was understood as a phenomenon that was located somewhere beyond all systems, a subject at large, as it were, that has to decide which aspects of reality it considers a system and which ones not. This can be seen in the distinction between an "analytic" and a "concrete" system concept that used to be so important. An "analytic" systems theory leaves it to the systems theorist *qua* external observer to decide what he considers to be a system or the environment, which aspects of reality he groups together in a system and which ones he wants to exclude; or, to put it yet another way, how he draws the boundaries of a system. In contrast, a systems theory is "concrete" if it starts with the assumption that system formation happens in reality and that the systems theorist must describe these systems exactly the way they are.

Hidden behind this distinction are different epistemological options.

Any epistemology that derives from a transcendental-theoretical starting point – which is to say, any epistemology that assumes that all knowledge is filtered and determined by the concepts that are at the knower's disposal – almost automatically jumps on the bandwagon of the analytic systems theory option. Anyone who thinks in this manner knows, because he is epistemologically, methodically, and scientifically[11] informed, that everything one sees is determined by the observer's perspective. For this reason, it is likely that he will not believe that things such as systems exist in reality before they have been observed. Instead, he will treat the system concept as the construction of a systems theorist. Yet, this type of epistemological reflection is not customary in normal science. Normally, a scientist assumes that the object of his research does exist, even if he is not conducting research into it. Thus, a political system or an organism or a nervous system exists and also possesses certain qualities that predispose it to being called a system even before any research begins. And these entities will continue to exist well after research on them has ended.

It is difficult to make a decision in favor of one or the other of these two varieties of theories of observation, both of which equally presuppose that the observer is outside the system. Against the analytic theory, one could raise the objection that it cannot simply be up to the analyst to decide which units are subsumed under the system concept. It would not make much sense to say that all red-wine glasses constitute a system and all white-wine glasses constitute another system. For this purpose, concepts of set theory suffice. Presumably it would be no more meaningful to say that all women are a system and all men are another system, or perhaps that all children are a system. Systems theory must offer some limits and criteria that determine under what conditions a reality can be called a system. But, if one asks for such criteria, one runs into the additional difficulty that one justifies them on the grounds of an epistemological intention. One must try to get in touch with reality. At least this is the way it looks if one assumes that the observer is indeed an external being. In the very same way, it is possible to criticize the theory of concrete systems from the perspective that it does not give sufficient justification in respect of the degree to which its own perspective determines the observed phenomenon, which it merely describes as concrete and existing as a given reality. At this level, the disagreement between analytic and concrete systems theories would seem to be undecidable. The key question is whether there is a mistake that is common to both approaches, which is to say, whether there is something in need of correction in both cases.

I would like to explain this need to correct this mistake in regard to two specific points. The first concerns the question of whether one can indeed assume that there is an external observer where one wants to refer to physical, chemical, biological, psychic, or cognitive systems as well as social and other systems. Is it not the case that the observer is always already conditioned as a physical, chemical, biological, etc., being? Could

he even exist as an extramundane subject? Or should one rather assume that he partakes of the world that he observes in all essential respects? He must function physically and be alive. He must possess a cognitive apparatus, memory, and so forth. He must participate in science and society. He must communicate and obey, or at least somehow agree with, the peculiar nature of the mass media, the press, the publishers, and so on. All this means that the first question, which is of particular interest to the sociologist, now runs as follows: Is there a difference between object and subject, between the object of observation and the observer, that is not already predetermined due to the operational basis that is common to both sides? Or, in other words, is it not the observer who introduces the difference between the observer and the observed object? Or, in yet another formulation, is it not necessary to ask the question of how the world manages to observe itself and thereby be rent asunder by the difference between the observer and the observed?

Pursuing this line of questioning, we once again encounter the more recent development of systems theory. Specifically, we must consider all the developments in physics after it was recognized that all observations of physical phenomena for physical reasons change these phenomena and that the observer – regardless of whether we are dealing with a human being or an instrument – must function physically in order to be capable of observation. We must also consider the parallel account that biological epistemology would give: namely, that a cognitive apparatus must be available on the basis of living organisms, that life itself already has to produce a sort of cognition of its environment, and that all phenomena that one recognizes as living beings are determined, among other things, by the fact that one is actually alive oneself.

This is one way of criticizing the classical distinction between the analytic and the concrete. This criticism puts this very difference into question with new conceptions concerning a sort of operational persistence that is interrupted only by the somewhat artificial caesura between the observer and the observed – a caesura that must function according to real physical, chemical, communicative, and other conditions.

The second question that follows immediately concerns systems theory directly. It goes like this: How can one conceive of an observation if one does not consider the observer himself as a system? How can one suppose that a kind of cognitive connection, a kind of memory, a kind of limitation on perspectives, a kind of limited interest, and a kind of limited connectivity for further cognitive operations all come about, if one does not conceive of the observer himself as a system? On psychological grounds, for instance, one must face the question of why the subject is not said to be a system or, in a different formulation, how one should conceive of a subject if one does not consider the systematic nature of its operations. The classical transcendental-theoretical answer states that one must distinguish between the *a priori* conditions of experience, which are given

and are identical for all subjects, and the empirical enactment of these conditions, which is different for different subjects. But this does not free us from facing the question of how an empirically realized individual object distinguishes itself from its own observations. Moreover, all of this does not help to disperse our doubts as to whether it is even possible to derive deductively the concretely observable from transcendental *a prioris*.

The same certainly applies if science is conceived of as an observer. How is it possible to think of science as capable of observation without itself being a system: namely, a system with a network of communication, a system with certain institutional arrangements, a system with certain value preferences, a system with individual careers, and a system that depends on society? In the present sociological context, there is probably no need to explain this any further. But if this is how it is – that is to say, if the observer is always a system – then all that he ascribes to a system, the entire conceptual apparatus, and, furthermore, the empirical results of his research force him to accept some conclusions about himself. It is impossible for such an observer to proceed strictly analytically, if the condition of being able to proceed in such a manner is that he always has already to be a concrete system himself. The difference between the analytic and the concrete system concepts is ground down, so to speak, or even negated, if this necessity of "autological" conclusions is taken into consideration. "Autological," in this sense, means that whatever is valid for my object is also valid for myself.

[At this point, the tape is interrupted. Apparently, Luhmann begins to outline a research cluster within which the question concerning the observer appeared and a theory of observing systems was developed. Specifically, he speaks of Heinz von Foerster, an engineer and physicist from Vienna, who after World War II emigrated to the US. There, he acted as the director of the Biological Computer Laboratory at the University of Illinois from 1956 to 1972. During these years, almost all the important representatives of this theory were invited to conduct research at the laboratory, which emerged as one of the first centers for the formulation and development of the so-called cognitive sciences that arose at the intersections of biology, neurophysiology, mathematics, philosophy, music, dance, and the other arts.][12]

Another important name is Gotthard Günther. Gotthard Günther is a philosopher. He emigrated from Germany but has had difficulty establishing himself in America. His intellectual background consists of Hegel, dialectics, problems of reflection, and the question of subjectivity. In the American context, he also dedicated himself to the problem of connecting dialectics and an operationally oriented version of cybernetics.[13] Günther's contributions address the question of the kind of logic that is necessary to describe situations, in which several subjects – that is, several cognitive centers – interact. It is relatively easy to imagine how, within such a perspective, the issue of the observation of observers may become relevant.

Humberto Maturana was another occasional contributor.[14] He is interested in a biological theory that tries to focus on the circularity of the reproduction of life as the centerpiece of an epistemological and thus cognitive theory. The key concept here is "autopoiesis," which is to say, the self-reproduction of life by those elements that have in turn been produced in and by the living system. I will return to this conception in detail. For the time being, I am concerned only with describing the zones of contact that stood at the beginning of a further, extremely productive development.

Finally, George Spencer Brown has to be mentioned.[15] As far as I know, he was never a collaborator in this research cluster. Nonetheless, Heinz von Foerster immediately recognized the importance of his decisive book of 1969, *Laws of Form*, and accordingly emphasized it in a review.[16] Without a doubt, Spencer Brown has also had a decisive influence on the process of focusing systems theory on the theory of observing systems. He did this specifically by proposing a mathematical theory, a calculus of form that is based on the concept of distinction.

It is perhaps not immediately obvious how something that would deserve the name of a general systems theory could emerge from the discussion that was characterized primarily by these people and by a single institution. Nonetheless, it is apparent that systems theory, in a manner of speaking, began to react to its own historical situation and thus to that which already existed under the very same name. Systems theory became a sort of self-observing, autopoietic, recursive mechanism. Or, one might even say, it became a system that unfolded an intellectual dynamic all of its own, which, in my opinion, is among the most fascinating phenomena that we are able to witness today in our problematic so-called postmodern situation. I would like to build the further developments of the concept of a general theory on this foundation.

2 System as Difference (Formal Analysis)[17]

Fourth Lecture

I will now tackle what I consider the most important and most abstract part of my lecture series – namely, the introduction of the differential or difference theoretical approach. As we saw, the transition from the theory of closed systems to the theory of open systems drew increased attention to the environment. This change concerned not only the knowledge that there is an environment but also the insight that an open system is based on the relations between system and environment and that these relations are not static but dynamic; they are, as it were, channels that conduct causality. On these grounds alone, it was already obvious that no system can exist without an environment. Such a system would end in entropy or not

come about in the first place, since it would revert immediately to a state of equilibrium without difference.

Already Parsons spoke of "boundary maintenance" and thus changed the definition of a system; he shifted from a system definition that relies on an essence, essentials, or other unalterable structures to a definition that depends on the question of how the difference between system and environment can be maintained, possibly even at the same time that structures are being replaced. In this case, the identity of a system requires only persistence without necessitating any minimal or essential elements at the structural level. This change was important precisely because one can no longer account for death when one moves from a biological model to questions of social theory; instead, one must presuppose persistence in the development of extremely varied societies – that is, structural developments that go beyond anything that permits us to typify different societies or categorize them historically. Already here, the reproach of conservatism, which is often leveled against systems theory and aims at the structural level, had become meaningless.

What else could be added to this state of affairs? What has changed compared to the situation that was reached at the end of the 1950s or the beginning of the 1960s? What has been added, in my opinion, is the possibility of a more radical formulation of the system definition. Now one can say: a system *is* the difference between system and environment. You will see that this formulation, which sounds paradoxical and perhaps even is paradoxical, needs some explanations. I thus begin with the claim that a system *is* difference – the difference between system and environment. In this formulation the term "system" occurs twice. This is a peculiarity to which I will return in a roundabout way.

To begin with, my claim is founded on a differential or difference theoretical approach. Theory, insofar as it is intended to be systems theory, begins with a difference, the difference between system and environment; if the theory is intended to be something else, it must be based on a different difference. Therefore, such theory does not begin with a unity, a cosmology, a concept of the world or of being, or anything comparable. Instead, it begins with a difference. For at least one hundred years or so, precursors of such a procedure have existed. I will enumerate some of them in order to show that such considerations did not originate only in the 1970s and 1980s but had already been prepared, one might say, by a number of earlier attempts at working with conceptions of difference in a more radical fashion than previously. For instance, in the Greek language, a notion of difference, of distinctions, of *diapherein*, existed already. The sphere of this notion, however, was limited. In this sense difference was one thing among others. Theology as well as ontology worked with a concept of being. But, around 1900, such unitary concepts started to become questionable.

One of the precursors was Ferdinand de Saussure, a linguist, whose

lectures were published only much later. In them, he presents the thesis that language is the difference between different words or, if one would like to formulate the theory in terms of sentence structures, different propositions; language is thus not given, as imagined in classical semiology or semiotics (regardless of the preference one might have for either the French or the Anglo-American name), simply as the difference between words and things.[18] Language functions because, *qua* language, it can distinguish between the word "professor" and the word "student," for instance. It does not matter whether there are actual differences between the two specimens thus designated. When using language, we are bound to distinguish between professor and student. Whether there are also age differences, differences in attire, differences regarding the courage to display unconventional behavior, and so forth, is a different matter altogether. Language is able to draw these distinctions in the first place. And it is this difference between words that keeps language going and controls what can be said next. Whether these differences exist in reality may well remain an open question. Of course, we would not even begin to speak if we did not assume that something existed that could be designated in this manner. However, it is the difference within language that is decisive for the course of a particular linguistic action, of a linguistic process, or, we could also say, of a communication. This difference is detached from the problem of reference – that is to say, from that whereof one wants to speak.

The problem of reference was worked out with increasing clarity in a lengthy, specifically French development. It was recognized with increasing clarity that the designated object could not be known as that which is meant by language or be at one's disposal without language. Therefore, it could be neglected in the theory of language. Theories of sign use and of language that had structuralist affinities resulted from this insight.

At the same time, similar considerations emerged within the field of sociology. Once again this development took place in France, namely, in Gabriel Tarde's work. Tarde is no longer very well known, either in France or in Germany. However, from at least one point of view he is important. He conceived of a theory of imitation, a theory of the spread and consolidation of sociality by means of imitation that also did not begin with unity but with difference. If one imitates somebody else, this somebody else must exist in the first place. One cannot continuously imitate oneself, although some people seem to succeed even in this project, especially in the field of art. But, in that case, one has oneself as that "somebody else," as another who painted a picture that one found so beautiful that one now wants to create something similar once again. In any case, a difference is presupposed – a difference that was expanded into a fundamental social theory in Tarde's book *Les Lois de l'imitation* of 1890.[19]

Today, one can find a similar project in René Girard's work,[20] although I do not know whether Girard refers explicitly to Tarde. In his case, too, it

is a matter of a beginning conceived as a conflict of imitation. One enters into a conflict with another whom one wants to imitate. In a certain sense, copying somebody is a friendly gesture; a first thought might be that one imitates somebody whom one admires. However, if the goods of the world are scarce, particularly if there are only few desirable women, and one imitates the person whose wishes and desires – whose *désir* – have a specific aim, one becomes a competitor of the imitated person. The result is a conflict. René Girard's theory discusses the conditions that are required in order to transform such conflicts into social order. One of his examples is the sacrifice of a scapegoat. I will not deal with this question at length; I wanted merely to invoke some examples in order to point out one tradition that poses difference as the beginning and turns the problem of further developments resulting from this initial difference into the basic problem of explaining social order.

Nowadays, information theory is also often conceived of in terms of a theory of difference. This tendency can be traced back to Gregory Bateson's classic formulation that information is "a difference that makes a difference."[21] Information is information only if it is not just an existing difference; it is information only if it instigates a change of state in the system. This is the case whenever the perception (or any other mode of input one might have in mind) of a difference creates a difference in the system. Something was not known; then information arrives – namely, that these, and none other, are the facts of the matter. Now one has knowledge and, as a consequence, one cannot help orientating one's subsequent operations by means of this knowledge. A difference that makes a difference! In this case as well, the question of how a theory arrives at its first difference remains unanswered. One begins with a difference and, interestingly, ends with a difference. Information processing in its entirety takes place between an initial difference and a difference that emerges during, and as a consequence of, the process. The difference that has thus come about can in turn be a difference that sets in motion further information. The process does not follow a course just from an indeterminate to a determinate unity, if we may paraphrase Hegel in this manner, but from a difference to a difference.

At this level, the differential approach is already textbook material. There are reports about the state of philosophy in France and similar topics that presuppose these insights or rehearse them once again.[22] This knowledge is not secret, and it can also be found under the brand name "difference theory" in the literature. In addition, I could adduce many further examples.

Instead, I would like to turn to the form of such differential thinking that I consider the most radical and which is available in a work written by George Spencer Brown. To begin with, it might be worth mentioning that it is often difficult to find his book *Laws of Form* in the libraries, because librarians often do not know that "Spencer" is part of his last

Figure 5 The "mark of distinction" used in *Laws of Form* by George Spencer Brown

name and therefore shelve Spencer Brown among the many Browns with the first name "Spencer." Then of course a search under "Sp" turns out to be in vain. Only after Spencer Brown noticed this difficulty and began to write his name with a hyphen was the problem resolved, at least for some of his books. But his name is George Spencer Brown, written as two separate words, and should be listed under "Spencer" in any bibliography.

Spencer Brown's text is the presentation of a calculus. He states explicitly that he is not writing a logic, presumably because he associates propositions that are capable of fulfilling truth conditions with logic. His is an operational calculus: that is, a calculus that presupposes time in the transformation of the signs that are used – or, as I will discuss in a moment, of Spencer Brown's "mark." The content concerns an issue that is not of the foremost interest for us, namely, the attempt to combine the bivalent schema of Boolean algebra with arithmetic and to use only a single "mark" in the process. This mark represents a distinction. To this purpose, Spencer Brown introduces a specific symbol (figure 5):

Many of the annotations, preliminary remarks, and afterthoughts in this book are written in almost standard English and are easy to read. However, the essence of Spencer Brown's statement lies in the order of his steps. Step by step, marks are linked with other marks, and their combinations become increasingly complex. It helps me (I am not sure that others feel the same way) to imagine that there is first of all a white sheet of paper; then the marks are put down on the sheet and thereby gain a peculiar independence: one mark and another one, the second one copied in part from the first, and so forth. [In this context, Spencer Brown distinguishes two "laws":]

1 The "law of calling": If I repeat the same distinction (the same mark) several times, then the value of the repeated distinctions taken together is equal to the value of one single distinction. The "law of calling" can be formalized as in figure 6:
2 The "law of crossing": A mark can be crossed within the boundary it marks and thus, as it were, be negated. This means that a second distinction can be applied to the first one in such a manner that the original distinction is "cancelled." The "law of crossing" can be formalized as in figure 7:

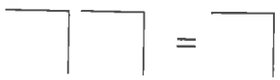

Figure 6 The "law of calling"

Figure 7 The "law of crossing"

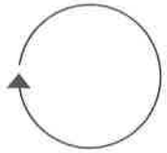

Figure 8 Louis Kauffman's bent arrow

I will now introduce a parallel conception that presents something similar but uses a different mark: namely, an arrow. This mark was created by the mathematician Louis Kauffman and has the advantage that it is better able to depict self-reference (which is of particular concern to me). We have only to bend the arrow, so to speak, and turn it into a circle so that it points to itself (figure 8).[23]

At the beginning we have nothing but the arrow, and Spencer Brown would say: "Let's draw another arrow! Let's copy this arrow from the first one!" Louis Kauffman would answer: "Before anything else, the arrow must point to itself." Both Spencer Brown and Kauffman built a peculiarity into their respective statements. In the following, we will have to deal with this peculiarity, namely, the fact that these marks consist of two parts. Spencer Brown's mark consists of a vertical line that separates two sides and a horizontal line that points to one side and not the other, and could thus be called an indicator or pointer. The mark is consciously thought of as *one* sign, but it consists of *two* components. However, if we start out in this manner, a question arises: Who could designate one but not the other component without already having a sign for this particular purpose at his disposal? Thus, we must first of all simply accept the mark as a unified mark.

Only in the further development of the calculus can it become apparent that it was not as simple as the beginning might have thought – if indeed the beginning could think at all, something that is very much in question.

Figure 9 One arrow: body and pointer

Kauffman's notation has the advantage that it makes clear that the entire thought process begins with self-reference. There is, as is stated in rather enigmatic formulations, no difference between self-reference and difference. Or, to put it differently, in a language that I will be able to introduce only at a later point in my argument: there is no difference between self-reference and observation. For he who observes something must distinguish himself from that which he observes. This fact is accounted for in the circular mark, and everything else – even mathematical infinity, the direction of a process, or anything else – is represented as an unfolding of self-reference. Here, too, the mark (the mark *in the singular*) has *two* parts: a "body," as Kauffman says – namely, the long line that is positioned in space – and a "pointer" that indicates the direction (figure 9):

We begin with a distinction. However, since the result of the distinction must function as a unity, the distinction can be neither designated nor named. It is simply there.

In logic, in mathematics – whatever one wants to call it – in Spencer Brown's calculus, this fact assumes the form of an injunction: "Draw a distinction!" Draw a distinction, otherwise nothing will happen at all. If you are not ready to distinguish, nothing at all is going to take place. There are interesting theological aspects that pertain to this point. However, I will not work them out in this space.[24] Nonetheless, I would like to point out that advanced theology (for instance, the theology of Nicholas of Cusa) contains the proposition that God has no need for distinguishing. Evidently, creation is nothing but the injunction "Draw a distinction!" Heaven and earth are thereby distinguished, then man, and finally Eve. Creation is thus the imposition of a mode of distinguishing, if God himself is beyond all distinction. Interesting connections with our present topic could be made, but they are of no importance for an analysis of Spencer Brown's theory. For he is on earth and stands on the ground – at least on the white sheet of paper – and from there he proceeds, interlocking his operational calculus of marks in the direction of greater complexity.

To speak with more precision and return to the two aspects of the one mark, Spencer Brown remarks that a distinction is always needed simply for the purpose of indicating one side and not the other. (What are called "distinction" and "indication" in his terminology, I translate into the German terms "*Unterscheidung*" and "*Bezeichnung*.") What purpose could drawing a distinction serve other than to indicate one thing rather than

another? Every distinction is a boundary, the marking of a difference. As a result, we have two sides; however, they are subject to the condition that both of them cannot be used simultaneously. If they were, the distinction would be meaningless. Thus, if we intended to distinguish men and women, we would have to ask, "Is it a man or a woman?" And if we answered, "It is a microphone," then our distinction would be unnecessary. In case we would like to mix the terms (nothing speaks against it), we would need a new term – for instance, "hermaphrodite" – which in turn would have to be distinguished from other things.

In principle, a distinction contains two components: namely, the distinction proper, marked by the vertical line, and the indication, marked by the horizontal line. It is striking that a distinction contains both a distinction and an indication and thus distinguishes between distinction and indication. If a distinction is supposed to become operational as a unity, it always already presupposes a distinction within the distinction. How this fact is to be interpreted is not entirely clear, at least not in the discussions of Spencer Brown with which I am familiar. I understand Spencer Brown's calculus in the following way (although I am not entirely sure about it). The distinction is extracted, so to speak, from the distinction. And in the end it is made explicit that a distinction had always already been present in the distinction. A unity is put into operation; in the instance of the beginning, it cannot yet be analyzed. Only later, when possibilities of observation are introduced into the calculus – that is, when self-referential figures can be used – does it become apparent that a hidden paradox had already been present at the beginning. This paradox is the distinction contained in the distinction.

This brief description of Spencer Brown's conception is sufficient for my purposes. I will not deal explicitly with the actual calculus. I have never tested it in a technical sense. Experts allegedly claim that it is correct and that it is much more elegant than the original mathematical calculus. But they also claim that something gets lost in the process.[25] For our purposes, the important idea is to use only a single operator. I will return to this point. My interest and the specific interest advanced in this lecture concern applications to systems theory. You may already have suspected that the difference between system and environment can be understood as a distinction. A systems theoretician reacts first of all to the injunction "Draw a distinction!" This distinction is not just any distinction but the distinction between system and environment. The theoretician must use the pointer or indication in such a way that it indicates the system and not the environment. The environment remains outside. The system is on one side, the environment on the other.

In order to clarify this point for further use, I would like to refer once more to Spencer Brown. When the boundary between the two sides of a distinction is marked, he also names this boundary "form." That is the reason for his expression "laws of form." A "form" has two sides. It is not

just a beautiful shape or object that can be presented free of all context. Instead, it is a thing with two sides. If one wants to present a context-free object, then one is dealing with an object in an "unmarked space": for example, a mark, perhaps a circle or something else, on a white sheet of paper or something determinable in the world, where other things exist as well, which, however, are not being determined in this instance. In principle, "form" is a matter of two sides: in our case, system and environment.

This is a very general conception. The analysis of form could be pushed far beyond systems theory. I could perhaps say that one could even "redraw" semiology and semiotics with the help of its tools. To this end, one would state that on the one side of the "form" there is a sign – that which one needs to signify something – and on the other side there is the signified. Thus one would arrive at the tripartite figure that plays such an important role for Peirce and others.[26] To speak more precisely, the sign is the difference between signifier and signified. The French expressions Saussure uses are *signifiant* and *signifié*. Something signifies something else. In German we have a tendency to call the signifier [*das Bezeichnende*] that is used for signification the sign [*das Zeichen*]. But by means of a formal analysis we recognize that the sign is a form with two sides and that, in using it as a sign, we must always move to and operate from the inner side of the form – that is, the side of the signifier. Thus, language is used on the assumption that words signify something we do not know very clearly.

I suspect that we could develop a very general theory that would transcend even systems theory on the basis of this very general concept of form that we can detach from its specifically mathematical use in Spencer Brown. We would be dealing with a theory of two-sided forms that can be used only in a one-sided way. I allude to this possibility merely because it could potentially relativize even the systems theoretical approach in spite of its universal pretensions and its scientific claims that are currently being especially well developed (which simply means that there is much literature regarding systems theory). It also could instigate reflection on the possibility of an even more comprehensive general theory of forms and whether such a theory could then be applied to the concept of number, to mathematics, semiotics, systems theory, the medium/form difference between loose and tight couplings, and other issues. However, I will leave it at this.

The consequence of this notion of "form" for systems theory is that the "system" can be called a "form" under the condition that the concept of form must always apply to the difference between system and environment. I have recapitulated this point several times because it may not be entirely intuitive, and one must simply keep it in mind. We will only be able to judge this presupposition after we have seen what can be done by means of it. Against the background of the tradition of open systems and

differential approaches of all kinds, we notice that we might have here within our reach a synthesis that could make it possible to include in a single theory knowledge derived from widely disparate sources.

Thus the *first* point we enter under the heading "applications to systems theory" is: a system is a form with two sides.

A *second* suggestion that can also be derived from Spencer Brown concerns the question of whether it makes sense to define a system like Spencer Brown's calculus merely by a single operator and a single mode of operation. If you look at common descriptions and definitions of systems, you will notice that they do not work in this way. Usually, systems are described through a plurality of terms. For example: systems are relations between elements; or: a system is the relation of structure and process, a unit that directs itself structurally in and through its own processes. Here you have unit, boundary, process, structure, element, relation – a whole bunch of terms – and, if you ask what the unity of all these terms is, you end up with the word "and." A system, then, is an "andness." Unity is provided by the "and" but not by any one element, structure, or relation.

The question is whether it is possible to transcend this "and-state" in the description of the object "system." I believe that it is possible if one pursues a principled operational approach. In other words, we must come to terms with the notion that it is actually a type of operation that produces the system, provided that there is time. A mere one-time event does not suffice. If an operation of a certain type has started and is, as I like to say, capable of connectivity – that is, if further operations of the same type ensue from it – a system develops. For, whenever an operation is connected to another, this happens selectively. Nothing else happens; the unmarked space or the environment remains outside. The system creates itself as a chain of operations. The difference between system and environment arises merely because an operation produces a subsequent operation of the same type.

How should one imagine this process? First of all, I believe that the biology of living beings can be described well in this way, especially in light of the information we glean from recent biochemical theories that tell us that life is a biochemical invention that happened only once. It is a circular structure or, to speak with Maturana,[27] an autopoiesis, a circular self-production. At some point in time, such a circular mode of operation was set in motion for reasons that can no longer be known with any precision and which one can state as a living being only if one is already alive. For evolutionary reasons this process multiplied, and then there were worms, snakes, human beings, and all forms that are possible on the basis of an orientational type that, in principle, always has the same chemical composition. From the viewpoint of operation, the unity of life is guaranteed in the strict sense. The necessary presupposition is that the effect of the operation contributes to the creation of a system. Life

must live on. Life must be connected to, and followed by, life instead of dying immediately after birth. Additional inventions, such as bisexuality, the central nervous system, and so forth, presuppose such a mode of operation. Among other things, this means – and I will return to this point – that the concept of autopoiesis itself explains next to nothing, except this beginning with self-reference: an operation that possesses connectivity.

The previous thoughts can be applied to social systems if we succeed in identifying an operation that meets the following conditions: it must be one *single* operation; it must always be the same; and it must possess connectivity. It is this operation that either ceases or continues as the same operation. I think that we do not have many potential operations to choose from. In actual fact, communication is the only type of operation that meets these conditions. A social system emerges when communication develops from communication. There is no need to discuss the problem of the first communication, for the question "What was the first communication?" is already a question within a communicating system. In the beginning, the system always thinks outwards from its center. Once it has become complex enough, it can ask the question as to how it all began. There may then be different answers. However, they do not disturb the continuation of the communication. On the contrary, they may even quicken it. Thus, the question concerning the beginning or origin is of no particular interest to us; or, to put it differently, it interests us merely as one question among many.

What is interesting about the model I have presented is that it manages with a single type of operation. Yet much ought to be said now about how the notion of "communication" is to be understood. In other words, which concept of "communication" are we using here? At this juncture of my argument, I want to say only this much: communication can be conceived as the *synthesis* of information, utterance, and understanding. That is to say, that communication happens when information that has been uttered is understood.[28] "Communication" is the structural equivalent of biochemical statements by means of proteins and other chemical substances. It is of primary importance that there is a prospect of identifying an operator that makes possible all social systems, no matter how complex societies, interactions, or organizations might become in the course of evolution. From the viewpoint of an operational theoretical approach, everything exists because of the same basic occurrence, the same type of event: namely, communication.

Naturally, this usage of *communication* is intentional. Provided that we advance far enough in this lecture course, I will say something more about action theory at a later point in time. In relation to Parsons, we have already discussed this issue extensively. It is my opinion that the concept of action, in contrast to the concept of communication, does not meet the necessary requirements for functioning as a system-producing type of

operation. For, on the one hand, the concept of action presupposes an agent to whom the action can be ascribed; on the other hand, the concept of action cannot easily be tailored specifically for sociality. Action occurs even when nobody is watching, when nobody else is there, when the agent does not expect that somebody else will react to her action – for instance, when somebody brushes her teeth while by herself. It is done merely because everybody knows that it ought to be done. True, one was told by somebody to do it and somebody put the toothbrush there for this purpose. However, in principle, action can be conceived of as a solitary, individual operation that has no social resonance. In the case of communication, this is not possible. Communication happens only if somebody understands it at least roughly or perhaps even misunderstands it; in any case, somebody must understand enough so that communication can continue. Language use alone cannot assure this possibility. It lies beyond the mere use of language. Somebody must be there who can be reached and who is capable of hearing or reading.

Let me summarize these two points once again. The first statement concerns the analysis of form: a system is a difference. The second statement says that a system needs only one single operation, one single type of operation, in order to reproduce the difference between system and environment if the system is to continue to exist (this "if" is of course not unimportant). In the case of the social system, we have identified communication as this type of operation. Communication is connected to communication.

A *third* point also relies on Spencer Brown and pertains to the concept of "re-entry" – that is, the re-entering of the form into the form or of the distinction into the distinguished. Initially, when I introduced Spencer Brown, I did not say anything explicit on this topic. You will recall that already the initial injunction "Draw a distinction!" is an injunction that concerns an operation which consists of two components, the distinction itself and the indication of one side, the pointer that tells you where you are and from where you might continue. Distinction is already provided for in the distinction. Using Kauffman's terminology, one might say that distinction is already copied into the distinction. In the course of developing his calculus, Spencer Brown eventually arrives at the point where he makes this premise explicit. He presents the re-entry of the form into the form or the distinction into the distinction as a theoretical figure that eludes calculus and therefore can no longer be treated in the form of arithmetic or algebra. However, in the sense that certain mathematical problems can be solved only by means of this figure, it belongs, as it were, to the cornerstones of the entire system. This leads Spencer Brown into a theory of imaginary numbers.

I suspect that we may have some difficulty imagining this re-entry, this entering of the form into the form, at the abstract level that is required. Spencer Brown draws circles in his book, but in the process he always

takes the white sheet of paper for granted. However, as soon as we begin to deal with a theory of social systems and can take the regular apparatus of communication (which can also be communication about communication) for granted, the problem loses its difficulty and acquires a certain persuasive power. Therefore, one may ask oneself what purpose our theoretical exploit serves, especially as we merely acquire knowledge that we have known all along. I will return to the question of purpose. It is connected to the concept of paradox. But, for the time being, I will merely explicate what I mean.

What I mean is that a system can distinguish itself from its environment. Its operation *qua* operation produces the difference. This is why I use the term "difference" in this context. One operation connects with another; then a third one is added, a fourth and a fifth one. Then all that has hitherto been said becomes the topic of the next operation and is added to the series, and so forth. All this happens in the system. At the same time, something else, or nothing at all, happens outside the system. The outside world has only limited importance for the consequences of communication. If a system has to decide or to speak with greater caution, create couplings between one communication and another, then it must be able to discern, observe, and establish what is compatible with it and what is not. A system that intends to control its own conditions of connectivity must have at its disposal a type of operation that, for the time being, we may call "self-observation." I will return to the problem of the observer. (The problem is that the concepts are circular. I always have to presuppose something that I will explicate only later. This is necessarily the case for any system design of this type. For the moment, I would encourage you simply to accept observer and observation as terms that are yet to be explicated.) A system has to be capable of controlling its own conditions of connectivity. This is the case at least if you are thinking of systems that reproduce themselves via communication. We can distinguish communication from all that is not communication, particularly in the case of linguistic communication but also in the case of a standardized repertoire of signs. When I say "we," I do not mean individuals with their specific psychic structure, although it may be true for them as well. However, it is also possible that an individual is absent-minded at that very moment and may therefore not notice that communication is happening.

It is crucial that communication itself draws the distinction between communication and non-communication. Thus it is for instance possible to react with linguistic means to the fact that speaking has taken place and that one normally does not have to reckon with a denial of this fact. It is possible to get lost in interpretative difficulties or to look for excuses by explicating what was really meant. However, communication possesses the recursive certainty that it is based on communication; that it can and even has to restrict what can be said in the future (the same holds true of

writing); and that, as a consequence, it can observe the difference between system and environment and thus separate self-reference from hetero-reference. This already becomes obvious when we look at the structure of communication. Communication happens only when something – specifically, a piece of information – is passed on by means of an utterance. Information and utterance already indicate the bipartite structure of communication. In addition, communication has to be understood. To begin with, we can say: there is speaking about something. A topic is being dealt with. This topic can even be the speaker himself. He can turn himself into the topic of his speaking and say, "I wanted to say something completely different." Or he can turn his own emotional state into a piece of information: "I don't feel like it anymore, I'll stop." As a matter of principle, there is always this bipartite structure of utterance and information. And communication can continue on the one or on the other side of this divide. Either the question "Why did you pass on something? Why did you say something?" or the question "Did you perhaps lie?" is turned into the topic of the subsequent communication. Thus, one proceeds either from the utterance or from the information, and then communicates about that which has been said.

Here we have an indication that the difference between hetero-reference *qua* information and self-reference *qua* utterance is always already included in the operation itself. This inclusion is yet another illustration of the general topic of re-entry: the system re-enters into itself or copies itself into itself. Communication remains an internal operation. It never exits the system, for the next connection is once again provided for and has to take place in the system. Self-reference (reference to that which takes place in the system) and hetero-reference (reference to the intended internal or external, past or present states of the system) must therefore be distinguished: one is the utterance, the other the information.

I believe that one can make plausible in this manner (even if it would be possible to offer a much more extensive and detailed treatment) that a social system that works with the operator "communication" always already includes re-entry and could not function otherwise. An internal reference or self-reference and an external or hetero-reference are processed more or less simultaneously. In other words, the system can switch from one side to the other at any moment – but only by means of internal operations. This explains the difference between the environment of a system from the standpoint of the observer and the environment as defined by the system itself, as it oscillates between self-reference and hetero-reference or as it chooses specific emphases in one or the other direction for a certain amount of time, but always under the condition that they may and can be revised and changed. This also means that one deals with a different environment depending on whether one has in mind an environment as defined by a system – that is, the hetero-reference of a particular system – or whether one assumes the existence of

an external observer whose environment includes the system as well as its environment. It is entirely possible that the external observer can see many more and quite different things that are not necessarily accessible to the system itself. We might add that, in biology, Jakob von Uexküll showed an early awareness of the fact that the environment of an animal is not that which we would describe as its surroundings or *milieu*.[29] We can see more (or perhaps fewer) and other things than the ones an animal can perceive and process. Hence, two concepts of environment must be distinguished.

So far I have limited my commentaries to social systems. However, I would like to add an excursus (anticipating a later part of this course) in order to present the thesis that psychic systems, too, work by means of the coupling of self- and hetero-reference, and that this can be shown not with the help of much additional knowledge, but merely with a clear presentation using the terminology of two-sided forms, including such terms as "internal side," "external side," "re-entry," and so forth. Evidently, these theoretical figures or concepts suit psychic as well as social systems.

In psychology, and even more so in the philosophy of consciousness, these topics were treated for a long time from the viewpoint of reflection. There is a psychology of self-awareness; it poses questions concerning the production of identity and the consciousness of identity. The social-psychological literature produced by the likes of George Herbert Mead has familiarized us with such inquiries.[30] However, the tradition of the philosophy of reflection is much older and has perhaps also been more articulate on many counts.

Here I would just like to address for a brief moment Edmund Husserl's transcendental phenomenology, which is perhaps the most striking example of this philosophical tradition. Husserl arrived at the insight that the operations of consciousness can take place only if they are concerned with phenomena – that is, if they *intend* a phenomenon, no matter what the environment may be (this is an entirely different question).[31] From the viewpoint internal to consciousness, consciousness is concerned with phenomena and, at the same time, with itself. The terminology shifts slightly. Thus, "noema" designates the phenomenon one has in mind or imagines. "Noesis" is the name of the reflexively accessible thought process or process of consciousness itself, or, to put it differently, of the reflexivity of consciousness and the phenomenality of the world with which consciousness is concerned. "Intention" or "intentionality" as the occurrence of the coupling between the two sides is yet another feature. Every intention allows for the possibility of further exploration of the phenomena or of considering the following questions: "Why am I currently thinking about this? Why am I preoccupied with this? What is my consciousness actually doing? After all, there are more urgent tasks; for instance, I am hungry right now or I would like to smoke a cigarette,

yet I am preoccupied right now with phenomena." It is via such reflections that I arrive at other phenomena – a cigarette, say, or a sandwich. This coupling is strict. Consciousness would never be able to lose itself entirely in its environment to the point that it could no longer return to itself. Similarly, it could not constantly be concerned merely with the reflection "I think what I think what I think." At some point, the need for phenomena becomes manifest.

For these reasons, this philosophy is called "transcendental phenomenology." It is "transcendental" insofar as it claims that this state of affairs applies to all consciousness systems (or, in other words, to every subject) and thus characterizes subjectivity as such, independent of the empirical multiplicity of differentiated phenomena. After all, there are many human beings, and each one of them is thinking about something different at any moment. The transcendental structure is not necessarily secured by *a prioris* but by this coupling of the reflexivity of consciousness with "having" phenomena [*Phänomenehaben*]. I take this to be a precise theory – that is, a theory that corresponds precisely to the one that would result if we decided to represent consciousness by means of systems theory, including, for instance, Spencer Brown's terminology. In that case, too, we would arrive at the following questions: How does the difference between system and environment re-enter the system? Does this actually happen at all? In what way does the system depend for its operations on re-entry? Could it operate without re-entry? (Evidently not.) And, finally, wherein does the peculiar operational form of the system lie? For Husserl, the operational form lies in intentionality, by means of which the problem is solved from one moment to the next. In addition, this starting point accounts for Husserl's distinct awareness of the importance of time. Every operation relies on retention (that is, a side glance on everything that has just happened) and on protention (the anticipation of everything that will come about during the next couple of occurrences in consciousness). On this basis, consciousness develops anticipations that are inspired by experience and theory, as well as a long-term memory. In principle, however, it operates in the center of time, as it were, along an axis that traverses the distinction between self- and hetero-reference. The result is a rather complicated theory design.

When faced with such a theory design, we recognize how flat by comparison are the theories that nowadays are pursued under the heading of "social phenomenology." As a matter of fact, all they express is that "there is something." In a manner of speaking, all that is offered under the name of the empirical is having-been [*Dagewesensein*]. One saw it and now one describes it. All of a sudden, phenomenology serves to justify a descriptive stance towards objects: "These are phenomena, and, since we are conscious of them, we may assume that they must exist somewhere. The precision of our description insures our method against possible doubts regarding the phenomena. After all, others could go and look for

themselves." This attitude is almost certainly related to the transfer of Husserlian phenomenology to the United States. However, it was already discernible in Alfred Schütz's attempts at creating a unified theory out of both Max Weber's structure of motives and Husserl's phenomenology.[32] It would be possible to show in greater detail how this simplification arose.

If we return to a systems theoretical theory of consciousness, we will see better which fundamental theoretical decisions are at the root of phenomenology. In Husserl's mode of thinking, these fundamental decisions were still very much present. Nowadays, however, they are ignored as being simply present or given, or as of no further interest.

Having noticed that there are two cases in which the operational coupling of external and self-reference works, of course the questions arise as to why there should be only these two, and whether there are in fact further cases. Could we, for instance, discover something like self- and hetero-reference in biology, or at the very least in neurology and neurophysiology? I would prefer not to commit myself to an answer to this question. Such an answer would require precise knowledge of the field. However, at this moment in time I suppose that the difference between the brain and consciousness, or between the central nervous system and the phenomenally present consciousness, lies in the fact that consciousness introduces the difference between self- and hetero-reference. In consciousness, we imagine that all we perceive is somewhere outside, whereas the purely neurophysiological operations do not provide any such clues. They are entirely closed off and internal. Insofar as it is coupled with self-reference, consciousness is also internal, and it knows that it is. And that is a good thing, too, for it would be terrible if someone could enter someone else's consciousness and inject a few thoughts or a few perceptions of his own into it. Consciousness, too, is a closed system. But its peculiarity seems to lie – if we choose a very formal mode of description – in the transition from the purely operational closure of the electrophysical language of the neurophysiological apparatus to the difference between self-reference and hetero-reference. Only this central difference constitutes consciousness, of course on the basis of neurophysiological correlates. I do not intend to claim that consciousness is no longer in need of a brain. However, it is of great interest to ask whether we are dealing not just with a new level of reflection, as is often said – a learning of learning or a coupling of coupling – but with the introduction of a critical difference.

If the operational management of self- and hetero-reference is indeed the mark of a certain sphere of reality, it would be possible to formulate a program that would aim at establishing a link with the concept of meaning. Here, I can only hint at such a connection.[33] For the moment, the only thing of importance is that there are a number of clues indicating that the phenomenal presentation of the world or the informative relations of

communication contain patterns or structures; we perceive these patterns as meaning. They are at the disposal of consciousness as well as communication. But in each case the operational base is quite different and the patterns will be marked by discrepancies that we will not be able to clarify without further efforts so long as we rely on world descriptions of the linguistic kind. We try to solidify the difference between the system of consciousness and social systems with regard to their respective operational base; at the same time, we try to maintain that there are agreements all the same – namely, the decisive guiding difference of hetero/self and all the meaning structures that emerge from it. But here is not yet the place to expand on these issues.

There is, however, a *fourth* point that shall occupy us at least for a short while. I have already alluded to it. Spencer Brown's theory design contains a well-hidden paradox. It is constituted by re-entry itself or – if we refer to the beginning of the calculus, the first injunction "Draw a distinction!" – by the fact that the distinction must be and is drawn merely in order to distinguish one side. Thus, every distinction contains two components: indication and distinction. The distinction contains itself, but apparently in a very specific form – namely, as the distinction between distinction and indication, and not merely some juxtaposition such as, say, of large and small, or anything else that could be conceived of as a distinction.

Accordingly, the re-entry of the form into the form – or of the distinction into the distinction, or of the difference between system and environment into the system – should be understood as referring to the same thing twice. The distinction re-enters the distinguished. This constitutes re-entry. Is the distinction now the same distinction it was before? Is that which existed before still there? Or does the first distinction disappear and thus become the second one? The answer is that we might well suspect that we are dealing with a paradox here, and that means that the distinction that re-enters itself is the same and, at the same time, not the same. And this is the whole trick of the theory: suspended between two markers, both of them paradoxical, a purely logical operational space is created. As is typical of paradoxes, this one, too, can be dissolved. In fact, a paradoxical formulation does not make much sense if one does not also possess a transformative formula, a formula that can dissolve the paradox. I think that such a solution can be accomplished with relative ease in the present case. It depends on the distinction that is drawn by an observer who is capable of distinguishing whether what is meant is his own distinction between system and environment (which could be another system or, if the observer is involved in reflection, an earlier state of his own system) or whether he is speaking of the distinction that is made within the observed system itself. The observer can make his appearance in two ways: as an external observer who sees that another system is observing itself, or as a self-observer, which is to say

somebody who observes himself, refers to himself, and states something about himself.

With the help of this distinction between external and internal observation, the paradox can be solved or, as logicians sometimes say, "unfolded"[34] – that is to say, it is taken as relating to different identities and variable perspectives. Logically, this method is questionable and disreputable. But the logicians keep using it themselves, so we do not have to expect any reproach from that corner. Typically, the logicians distinguish between different levels. As soon as a paradox occurs, they move to another level in order to dissolve the paradox. To be sure, under such circumstances, one must not ask the question Wherein does the unity of the difference between the two levels consist? One dissolves a paradox by postulating two levels – a meta-level and a lower level, or the external observer and the self-observer – and by making this move more or less plausible. One can achieve this gain in plausibility or fruitfulness by pointing to the phenomena that are made visible through this strategy of solving the paradox and to the efficiency of a theory construction that distinguishes between internal and external observation.

For sociological analyses, especially at the level of the theory of society, it is important that one keeps in mind this entire genealogy, including the concept of form, re-entry, the paradox of re-entry, and the dissolution of the paradox through the distinction between observers. But now it is our turn, so to speak. We are external observers. Of course we know that we exist socially, that we live in a particular era, earn salaries, have expectations for our retirement, and so on – or even that we read books in which others have already written about most of the things we had wanted to write about ourselves. Of course we lead a social existence, but as sociologists we can contemplate society as if from the outside. Regardless of the fact that we ourselves communicate in order to teach these things to other people, we can say that we observe society and see that society presents itself as a self-describing system. This system has two sides. On the one hand, society contains hetero-references. It does not speak just about itself but under normal circumstances also about something that is not communication but the topic of communication. Leaving the logical genealogy aside, I dealt with this question in a little book on ecological communication.[35] In it, I proceeded from the assumption that ecological communication is just communication about ecological questions and that the sociological description of a communicating system reduces the irritation over ecological problems to a communicative phenomenon. "Dead fish are floating in the Rhine." Once upon a time, that could have been a folksong; but nowadays it is alarming news. What is produced by means of this alarm is more obvious. We have certain connective expectations that are available for prospective manipulative purposes. Nonetheless, we are dealing first and foremost with a matter of communication. Whatever happens in society is communication. For this reason,

we in our role as sociologists must be able to distinguish between, on the one hand, that about which people talk, write, print, and broadcast and, on the other hand, that which is actually the case, so that we can see that certain topics could also have been chosen differently.

I do not – heaven forbid! – mean to suggest that the choice of topic is arbitrary and that everything could just as well have been done differently. Neither do I mean to say that the preoccupations of contemporary society are mere coincidences, fads thought up by journalists. No, far from it. But naturally we must look at the reasons that lead our society to refer to such states of affairs within a system of communication and to process such topics in a preferential manner, as it were. Along this path, one also gains access to specific questions. One finds out whether only the popular press speaks about them; whether they are only a topic of instruction in schools or of discussion in youth groups; how the economy reacts to them; in other words, which of the three enumerated systems communicates about these topics and what the consequences of such communication are. These are the sociologically interesting facts about the topic at hand – not the fact that the fish are dying.

This double perspective would also allow us to deal with the ideological quality of self-description in a society. Why did societies in the nineteenth and twentieth centuries describe themselves as "capitalist"? Why did they describe themselves in the second half of the eighteenth century as "patriotic"? Why are certain schematic models of society/community and individual/collective preferred at certain times, only to be neglected at other times? Why do notions like "modernity" and "post-modernity" arise? Why is the schema of tradition/modernity used for the representation of society? In our role as sociologists, we can assume the attitude of external observers, who we can never be in reality, and ask how it happens that systems prefer a certain self-description. With this, we return to the sociological tradition of ideology critique or even to the sociology of knowledge or Reinhart Koselleck's version of historical-social semantics.[36] But now we have more theoretical confidence in this position than was possible at a time when a free-floating intelligence in Karl Mannheim's sense[37] was presupposed, or, for that matter, when the mode of self-observation for a capitalist society was described, in keeping with Adam Smith and David Ricardo, by means of market laws, profit rates, and similar phenomena, and nobody noticed that the argument was tied to the position of the capitalist while everything else was neglected. The same restrictions apply in the case of work that relied on Freudian complexes and all sorts of other concepts that gained prominence at one time or another.

We would instead begin with the sociology of self-describing systems, of the systems that couple self- and hetero-reference. They do this in a selective fashion, referring to structures that have been around for some time and to the historical state of society in this very moment with its specific issues. Thus, we can occupy a somewhat more distanced position

due to the figure of re-entry. In my next lecture, I will speak about operational closure. This follows more or less automatically from the issues I dealt with today. If there is an operator, it functions only within a system, and thus one arrives at the thesis of the operational closure of this system.

3 Operational Closure

Fifth Lecture

In our last class, we spoke of the difference principle or the differential approach of systems theory. The thesis was that a system is not a unity but rather a difference, and, as a consequence, we have to face the difficulty of conceiving the unity of a difference. If something is said to be distinguished and, at the same time, not to be distinguished, and if thus these two things are said to be the same thing, one encounters a paradox. Once again, I would like to begin with the question of how one might handle paradoxes if one notices them. For there are many paradoxes that one does not notice. To give an example: a few months ago, I stayed in small apartment hotel in Brisbane directly on the Brisbane River. A telephone was hanging on the wall of this apartment. Lifting the receiver, one discovered a small piece of paper on the phone that said "If defective, call ..." followed by a number. This can be translated as "If you cannot act, then act." What should one do with such a paradox? It can be dissolved if one distinguishes between defective and non-defective telephones, copies the number, finds another phone, and calls said number. One deals with paradoxes by finding a distinction that suits them and fixes identities (such as: this telephone, other telephones) and in this way at least remains capable of action.

In systems theory it is not so easy. First of all, one would say that there is the distinction between system and environment. This distinction is the difference that constitutes a system. But the question that immediately arises is: Who draws this distinction? The answer to this question leads us to the topic of this lecture – namely, the topic of operational closure. The distinction between system and environment is produced by the system itself. This does not exclude the possibility that a different observer observes this distinction, which is to say, observes that a system exists in an environment. From the viewpoint of the thesis of operational closure, the important issue consists in the fact that the system draws its own boundaries by means of its own operations, that it thereby distinguishes itself from its environment, and that only then and in this manner can it be observed as a system. This always happens in a very specific way, not just in any way, but in a way that we can determine more precisely with the concepts of operation and the operational – which is to say, by means of