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The central concept around which the theory of social systems as developed by the later Niklas Luhmann is built is the concept of autopoiesis, originally developed by the two Chilean biologists Humberto Maturana and Francisco Varela. Autopoiesis (< *Greek*: autos = self, poiein = to produce) means self-(re)production. Autopoietic systems thus are systems that reproduce themselves from within themselves, as for example a plant reproduces its own cells with its own cells. Luhmann argued that the *basic* idea of autopoiesis applied not only to biological but also to a large number of non-biological systems. He thus appropriated the originally biological concept, modified it and applied it to the social domain. In a similar way as biological systems social systems were thus conceptualised as systems that reproduced their own elements on the basis of its own elements.

In this paper Luhmann's concept of autopoietic social systems will be introduced starting with the originally biological concept of autopoiesis by Maturana / Varela and Luhmann's modification of it as a general systems concept (section 1). Based on that Luhmann's concept of social systems as a specific type of autopoietic system will be explained (section 2). The third and fourth sections will describe and explain the three existing types of social systems: societal system, interaction system and organisational system. In the fifth section the mathematical calculus of distinction by George Spencer Brown will be introduced, which Luhmann has been drawing on extensively in his later writings, and its relevance for Luhmann's theory will be shown.

## 1. The concept of autopoiesis

### a. The original biological concept of autopoiesis

The theory of autopoiesis was developed by the two Chilean cognitive biologists Humberto Maturana and Francisco Varela in the sixties and early seventies. They were trying to answer the question: What is life? Or: What distinguishes the living from the non-living? Their answer was: A living system reproduces itself. This self-reproduction they referred to as autopoiesis. They defined the autopoietic system as a system that recursively reproduces its elements through its own elements.

Central to the concept of autopoiesis is the idea that the different elements of the system interact in such a way as to produce and re-produce the elements of the system. That is to say through its elements the system reproduces itself. A living cell, for example, reproduces its own elements, like proteins, lipids etc., they are not just imported from outside:

Consider for example the case of a cell: it is a network of reactions which produce molecules such that (i) through their interaction [they] generate and participate recursively in the same network of reaction which produced them, and (ii) realize the cell as a material unity. (Varela et. al 1974: 188)

In contrast to allopoietic systems (< *Greek*: allos = other; poiein = to produce), the elements of autopoietic systems are not produced by something outside the system. All processes of autopoietic systems are produced by the system itself and all processes of autopoietic systems

are processes of self-production. In this sense, one can say, autopoietic systems are *operatively closed*: there are no operations entering the system from outside nor vice versa.

A system's *operative closure*, however, does not imply a closed system model. It only implies a closure on the level of the operations of the system in that no operations can enter nor leave the system. Autopoietic systems are, nevertheless, also open systems: all autopoietic systems have contact with their environment (*interactional openness*). Living cells, for example, depend on an exchange of energy and matter without which they could not exist. The contact with the environment, however, is regulated by the autopoietic system; the system determines, when, what and through what channels energy or matter is exchanged with the environment. (To be sure there are some external forces that might influence the system directly, e.g. radioactive radiation, destroying parts of the system; but these influences can never determine what *operations* come about.)

This simultaneous (interactional) openness and (operative) closure of the autopoietic system becomes particularly important when considering cognitive processes. For Maturana and Varela the concept of living is directly linked to the concept of cognition.

Living systems are cognitive systems, and living as a process is a process of cognition.  
(Maturana and Varela 1980: 13)

In this sense the operations of an autopoietic system are defined as its cognitions; life and cognition are one and the same. Hence, everything that has been said about life applies equally to cognition: cognition is a self-referential, autopoietic process. This stance is generally known as Radical Constructivism (also: Operative Constructivism) expressing the idea that all cognitions (ideas) are constructs of the respective cognitive system and do not in any way reflect any kind of external reality.

In light of this, we might take a further look at the relation between system and environment. The operative closure of the cognitive system means that the environment cannot produce operations in the system. Cognitions are only produced by other cognitions of the same system. The operative closure does not, however, imply a solipsistic existence of the system, on the contrary. As Maturana and Varela argue: Operative closure is a *precondition* for interactional openness. On the level of its operations the autopoietic system does not receive any inputs from the environment but only perturbations (or irritations), which then might trigger internal operations in the system. In other words, external events may trigger internal processes but they cannot determine those processes. Luhmann (2000: 401) in this sense speaks of a “trigger-causality” [*Auslösekausalität*] instead of a “performance-causality” [*Durchgriffskausalität*]. For example, if one puts one’s finger in the flame of a candle, the rapid movement of the atoms in the flame will trigger an electric impulse in the nervous system, which will lead to the cognition of ‘heat’. Thus, what can be seen very clearly in this example is the clear distinction between cognitive system and environment. The events in the environment do not enter into the cognitive system; the rapid movement of the atoms triggers qualitatively completely different operations in the system. This triggering is only possible because the system has produced specific structures, i.e. nervous sensors which can be stimulated by rapid movement of electrons (in the same way as it would be stimulated e.g. by acid). From this the nervous system *constructs* the sensation of heat – the heat does not exist in the flame, in the flame we only have the rapid movement of atoms. If the eye, for example, was moved into the direction of the flame the nervous system would due to the specific structures of the nervous system in the eye *construct* the experience of light and specific

colours; again light and colours as such do not exist in the flame, in the flame there are merely electromagnetic waves.

The theory of autopoiesis clearly distinguishes between on the one hand the reproduction of the system as such and on the other hand the structures according to which this reproduction takes place: In order to 'survive' an autopoietic system constantly has to produce further elements. If this (re-)production stops the system disappears; e.g. if a plant stops producing its cells it is considered dead. For this it is irrelevant what concrete cells are produced; whether the plant produces a new leaf, extends its roots or grows a blossom does not matter – as long as any new elements are produced the plant is still alive. The fact of the reproduction as such – independently of the concrete elements reproduced – is referred to as the *autopoiesis* of the system. The likelihood of the continuation of reproduction, however, depends on the concrete elements reproduced. For example, if a flower stops producing leaves and instead only extends its roots it loses its viability, i.e. its ability to produce any further elements at all. What concrete elements are produced at any moment is determined by the structures of the system (the system in this sense is structure determined); e.g. the stem of the plant restricts where new leaves can be grown. The structures themselves however are not pre-given in any sense, as in structuralist theories, but are themselves the product of the autopoietic system. In other words, in its reproduction the system produces and reproduces its very own structures of reproduction. This aspect, i.e. the self-determination of its own structures, is referred to as *self-organization*. Thus, while autopoiesis refers to the reproduction of the elements as such, self-organisation refers to the determination of structures (Luhmann 2000: 47).

A central element within the theory of autopoiesis is the concept of *structural coupling* which refers to the relation between systems and their environments. As explained above environmental events can trigger internal processes in an autopoietic system but the concrete processes triggered (and whether any processes are triggered at all) are determined by the structures of the system. For example, some animals have certain neuronal structures that allow certain electromagnetic waves in their environment to trigger internally the sensation of certain colours; other animals again possessing other structures might not be stimulated by such waves or might be stimulated by them in other ways. A system is said to be structurally coupled to its environment (or other systems in its environment) if its structures are in some way or other 'adjusted' to the structures of the environment (or systems in the environment), i.e. if the structures of the system allow for reactions to 'important' environmental events. For example animals living above ground are structurally adapted to another environment than those living under ground. The former have structures that can be stimulated by electromagnetic waves leading to different impressions of colour, while the latter might have structures that can more easily be stimulated by vibrations leading to equally differentiated impressions corresponding to them.

#### **b. Luhmann's general, trans-disciplinary concept of autopoiesis**

There have been many attempts by social scientist to apply the concept of autopoiesis to the social domain (for an overview of different applications see Mingers 1995). Most of them however failed as they had tried to transfer the original concept directly. In contrast to most others, Luhmann did not apply the original concept directly to the social domain but (in line with the general systems tradition) tried to abstract from the originally biological concept of autopoiesis a *general, trans-disciplinary concept of autopoiesis*. This trans-disciplinary concept of autopoiesis should then be open to re-specifications by the different disciplines, e.g. sociology, biology, psychology. Luhmann in this sense wrote:

[I]f we abstract from life and define autopoiesis as a general form of system-building using self-referential closure, we would have to admit that there are non-living autopoietic systems, different modes of autopoietic reproduction, and general principles of autopoietic organization which materialize as life, but also in other modes of circularity and self-reproduction. In other words, if we find non-living autopoietic systems in our world, then and only then will we need a truly general theory of autopoiesis which carefully avoids references which hold true only for living systems. (Luhmann 1986: 172)

Luhmann suggests we speak of autopoiesis whenever the elements of a system are reproduced by the elements of the system. This criterion, as he points out, is also met by non-biological systems. Apart from living systems Luhmann identifies two additional types of autopoietic systems: social systems and psychic systems. While living systems reproduce themselves on the basis of life, social systems reproduce themselves on the basis of communication and psychic systems on the basis of consciousness or thoughts, their elements are not physical substances but elements of meaning (for explanations see below). Furthermore, social systems can be differentiated into the three sub-types: societies, organisations and interactions (Figure 1).

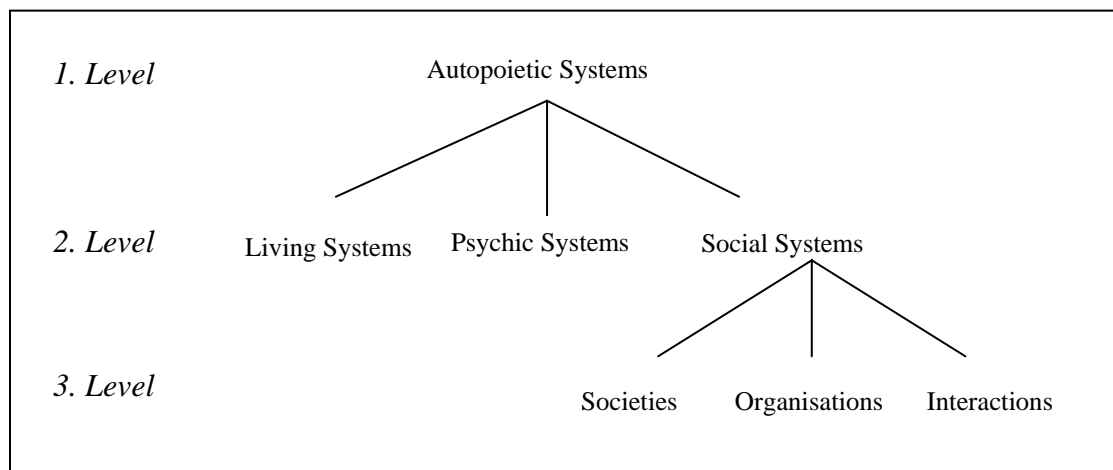


Figure 1: Types of autopoietic systems

Based on this typology of systems one can derive a hierarchy of three levels of analysis. On a first level we find statements which concern autopoietic systems in general without reference to any particular mode of reproduction. On this level we can find the general concept of autopoiesis. Statements on this level are equally valid for living as for psychological and for social systems (and its subtypes). On a second level we find different applications of the general theory of autopoiesis. There are three such areas: research concerned with the particular characteristics of living systems, psychic systems and social systems. Most of Maturana's and Varela's research can be placed on the level of living systems. It produces general statements concerning living systems, but are not applicable to social or psychic systems. Psychological research is concerned with the particularities of systems which are reproduced on the basis of consciousness. Sociological research on this level is concerned with the particularities of systems reproducing themselves on the basis of communication. Statements produced in this area concern all three types of social systems. On a third level one can find in the social field research concerning the particularities of societies, of organisations and of interactions. That is to say, for each type of system the particular mode of reproduction has to be defined and the consequences of the particular mode of reproduction analysed. Thus,

for social research, in particular, one can find four different areas of research: research on the general level of social systems (e.g. Luhmann 1995a) and research on the particular types of social systems - on societies (e.g. Luhmann 1997), on organisations (e.g. Luhmann 2000) and on interactions (e.g. Luhmann 1993a: 81-100).

Against the backdrop of categorisation of analytical levels the transformation of the original autopoiesis concept to the social domain becomes clear. Instead of just transferring the concept from the field of biology into the field of sociology, it is first abstracted to a general concept on a trans-disciplinary level, before being re-specified into social autopoiesis and the autopoiesis of particular types of social systems. We cannot examine the abstraction of the concept of autopoiesis in detail here, but merely want to highlight two important modifications: the temporalisation and de-ontologisation of the concept of element. (If this modified, general concept of autopoiesis were to be re-applied to the biological domain Maturana's and Varela's original theory would have to be modified accordingly.)

Luhmann's general concept of autopoiesis *radicalises the temporal aspect* of autopoiesis. While Maturana and Varela originally conceptualised the elements of their biological systems as relatively stable chemical molecules, which have to be replaced "from time to time", Luhmann conceptualises the elements as momentary events without any duration. Events have no duration but vanish as soon as they come into being; they 'are momentary and immediately pass away' (Luhmann 1995a: 287).

Events are elements fixed as points in time. [...] They occur only once and only in the briefest period necessary for their appearance (the 'specious present'). (Luhmann 1995a: 67)

Through this shift from a reproduction of relatively stable elements, to a reproduction of momentary events, Luhmann radicalises the concept of autopoiesis. Because the elements of the system have no duration the system is urged to constant production of new elements. If the autopoiesis stops the system disappears immediately.

In addition to temporalisation, Luhmann *deontologises* the concept of element. Elements are defined as elements merely through their integration into the system. Outside or independently of the system they have no status as elements; i.e. they are 'not ontically pre-given' (Luhmann 1995a: 22). Elements can, of course, be composed of different components, which could be analysed independently of the system, but as elementary units they are only defined through their *relation* to other elements and in this sense through the function they fulfil for the system as a whole. Luhmann writes:

[W]e have deontologized the concept of element. Events [...] are not elements without substrate. But their unity corresponds to no unity in the substrate; it is created in the system through their connectivity. Elements are constituted by the systems that are composed of them [...]. (Luhmann 1995a: 215)

As a consequence of deontologising the concept of element, the concept of "production" (as in 'self-reproduction') gets a functional meaning. Production refers to the use of an element in the network of elements. The important point in this conceptualisation is that the element and the use of the element are not two different issues, but two sides of the same coin. It is not that we first have the element and, then, the system makes use of it, but only by making use of the element, i.e. by relating it to other elements, it becomes an element. Thus, one can say: the element is produced as a result of being used (Luhmann 1997: 65-66). One can, of course,

analyse the substratum, on which an element rests, and find a whole range of causal factors which are involved in bringing it about, but the particular unity as which the element functions in the system, i.e. the characteristics that make it an element of the system, can only be produced by the system itself.

## 2. Social systems

### a. Communications as the elements of social systems

The first decision Luhmann as a theoretician had to make for constructing his general *sociological* theory of autopoiesis (which on this level of analysis is still unspecific with regard to the three types of social systems: society, organisation, interaction) is what to treat as the basic elements of the social system. The sociological tradition suggests two alternatives: either persons or actions. Luhmann rejects both as incompatible with the concept of autopoietic social systems. Instead, he chooses a completely different element: communication (or more precise: the communicative event); promoting a 'conceptual revolution' (Luhmann 1986: 178). He writes:

Social systems use communications as their particular mode of autopoietic reproduction. Their elements are communications which are recursively produced and reproduced by a network of communications and which cannot exist outside of such a network. (Luhmann 1986: 174)

In order to understand this conception of social systems, we have to clarify Luhmann's *concept of communication*, which differs considerably from the conventional notion of communication as an asymmetrical process of transferring meaning or information from a sender to a receiver. Building on the speech theories of Karl Bühler (1934), Luhmann conceives of communication as a combination of three components: (1) information, (2) utterance and (3) understanding, each of which Luhmann conceptualised as selection.

In accordance with Shannon and Weaver (1949) he defined *information* as a selection from a repertoire of possibilities. Every communication selects *what* is being communicated from everything that could have been communicated. With *utterance* Luhmann refers to the form of and reason for a communication: *how* and *why* something is being said. One can say, the utterance is the selection of a particular form and reason from all possible forms and reasons. *Understanding* is conceptualised as the distinction between information and utterance. For a communication to be understood the information has to be distinguished from the utterance: what is being communicated must be distinguished from how and why it is communicated. For example, if alter says to ego: 'I am tired', ego has to distinguish the information ('I am tired' and not e.g.: 'I am very energetic') from the utterance (the words alter is using and the reason why alter is saying it: e.g. alter wants to indicate that ego should leave him alone; he is not saying it in order to get any advice on what to do about his tiredness). Thus, understanding can be understood as a selection of a particular distinction between information and understanding.

While most communication theories refer only to the first two elements - information and utterance - in Luhmann's concept, the third element - understanding - plays a central role. Instead of approaching a communication from an 'intended meaning' of the communication, Luhmann reverses the perspective: (the meaning of) a communication is ultimately determined through the understanding. Luhmann (1995a: 143) in this sense writes:

'Communication is made possible, so to speak, from behind, contrary to the temporal course of the process.' This is also called the 'principle of hermeneutics':

[This principle states] that not the speaker but the listener decides on the meaning of a message, since it is the latter whose understanding of the set of possibilities constrains the possible meaning of the message, no matter what the speaker may have had in mind. (Baecker 2001: 66)

A central point in Luhmann's concept of communication is that the three selections form an '*insoluble unit*'; to be sure, this unit can be divided *analytically* into its three components (for example by other communications), but only as a unit does it constitute a communication. Because of that a communication - as this *unity* of the three selections - cannot be attributed to any *one* individual (psychic system). Instead communication constitutes an *emergent* property of the interaction between *many* (at least two) psychic systems. In this sense Luhmann writes:

Communication is a genuinely social - and the only genuinely social - operation. It is genuinely social insofar as it presupposes the involvement of a multitude of psychic systems but, or better: *because of that*, it cannot be attributed as a unit to a single psychic system. (Luhmann 1997: 81; my translation)

Thus, although psychic systems are *necessarily* involved in bringing about communication, the communication (as this unit) cannot be understood as the product of any particular psychic system.

In order to render more precise Luhmann's concept of communication we have to take another, closer look at his concept of understanding. Understanding as we said above is the distinction between utterance and information; but whose understanding is of relevance here? Again, for Luhmann it is *not* the psychic system that is of interest. Instead, it is the understanding *implied* by the ensuing communications – in the same way as the concrete meaning of a word in a text is only defined through the following words in the text. Thus, the meaning of a communication, i.e. what difference a communication makes for later communications, is only *retrospectively defined through the later communications*. For example, whether a 'Yes' is understood as an approval or as a question or as a neutral acknowledgement of the given information, is only determined through the reaction of the connecting communications; e.g. 'I'm happy you agree', 'You don't believe me?' or 'What is your own opinion' (Again, the meaning of *these* communication is itself only defined through the communications connecting to *them*). In other words, Luhmann is not referring to any form of psychic understanding, but an understanding on the level of the communications. What the 'involved' psychic systems think during the communication processes, i.e. how the psychic systems understand the communication, is (at first) completely irrelevant for the communication. For example, the psychic systems might understand the 'Yes' as a question, while the ensuing communications treat it as an approval. Of course, what the psychic systems think about the communications ultimately might influence the communications because of the structural coupling between the two systems: different thoughts about the communications might lead to the psychic systems causing different irritations in the social system and thus ultimately might lead to different communications coming about. But it has to be stressed again that the psychic systems cannot determine what communications come about.

This retrospective determination of the communication through ensuing communications is connected with a fourth type of selection. With understanding, a communicative event as the



synthesis of the three selections (utterance, information and understanding) is complete. However, if the social system is not discontinued a fourth type of selection will take place: acceptance or rejection of the meaning of the communication. This fourth selection is already part of the next communication. It is important not to confuse the third and fourth selection: understanding does not imply acceptance! For example, a pupil understands when the teacher says: 'do your homework', but he might still reject the communication, answering: "No, I won't". There might be communicative structures which make acceptance more likely than rejection, but the *concept* of communication is not focussed on acceptance - in contrast, for example, to Habermas's (1987) concept of communication. On the contrary, every communicative event provokes the *selection* between acceptance and rejection. This distinction between understanding (as part of the first communication) and the selection acceptance/rejection (as part of the ensuing communication) adds a dynamic element which bridges the gap from one communicative event to the next.

This leads to a very important point: the (re-)production of communications. In accordance with the general concept of autopoiesis, communications do only 'exist' as communications through their *relation* to other communications; as explained above a communication is only defined through the ensuing communications. This does not mean that without the relation there is nothing at all (there are, for example, words and sounds), but they have no status as communication. In this sense one can say that it is the network of communications that 'produces' the communications. In other words, it is the context of other communications that makes it count as a communication at all. Luhmann thus famously said: "*Only communications can communicate.*"

So far we have explained the autopoiesis of social systems, i.e. the reproduction of communications through communications. We have explained *how* communications produce communications but not *what* communications are produced, which is a question about the *structures* of social systems. Luhmann conceptualises social structures as *expectations* (Luhmann 1995a). In every situation certain communications are expected and not others. For example, a question about one's wellbeing is *expected* to be followed by an answer on this issue and not by a statement about the latest weather forecast. The expectation to a certain extent pre-selects the possibilities for further communications: it makes certain communications more likely than others (it does not however exclude any possibilities completely). These expectations are recursively reproduced through the communications. Whenever a specific expectation is met by an adequate communication the expectation is confirmed and thus likely to continue to function as a structure. However, if the expectation is repeatedly not met the expectation might be changed. An important form of social structures is the *topics* of communication. Topics provide pre-selections of all in principle possible communications: certain possibilities of communication fit a specific topic and others do not. For example, in a conversation about social theory one would not expect a communication about cooking. However, if such a communication came about the topic of communication might be changed.

## **b. Interpenetration: the relation between social and psychic systems**

The relation between social system and 'human being' is a very controversial aspect of Luhmann's theory; it is also the most misunderstood aspect. For an adequate appreciation it is thus necessary to carefully outline this relation.

In Luhmann's theory the 'human being' is not conceptualised as forming a systemic unity. Instead it has to be understood as a conglomerate of organic and psychic systems. The former

consists of biochemical elements, the latter of thoughts. Both systems are operatively closed against each other: no system can contribute elements to the respectively other system. The systems are however structurally coupled; i.e. their respective structures are adjusted to each other in such a way as to allow mutual irritations.

Although the 'human being' does not constitute a systemic unity, the social system treats it as such: it constructs it as a *person*. In other words, 'persons' do not exist as such – they are no systems – but they are a construct of the social system with which it refers to the conglomerate of organic and psychic systems. A social system might for example construct the person 'John Smith'. Whenever the 'corresponding' conglomerate of organic and psychic systems causes irritations in the social system, the social system will refer to it as caused by 'John Smith'. In the course of time a social system will develop certain expectations about when and how this conglomerate might cause irritations. These expectations become part of the construct 'John Smith'. Ultimately we could say, a person is nothing other than a complex of expectations that a system has vis-à-vis a specific conglomerate of organic and psychic systems. Luhmann in this sense defines 'person' as the 'social identification of a complex of expectations directed toward an individual human being' (Luhmann 1995a: 210)

Particularly important for the social system is the psychic system. Like social systems psychic systems are meaning-constituted systems. However, in contrast to social systems, the meaning events do not materialise as communications but as thoughts. In other words, psychic systems reproduce themselves on the basis of consciousness: only thoughts can produce thoughts. Not even events in the brain, i.e. electric impulses, can take part in the autopoiesis of psychic systems: a nerve impulse is not a thought. Psychic systems are not only closed with regard to other types of systems but also with regard to each other. No psychic system has direct access to another psychic system; my thoughts can never enter your psychic system.

As operatively closed systems psychic and social systems constitute environment for each other: thoughts cannot become communications and communications cannot become thoughts. Mutual influences are restricted to the structural level. There merely exists a relation of structural coupling: both types of systems are *structurally* adapted to each other in a way which allows for mutual irritation (see our explanations on structural coupling above). Luhmann calls the specific structural coupling of social and psychic systems *interpenetration*. Luhmann speaks of interpenetration if

an autopoietic system presupposes the complex achievements of the autopoiesis of another system and can treat them like parts of the own system. (Luhmann 1995b: 153; my translation)

For the autopoiesis of the social system the simultaneous (but separate) autopoieses of psychic systems is constitutive. Without psychic systems social systems are impossible – and probably vice versa. Every communicative event presupposes 'parallel' events in the psychic systems. Already for the perception of utterances the social system depends on the psychic system: the social system cannot hear spoken words, nor read letters. Furthermore psychic systems serve as a memory as they can remember communicative events beyond their momentary point of existence. Because of their structural coupling social systems can expect their communications to cause irritations in the psychic systems and to receive irritations from the psychic systems when necessary. They can, for example, count on psychic systems to trigger further communications after every communication. Although psychic systems trigger communication processes and vice versa - we repeat this point, since it is very important - the processes of the psychic system and the social system *do not overlap in any way*.

The most important evolutionary achievement for the coupling of social and psychic systems is language – this does not, of course, mean that communication is possible only with language. Language ensures that psychic systems are *irritated* through the communication processes. Articulated speech, for example, normally disturbs people who are not involved in the communication more than mere noise. In this sense, Luhmann writes:

Crucial [for the coupling between social and psychic systems] is the differentiation of specific objects of perception which stand out and fascinate as they have no resemblance at all with anything else perceptible [...]. Language and writing fascinate and preoccupy consciousness and in this way ensure that it comes along, although the dynamic of the consciousness does not necessitate this and always provides distractions. (Luhmann 1995b: 41; my translation)

Language is a purely social phenomenon (psychic systems do not think in language) but thought processes can be structured in a complementary way to language; particularly during communication processes: thoughts are broken down into equivalent chunks to those of sentences and words. In other words, psychic processes are synchronised with communication processes and, in this way, they 'know' when to contribute irritations to the communication process in order to make the reproduction of the social system possible.

Although Luhmann's strict distinction between social and psychic systems runs counter to our everyday beliefs and almost all social and psychological theories, it has one important theoretical advantage. It allows for a concept of the social which is clearly distinguished from the psychological. Consequently, social and psychic phenomena can be analysed in their own right. This does not lead to a marginalisation of the psychic for the social system – as has often been criticised. On the contrary, through this differentiation it can be clearly shown that, and in what way, both systems are *dependent* on each other. The treatment of human beings as environment of the social system (and not as part of it), as Luhmann writes,

does not mean that the human being is estimated as less important than traditionally. Anyone who thinks so (and such an understanding underlies either explicitly or implicitly all polemics against this proposal) has not understood the paradigm change in systems theory.

Systems theory begins with the unity of the difference between system and environment. The environment is a constitutive feature of this difference, thus it is no less important for the system than the system itself. (Luhmann 1995a: 212)

### **c. Communication and action**

While Luhmann suggests treating communications - and not actions - as the elements of social systems, the concept of action does not become completely irrelevant. On the contrary, Luhmann assigns it an important role in the reproduction of the system. Already the fact that not only sociologists but all social systems use the concept of action meant that it could not be ignored.

Often communication is treated as some kind of action; in this sense Habermas (1987), for example, speaks of 'communicative action'. But Luhmann's communication - and this is very important - is not a kind of action. As explained above, communication is constituted as a synthesis of a threefold selection of utterance, information and understanding. The concept of

action cannot account for all three selections. It might capture the first two selections but certainly not the third: understanding.

[T]he perfection of communication implies understanding and understanding is not part of the activity of the communicator and cannot be attributed to him. (Luhmann 1986: 178)

Thus, a central element of Luhmann's concept of communication would be missing if interpreted as action. Apart from that, the original intention of an action is not important for the communication. For example, looking at one's watch might be understood as communicating one's boredom, although one only wants to know what time it is.

Luhmann suggests treating action as a (fictive) construct of social systems for *observing*, and communicating *about*, their communications: social systems observe their communications not as communications but as actions, which they causally *attribute* to 'persons' ('actors'). As explained above also the 'person' is a construct of the social system with which it refers to the human being as the conglomerate of psychic and social systems. This attribution of communications to persons as actions is deeply ingrained in language: our sentences are usually based on a subject-object logic – "somebody is doing something". In other words language forces the attribution of communication to *someone*; it is almost impossible to speak about communications as something that is not 'done' by someone.

In this way, the social system constructs an image (self-description) of itself as a nexus of actions. This self-description constitutes a simplification of the system and this is also where its function lies. The simplified version of itself serves as orientation for its (re-)production, which has several advantages: First, actions are easier to recognise and deal with than communications. While an orientation according to communications presupposes a clear distinction between utterance, information and understanding, an orientation according to action only has to deal with the specific rules of attribution.

The simplification lies in the fact that only actions and not fully communicative events serve as connective points, in that an abstraction suffices to communicate action or simply connective behaviour, and in that one can to a great extent omit the complexities of the complete communicative occurrence. The fact that one need not examine (or need examine only under very specific conditions) which information an utterance referred to and who understood it takes some of the load off. (Luhmann 1995a: 168)

Second, the description of communication processes as connections of actions leads to clear-cut temporal relations between different elements. While communications are completed only after understanding has taken place, that is, the communicative occurrence is 'held in suspense' (Luhmann 1995a: 169) between utterance and understanding (this is particularly extreme in the case of communications by letter where the utterance and the understanding are usually drawn far apart), actions mark one point in time (determined by the utterance). As a consequence, the different communications are also much more clearly differentiated from each other: while communications are heavily entangled with each other – with later communications retrospectively defining the meaning of earlier ones –, actions appear self-defined and do not presuppose other actions.

### **3. Society and interaction**

According to Luhmann we can distinguish three types of social systems: society, face-to-face interaction and organisation. All three systems are social systems insofar as they reproduce themselves on the basis of communications. They are however different *types* of social systems insofar as they reproduce different types of communications. In the following we will give a brief description of Luhmann's concept of society and interaction system; the organisation as the third type of social system will be dealt with afterwards in a separate section.

### a. Society

For Luhmann society is the system that encompasses all communications; all communications that are produced are part of society and as such reproduce it. Hence there are no communications outside society. The borders of society are the borders of communication. Luhmann thus writes:

[S]ociety is the all-encompassing social system that includes everything that is social and therefore does not admit a social environment. If something social emerges, if new kinds of communicative partners or themes appear, society grows along with them. They enrich society. They cannot be externalized or treated as environment, for everything that is communication is society. Society is the only social system in which this special state of affairs occurs. (Luhmann 1995a: 408)

As a consequence of this conceptualisation society only exists in singular: there is only one *world society*. For Luhmann society is thus 'the autopoietic system par excellence': all elements (communications) are produced by the own elements (communications) and cannot get out of this network of elements (society).

Amongst the three types of social systems society is a very particular one as it encompasses the other two systems - interaction and organisation. As the system including *all* communications it also includes the specific interactional and organisational communications. Or the other way around, all interactional and organisational communications always also reproduce society.

In the course of its evolution society has undergone three major structural changes; i.e. changes of how the societal *communications* were structured (Luhmann 1997). In archaic times society was differentiated into equal subsystems (*segmentation*), e.g. different tribes, clans or families. This was replaced in the following by a differentiation according to the logic of *centre and periphery*: the differentiation between city and country. In the late medieval times a hierarchical form of differentiation emerged with different social strata or classes (*stratification*). With the emergence of the modern society, around the 18<sup>th</sup> century, this has been replaced by the current, *functional* differentiation, where we find several societal subsystems specialised in serving specific societal functions; e.g. law, science, economy, art, religion. Each of these *primary* forms of differentiation can be combined with the other forms of differentiation on a *secondary* level; e.g. in stratified society the different strata were often differentiated internally into equal subsystems (segmentation) or according to the difference centre/periphery. Similarly the different functional subsystems might be differentiated internally into equal subsystems, into centre/periphery or hierarchically.

While Luhmann has written extensively about all four types of differentiation the functionally differentiated society as the present form of differentiation is of most interest to us here. It is characterised by the existence of different functional systems. All of these systems are

communication systems that are themselves operatively closed on the basis of a specific *binary coding*. That is to say, all communications taking part in the reproduction of a particular functional subsystem ‘carry’ a specific code. For example, the code of the legal system is justice/injustice; the code of the economic system is payment/non-payment; the code of the system of science is truth/untruth; the code of the political system is power/non-power. Each of these systems communicates about itself and its environment according to its specific code: for example, for the legal system something is either just or unjust or it does have no relevance at all; for the economic system something is either a payment or a non-payment or it does have no relevance to it, i.e. whether something is just or unjust is irrelevant for the economic system. Each communication of a functional system relates to other communications of the same function system on the basis of the function-specific coding. For example, a communication of the legal system relates to other legal communications as either just or unjust communication. A legal ruling refers to another legal ruling (as a just ruling) in order to substantiate itself – it can not however refer to some payments being made (economic system). These functional systems are operatively closed in the sense that only communications carrying the function-specific code can take part in the reproduction of the function system. Thus, only legal communications can reproduce the legal system - economic, scientific, political etc cannot; only scientific communications can reproduce science, etc.

The functionally differentiated society combines extreme inclusiveness with extreme exclusiveness. On the one hand each function system includes *all* function-specific communications. Thus, all legal communications are part of the legal system; all economic communications are part of the economic system; all scientific communications are part of the scientific system, etc. On the other hand, these societal functions are exclusively served by the respective function system; only the legal system can provide justice, the economic or scientific systems cannot; only the economic system can produce payments; only the scientific system can produce truth. Each of these systems thus has an enormous reach as they refer to the entire world society, but at the same time their range is also very narrow as they deal with only one function.

Functional systems constitute environment for each other. The systems cannot ‘exchange’ their communications; an economic communication cannot take part in the scientific system; a political communication cannot take part in the legal system etc. Each system reproduces itself self-referentially and registers communications of other function systems merely as irritation, which it processes according to its own logic. The economic system for example would register legal communications merely with regard to its consequences for payments/non-payments. No function system can control any other function system; there is no dominance of any system over another, not even the political system. In this sense there is no centre to the functionally differentiated society. The different systems are merely structurally coupled to each other, i.e. their structures are adjusted to each other in such a way as to allow them to react to their respective operations. For example, legal system and economic system are structurally coupled through sales contracts. The sales contract is a legal communication for the legal system re-distributing legal rights and duties; and it is a (different) economic communication for the economic system re-distributing payments. In other words, the sales contract is two different communications for the two different function systems, but it allows the two systems to somewhat ‘co-ordinate’ their respective processes.

## **b. Interaction**

Like all social systems (face-to-face) interactions are systems which reproduce themselves on the basis of communications. In contrast to society, however, the communications are of a

particular kind, namely communications which are based on the perception of the physical presence of their participants.

To be sure, perception as such is clearly a psychic phenomenon – communications cannot perceive. However, *reflexive* perception gives rise to communication as Luhmann argues:

If alter perceives that alter is perceived and that this perception of being perceived is perceived, alter must assume that alter's behavior is interpreted as communication whether this suits alter or not, and this forces alter to control the behavior as communication. (Luhmann 1995a: 413)

Thus, every communication refers to the fact that all participants perceive each other as present - a face-to-face contact is thus a precondition. However, not everyone who is physically present will also be treated as present by the communication. For example, people at other tables in a restaurant although physically present might not be considered present by the interactional communication. Similarly, not all perceptible behaviour will necessarily be treated as perceptible, i.e. treated as present, by the interaction; for example blowing one's nose. In other words, every interactional communication distinguishes between what to consider as present and what to consider as absent. Making this distinction qualifies the communication as interactional. One could also say, the interactional communications carry the code 'presence/absence' analogously to the function codes described above.

Like the functional systems interactional systems are operatively closed insofar as only communications carrying the code 'presence/absence' take part in the reproduction of the interaction system. Communications in an interaction can only connect to other communications that are treated as present and not those treated as absent, e.g. the communications of another communication at the next table; unless that communication were treated as present and thus as part of the same interaction system.

What communications are treated as present or absent depends to a certain extent on the structures of the interaction. Like all social systems interactional communications are structured (apart others) through the topics of communication. These topics often make a pre-selection of who to treat as present. For example, if managers of a company sit in a pub to discuss the company's strategy, the interaction would probably treat only these managers as present and all other visitors of the pub, who might even happen to sit with them at the same table, as absent. However, if the topic changed to football new persons might be included in the interaction, while some of the initial participants might be excluded again.

## **4. Organisation**

### **a. Decisions as the elements of organisations**

Luhmann conceptualises organisations as social systems which reproduce themselves on the basis of decisions. In other words, organisations are

systems that consist of decisions and that themselves produce the decisions of which they consist through the decisions of which they consist. (Luhmann 1992b: 166; my translation)

But what is a decision? Luhmann argues that the standard definitions of decision are not very helpful. Mostly decision is defined as 'choice'. This, however, means decision is defined

through a synonym which is equally unclear. Sometimes the definition is specified somewhat more as ‘a choice among *alternatives*’. This, however, does not add much as the concept of alternative is itself only defined in relation to choice: alternatives are those possibilities among which one can *choose*; i.e. the choice defines the alternatives. Thus, one only finds tautological definitions.

Building on, and modifying, the existing definitions Luhmann suggests conceptualising decision as a specific form of *communication*. It is not that decisions are first made and then communicated, but decisions *are* communications. As has been said about communications in general, also decision communications are not produced by ‘human beings’ but by the social system, the organisation.

What is particular about decisions is that they are ‘compact communications’ (Luhmann 2000: 185) which communicate their own contingency (‘contingency’ here in the sense of ‘also possible otherwise’). In contrast to an ordinary communication which only communicates a specific content that has been selected (e.g. ‘I love you’), a decision communication communicates also – explicitly or implicitly – that there are other alternatives that could have been selected instead (e.g. ‘I am going to employ candidate A and not candidate B’). As such decision communications are always *paradoxical* communications: the more they communicate that there are *real* alternatives to the one that has been selected, the less the selected alternative will appear as justified and thus the less the decision will be accepted as ‘decided’; and the more the selected alternative is being justified as the right selection the less the other options will appear as alternatives and thus the less the decision will appear as ‘decision’. Or to put it in linguistic terms, every decision communication contains a performative self-contradiction: the ‘report’ aspect and the ‘command’ aspect (Ruesch and Bateson 1951) of the decision communication contradict each other. The more clearly the decision is communicated as selection among possible alternatives (report aspect), the less the decision will be accepted by later communications as decision (command aspect).

Because of their paradoxical nature decision communications are very delicate calling for their own deconstruction by the ensuing communications. Without any other communicative provisions decision communications would have a very high ‘failure rate’. So, why does the organisational communication not break down all the time? Luhmann gives two answers to this question. First, organisations totalise decision as the organisational form of communication – organisations are operatively closed on the basis of decisions. Thus, even the deconstruction of a decision in an organisation has to be communicated as a decision. In other words the rejection of a decision can itself only be communicated as yet another decision – otherwise it would not be part of the organisational autopoiesis (Luhmann 2000: 145). Second, decision communications in organisations usually can refer to other (successfully completed) decisions – ‘decision premises’ (see below) – to stabilise the decision; i.e. decisions prohibiting the rejection of certain other decisions (Luhmann 2000: 142).

The operative closure of organisations on the basis of decision communications must not – as Luhmann pointed out in his later writings (Luhmann 2000) – be misunderstood in the sense that there are no other communications ‘in’ organisations. There are of course also other communications as for example gossip. These communications take place in the organisation but they ultimately do not contribute to the autopoiesis of the organisation. Luhmann illustrates this idea with an example from biology:



In living cells there are also some minerals [...] which do not take part in the autopoiesis of the system but which nevertheless serve important functions. (Luhmann 2000: 68; my translation)

## **b. Uncertainty absorption**

Within organizations, decision communications are always integrated into a process of connecting decisions – the actual autopoiesis of the organisation. Every decision is the product of earlier decisions and gives rise to ensuing decisions. Luhmann describes this process of decisions connecting to each other with the concept of uncertainty absorption, the idea of which he takes from March and Simon:

Uncertainty absorption takes place when inferences are drawn from a body of evidence and the inferences, instead of the evidence itself, are then communicated. (March and Simon 1958: 165)

For a decision to be made information is needed on the basis of which one alternative can be chosen over the others. An investment decision, for example, is based on information on availability of financial resources, on current interest rates, on current market demand etc. Formulated the other way around one can say, a decision is 'inferred' from the given information. Yet, the important point is that no decision can rely on complete information; some uncertainty inevitably remains. In our example, there is uncertainty concerning future market demand, investment projects of competing firms, future inflation figures etc. All this uncertainty, however, is absorbed by the decision: all given information and all remaining uncertainty is transformed into the selection of one alternative over the other ones. Uncertainty absorption now takes place in the *connection* between decisions. As decisions do not inform about the uncertainties involved in making the decision – they merely inform about selected and excluded alternatives – ensuing decisions connecting to them cannot 'see' the uncertainties. That is to say, from the perspective of the connecting decisions orienting themselves toward the first decision the uncertainty of the first decision is absorbed.

Based on such a processual understanding of decision, we can distinguish between two 'states' of a decision: before and after subsequent decisions have connected to it. A decision is only completed, when subsequent decisions connect to it. Before that, the decision is merely *virtual* (Baecker 1993). The decision is virtual because the realisation of the decision in subsequent decisions is expected, but it is not realised, yet. For example, the organisation decides to manufacture a particular new product - in contrast to producing another new product or not producing anything new at all. This decision is only virtual until subsequent decisions have completed it as decision by orienting themselves according to it. The marketing division, for example, might decide on the advertisement of this new product. This can be understood in analogy to the relation between different communications – as described above – where a communication is only completed once another communication connects to it by retrospectively defining its meaning.

## **c. Decision premises**

A concept closely related to uncertainty absorption is that of decision premise – originally introduced by Herbert Simon (Simon 1957: 201). The concept of decision premise refers to the structural preconditions that define - or create - a decision situation. For example: the alternatives given, the objectives of the decision etc.. While one could include in the term everything that influences the situation, Luhmann argues that such a concept would not be

very fruitful. Instead he restricts the term – in a first step – to those structural preconditions that are themselves the 'result' of other decisions. In other words, a decision takes previous decisions as decision premises, or formulated the other way around: every decision serves as a decision premise for later decisions. With regard to the previous section we have reversed our perspective: we are not looking at the transformation from the initial choice situation to the connection of subsequent decisions, but are looking 'back' from a decision to previous decisions and ask about their relevance for it. The answer is: they serve as decision premises. To bring the concepts of uncertainty absorption and decision premise together we can say: uncertainty absorption takes place, when a decision is used by subsequent decisions as decision premise.

An important aspect of the concept of decision premise is its double function as both creating and restricting the decision situation. Decision premises create the decision situation in the first place: they define the decision situation as such. Without decision premises there is no occasion for decision making. At the same time, decision premises restrict the decision situation by creating a particular decision situation and not a different one. If decision premises define a decision situation as a choice between alternative A and alternative B, one cannot decide between X and Y.

The concept of decision premises becomes particularly interesting when the concept of decision and decision premise are applied recursively to each other. Apart from the factuality of every decision becoming a decision premise for subsequent decisions, decisions can decide explicitly on decision premises for other decisions, i.e. decisions on decision premises. The crucial point of this is that a decision can decide on decision premises which are not only binding for immediately succeeding decisions, but for a multitude of later decisions. They serve 'a sort of anticipated, generalised uncertainty absorption.' (Luhmann 2000: 261) In this way decisions can influence other decisions that take place much later in the decision process. Luhmann now suggests restricting the term decision premise – in a second step – to those far reaching decision premises. He distinguishes three types of such decision premises: programmes, communication channels and personnel.

*Programmes* are decision premises that define conditions for correct decision making; they are often also called 'plans'. There are two different kinds of programmes: conditional programmes and purpose programmes. *Conditional programmes* define correct decision making on the basis that certain conditions are given. They generally have an 'if-then' format – 'if this is the case, than do that'. *Goal programmes*, in contrast, define correct decision making by defining specific goals that are to be achieved, e.g. 'profit maximisation', and in this way structure the given decision possibilities. Neither type of programme, however, removes the uncertainty from the decisions which they call upon – they do not decide the decisions (otherwise they were no decisions). In the case of conditional programming there is uncertainty about whether the conditions are actually met by the decision situation - there is always some scope for interpretation. In the case of purpose programming the main uncertainty concerns the causal link between alternatives and purpose, e.g. which alternative maximises the profit. Apart from that there is in both cases uncertainty on whether the programmes should actually be applied to the decision situation - reasons for making an exception can always be found.

The decision premise *personnel* concerns the recruitment and organisation of personnel. Organisations, on the one hand, decide on commencement and termination of membership and, on the other hand, on transfer of members to different positions within the organisation - both with and without promotion. Personnel is a decision premise insofar as it makes a

difference who is in charge of a decision. An experienced manager is likely to 'give rise' to different decisions than a newcomer. (This recognition of different individuals making a difference for the organisation does not contradict the concept of autopoiesis. Different individuals are only considered for the difference in irritations that they cause.) In this sense, organisations have expectations about the behaviour of different persons, which serve as basis for selecting their personnel.

The decision premise *communication channels* concerns what can be called the organisation of the organisation. Usually in an organisation not everybody can communicate with everybody at any time, but the communication is restricted to certain channels. The classical case is the hierarchical structure, in which the communication channels only run vertically. Decisions on one level only inform decisions on the next lower or next higher levels, but not decisions on the same level. That is to say, decisions can only use other decisions on the vertical line as decision premises and not the ones on the horizontal line. Apart from the hierarchy a multitude of other forms of communication channels exist, for example the matrix-organisation.

The three decision premises - programme, personnel and communication channel – are co-ordinated through the creation of '*positions*'. Positions are nodes at which the three decision premises meet and are specified with regard to each other. Every position is executing a particular programme, is filled by a particular person and is located somewhere in the communication network. Positions co-ordinate decision premises in two respects. On the one hand they co-ordinate them with regard to concrete decisions. On the other hand they serve as an orientation for decisions on new decision premises: only such new decision premises can be integrated which fit into the existing structures of positions, or for which new positions can be created.

In his later writings Luhmann (2000) introduced another type of decision premise, a concept with which he wanted to account for what is usually termed 'organisational culture': the *undecidable decision premise* – in contrast to the decidable decision premises described above. Undecidable decision premises are decision premises which have not been explicitly decided upon but are some sort of by-product of the decision processes. For example, in a series of recruitment decisions the organisation might have chosen only male candidates, which might condense to a (not explicitly decided) decision premise for future decisions not to choose female candidates.

#### **d. The double closure of the organisation**

Like all autopoietic systems organisations can be said to be doubly closed (on this point see particularly Baecker 1993): closed on the level of their operations and closed on the level of their structures. The first closure refers to the conceptualisation of organisations as reproducing themselves *exclusively* on the basis of decisions. No external operations can take part in the network of decisions nor can any decisions get out of this network. In other words on the basis of its operations the organisation has not contact to its environment whatsoever. Decisions are only oriented according to other decisions and nothing beyond the decision network. Thus, the individual decisions are 'blind' with regard to anything outside the organisation. On this operative level the only thing that is important is the continuous reproduction of decisions out of decisions – regardless of which decisions. As long as *any* decisions are produced the autopoiesis of the organisation is continued.

The 'blindness' of decisions is however compensated through the decision premises, i.e. the structures of the organisation (structural level). These decision premises (in particular: decision programmes, communication channels, personnel) determine which decisions are produced. For example a recruitment programme will lead to certain recruitment decisions and not to decisions on the colour of waste paper baskets. In other words the decision premises channel the reproduction of decisions. In this sense the orientation according to decision premises serves the decisions as substitute for the orientation according to the environment. But even on this structural level of decision premises the organisation cannot get out of the decision network; even there it does not get into direct contact with its environment. This is the second closure. Decision premises are not in any way given from outside but are themselves the product of decisions. Decisions and decision premises are recursively reproduced - compare Giddens's (1984) concept of structuration. Thus neither on the level of its operations (first closure) nor on the level of its structures (second closure) is the environment directly taken into account in the reproduction of decisions.

The double closure of the organisation has a twofold implication. On the one hand double closure implies autonomy: it is the organisation itself which determines its own structures and operations. Without the ability to decide on its own structures the organisation would be the mere continuation of its environment. On the other hand, double closure implies unavailability. As the organisation can only operate on its 'inside' and cannot distance itself from itself, i.e. it has no other mode of operation than decisions, it is captive of its own processes and thus does not have (complete) control over itself.

#### **e. The paradox of decision at the heart of the organisation theory**

In this last section on organisation I briefly want to come back to the paradox of decision in order to highlight how crucial it is for Luhmann's way of theorizing about organisations. Particularly in his later writings (Luhmann 2000; 1993c) the paradox of decision is made the starting point for unfolding his entire organisation theory. Independently of the conceptualisation of decision as communication Luhmann argues that the very idea of decision is paradoxical. In this sense he quotes Heinz von Foerster (1992: 14), who famously wrote: "Only *those* questions that are in principle undecidable, *we* can decide" – everything else would be mere calculation. In other words, in a *real* decision situation the given alternatives are all *equally* valid; there are no better or worse alternatives – otherwise these would not be *real* alternatives. If the 'alternatives' were of different value (in which case they would not be real alternatives) there would be no need to decide between them anymore – the decision situation would be already decided. In a real decision situation with real alternatives, however, there is no valid reason for choosing one alternative over the other – otherwise the alternatives were not of equal value. Thus, at the heart of every decision there is undecidability.

In order to prevent a paralysis of decision situations the paradox of decision has to be *deparadoxified*; i.e. the paradox has to be deferred to another place. This deferral does not mean that the paradox disappears but it is just moved 'out of sight'. For example the undecidability of the decision might be shifted to the selection of a decision rule; e.g. 'choose the alternative that is least risky'. This decision rule might allow a clear ranking of the different alternatives and in this way the decision rule can be said to 'decide' the original decision situation. In this case the original decision paradox has been deferred to the decision about which decision rule to choose. There exist many different decision rules which themselves constitute alternatives between which one needs to decide. Again, this decision situation is itself undecidable and thus paradoxical. The paradox might thus have to be

deferred to yet another place, e.g. to the decision about a meta-decision rule. Ultimately the paradox can only be deferred but never solved. This might lead to an infinite regress unless the paradox ends up in a place where it is not 'noticed'. For Luhmann most organisational phenomena can in one way or other be traced back to this undecidability of decisions: most problems in organisation are directly or indirectly linked to the decision paradox and most structures and processes function as a means of deparadoxification.

## 5. Luhmann's theory of social systems as a theory of distinction

In his writings – particularly the later ones (e.g. Luhmann 2000) – Luhmann drew heavily on the calculus of distinctions, *The Laws of Form*, by the British mathematician George Spencer Brown. This calculus allowed him to describe the self-referential logic of autopoietic systems in an extremely stringent and analytical way. While it is possible to comprehend Luhmann's social systems theory also without Spencer Brown, a deeper appreciation of it however presupposes an at least rudimentary familiarity with its basic ideas. Some of Luhmann's followers even tried to translate Luhmann's theory completely into the language of the calculus, even aiming at making the theory of social systems 'calculable' (in particular Dirk Baecker).

In the following we want to introduce the central elements of Spencer Brown's *Laws of Form* and explain the way in which Luhmann used it in his systems theory. It should however be noted that our explanations of Spencer Brown are based on Luhmann's own reading of him, which differs from other readings.

### a. Observation as basic concept

Spencer Brown suggests treating *observation* as the most basic concept of any analysis. As a concept it is supposed to be even more basic than e.g. that of thing, event, thought, action or communication. This means, of course, that the concept of observation is not restricted to its usual sense of optical perception – optical perception is just one type of observation, i.e. the observation of psychic systems. Instead its level of abstraction is such that it refers to any operation from communications to thoughts and even to operations of machines; even the observer himself is an observation.

Spencer Brown's concept of observation does not focus on the object of observation but on the observation itself as a selection of what to observe. In this sense, the underlying question is not: What does an observer observe, but how does an observer observe; how is it that an observer is observing what he is observing, and not observing something else.

Every observation is constructed from two components: a distinction and an indication. An observer chooses a distinction with which he demarcates a space into two spaces (synonymous: states or contents). Of these two states he has to choose one which he indicates. That is to say, he has to focus on one state, while neglecting the other. It is not possible for him to focus on both. In this way the initially symmetrical relation between the two states becomes asymmetrical. We get a *marked state* and an *unmarked state*.

Spencer Brown illustrates this rather abstract idea with an example. Let us imagine a uniform white piece of paper. On this paper we draw a circle. In other words, we draw a distinction which creates an inside of the circle and an outside of the circle. It is important to note that it is the act of drawing the circle which establishes the two different states: without us drawing the distinction the two states as such do not exist. We can now indicate one of the two states:

either the inside or the outside. Let us choose the inside. The inside becomes the marked state and the outside the unmarked state. While we can see the marked state, the unmarked state remains unseen. With the metaphor of figure and ground we can say: the inside becomes figure and the outside ground.

Spencer Brown calls the distinction with both sides the *form* of the distinction. Thus, in contrast to the common use of the term, form does not refer merely to the marked state. The form of something is not sufficiently described by the de-fined - the marked state - but the unmarked state is a constitutive part of it. The marked side cannot exist without its unmarked side. In our example, the form of the circle is the inside together with the outside of the circle. In this sense Spencer Brown declares:

Distinction is perfect continence. (Spencer Brown 1979: 1)

A distinction, thus, has a double function: like any boundary it both distinguishes and unites its two sides.

Spencer Brown introduces a specific notation to refer to the distinction, 'the mark of distinction' or the 'cross' (synonymous: token, sign, mark):

marked state  unmarked state

This sign symbolises the distinction separating the two sides. Connected with this sign is the instruction to cross the boundary from the right to the left side by which the left side becomes the marked state and the right side the unmarked state.

It is important to understand that the 'cross' has *two* meanings: an operative and a descriptive meaning. Firstly, the cross stands for an *instruction* to cross (!) the distinction from unmarked to marked state. Secondly, the cross stands as *sign for* the result of the crossing, the marked state. In our example, the cross can be meant as an instruction to draw a circle or it can stand as a symbol for the result of the drawing, i.e. for the circle itself. In this sense Spencer Brown writes:

In the command  
let the crossing be to the  
state indicated by the token  
we at once make the token doubly meaningful, first as an instruction to cross,  
secondly as an indicator (and thus a name) of where the crossing has taken us.  
(Spencer Brown 1979: 81)

In terms of the calculus the cross is used both as operator and operand: on the one hand, it gives instructions to calculate and, on the other hand, is the element that is calculated. This double meaning might be confusing but as Spencer Brown writes:

It is the condensation [of the two meanings into one symbol] which gives the symbol its power. (Spencer Brown 1979: 81)

Another important element of the *Laws of Form* is the 'unwritten' distinction (*unwritten cross*), which defines the space – context - within which the distinction is drawn. In our

example from above the unwritten cross is constituted by the border of the paper. As border of the unmarked state it remains equally unobserved as the unmarked space. Now we have a complete unit of observation: a space defined by an unwritten cross is divided by a distinction into two states; the relation between the two states becomes asymmetrical by indicating one state as the marked state in contrast to the other, which becomes the unmarked state (Figure 2)

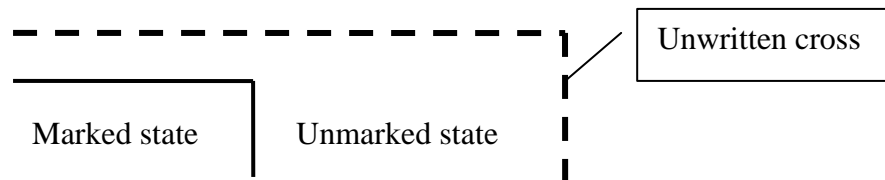


Figure 2: Observation as distinction and indication

The central point in this concept of observation is that once you have drawn a distinction you cannot see the distinction that constitutes the observation - you can only see *one* side of it. With Heinz von Foerster (1981: 288-309) this can be referred to as the 'blind spot' of observation. The complete distinction with *both* its sides (the inside *and* the outside), can only be seen from *outside*; if you are inside the distinction you cannot see the distinction.

We can now distinguish two orders of observation: first-order and second-order observation (von Foerster 1981). So far we have been explaining the operation of a first-order observer, who cannot observe the distinction he uses in order to observe. The second-order observer is an observer who observes another observer. He uses a different distinction from the first-order observer: in order to observe the observer he has to draw a distinction that contains the distinction (the marked and the unmarked state) of the first-order observer in *his* marked state. The second-order observer can see the blind spot, the distinction, of the first-order observer. He can see *what* the first-order observer cannot see and he can see *that* he cannot see. Particularly, he can see that the first-order observer can see what he sees, because he uses one particular distinction and not another. He sees that he could also have used another distinction and, thus, that the observation is contingent. In this sense, a second-order observation is more than a first-order observation, because it does not only see its object (first-order observer), but it also sees, what he sees, and how he sees; and it even sees, what he does not see, and sees, that he does not see, that he does not see, what he does not see (Luhmann 1993b: 16).

Since the second-order observer needs a distinction to observe the distinction of the first-order observer, he himself is a first-order observer, who could be observed from another second-order observer. In this sense, every second-order observation is only possible as a first-order observation and as such knows as little about its own observation as every other first-order observer.

For Luhmann the most interesting element of Spencer Brown's calculus of form is the *re-entry* describing the operation of *self-observation*. As explained above, an observer can only observe the marked side, and not the unmarked side or the distinction itself. In order to observe the other side he would have to 'leave' the marked state and cross the distinction to the other side. This however would mean that the initially marked state could not be observed anymore; one can either observe the one or the other side of the distinction but not both at the same time. As such, self-observation, i.e. observing one's own observations would be impossible. Spencer Brown's 'solution' to the problem is the re-entry of the distinction into

the distinction; i.e. the original distinction contains a copy of the distinction (with marked and unmarked states) in its marked state. This however constitutes a *paradox*: the unmarked state is both unmarked state and marked state (as it is contained in the marked state) and the marked state is both marked state and unmarked state (as it contains the unmarked state) – the observer can see his blind spot, but then, if he can see it, it is not his *blind* spot anymore. Spencer Brown unfolds this paradox claiming that the re-entered distinction is never exactly the same as the original distinction.

## **b. Autopoietic systems as distinction processing systems**

Based on the calculus of forms Luhmann described autopoietic systems as distinction processing systems. Every operation of an autopoietic system constitutes an observation, i.e. a distinction and indication. Take for example the communication: Every communication communicates something (marked state) while at the same time having to leave everything else in the dark - in particular: all other possible communications (unmarked state). These other possibilities of communication however are not just other communicative options which just happen not to have been realised, but they are *constitutive* for the realised communication; the meaning of the communication depends to a large extent on what *has not* been communicated. In other words, one needs to know what could have been communicated (i.e. the context of the communication) in order to establish the meaning of the communication. These other possibilities are on the unmarked side of the communication – as they have not been communicated. Other communications (second order observation), however, can communicate about the communication (first order observation) and its unmarked state, but only at the cost of producing yet another unmarked state. Thus, the communication can never fully communicate about its own conditions of communication.

Not only the operations but also the system itself can be conceptualised as observation, i.e. distinction and indication. A system is constituted as distinction between system and environment, of which the system is the marked state and the environment the unmarked state. In accordance with Spencer Brown's concept of observation the system and environment are the two sides of the same distinction and as such are constitutive for each other.

While an observer can draw his distinctions where he likes and thus define what to treat as a system and what as environment, the concept of autopoiesis assumes that the system/environment distinction is not drawn by an external observer but by the system itself. Luhmann in this sense writes:

If we describe [something] as autopoietic system, we are dealing with the production and reproduction of a distinction (in systems theoretical terms: the distinction of system and environment), and the *concept* of autopoiesis says, that an observer using it assumes that the difference is produced and reproduced by the operations of the system itself. (Luhmann 2000: 55; my translation)

How are we to understand this reproduction of the system/environment distinction? Every operation of an autopoietic system constitutes a distinction between that which it is, i.e. an operation of the system, and that which it is not, i.e. an operation of the environment. Let's for example take the organisation. The operations of that system are decision (decision communications). Every decision constitutes a distinction between that which it is (marked state), i.e. a decision and thus an element of the organization, and that which it is not (unmarked state), e.g. a 'normal' communication or a thought. In this sense, every single



decision (re-)draws the distinction between system and environment. Thus, the reproduction of decisions in actual fact is the reproduction of the distinction decision/non-decision, i.e. of the distinction organisation/environment. According to this conceptualisation every single operation of a system reproduces the 'boundary' of the system. In this sense we do not distinguish between 'boundary elements' and elements taking place 'inside' the boundary, as the classical notion of systems suggests.

This conceptualisation of the system's boundary as reproduced by every single operation implies an operative closure of the system: Every operation constitutes a distinction between the operation and everything else (i.e. between system and environment). It can only be this operation as the one side (marked state) of the distinction and not the other (unmarked state). E.g. a decision is only a decision (marked state) to the extent that it is not something else (unmarked state). Operative closure of a system in this sense means that the system (i.e. system/environment distinction) is only reproduced by operations that are themselves constituted as system/environment distinction; e.g. the "decision system/environment" distinction (organisation) can only be reproduced by operations constituted as decision/non-decision distinctions – other distinctions, for example thought/non-thought (decision is here included in the unmarked space), cannot. The integration of other distinctions, in which decision is included in the unmarked space, would dissolve the organisation/environment distinction and thus dissolve the system. In other words, the system cannot enter into its environment nor could the environment enter into the system otherwise the distinction between system and environment would disappear.

While the system can only operate on the marked state of the system/environment distinction, other observers outside the system might observe the system/environment distinction by including them in their marked state. Consider for example an organisation: The organisation as system of decisions is constituted by the distinction "decision network/social environment". While the organisation can only operate on its inside, i.e. it can only produce and reproduce decisions and cannot enter into its environment consisting of all kinds of other communications, the societal system constituted by the distinction "all-encompassing social system/non-social environment" contains the organisation/environment distinction in its marked state. Society can thus observe the distinction of the organisation and can thus see what the organisation itself cannot see.

Although autopoietic systems can only operate on their inside (marked state) and have no contact to their outside (unmarked state), the system/environment distinction can re-enter into the system. We can distinguish two re-entries: First, every single operation distinguishes between other operations of the same system and other events outside the system. In other words, every operation has a *self-referential* aspect and an *other-referential* aspect. Take for example the communication as element of a social system. Every communication can be divided on the one hand into the utterance, i.e. how and why something is expressed, which is (treated as) determined by the communication system (self-reference) and on the other hand into the information, i.e. what is expressed, (treated as) referring to events in the environment (other-reference). For example, A says to B: 'My dog is dead'. Here we can distinguish the utterance, i.e. the words A uses, what other communications this communication is referring to etc., as the self-referential aspect, and the information about a dog being dead as referring to something outside the communication network (other-reference). The important point here, the re-entered distinction is not identical with the distinction itself: (1) the utterance/information distinction is not the system/environment distinction – a communication is not a system - and (2) the information about the dog being dead is not the dead dog.

A second re-entry takes place on the structural level of the system. Structures 'represent' internally the system/environment distinction to the system. As explained above with regard to organisations the operations of a system cannot observe their environment. Instead they observe the system's programmes as substitute and orient themselves according to them. Take for example a business programme of a corporation. This programme refers on the one hand to the market situation, possible moves by competitors, characteristics of consumers or something similar and on the other hand to the necessary decision processes in the organisation. Decisions by taking the programme as decision premise orient themselves according to the two aspects of the programme *as if* to the organisation/environment distinction itself. Here again we have to note, the programme represents the system/environment distinction but it is not identical to it.

These few comments on the application of Spencer Brown's calculus of distinctions to Luhmann's systems theory have to suffice for now. While our descriptions and explanations have been very selective the basic ideas, however, should hopefully have become clear so far.

## **Conclusion**

In this paper we have tried to present the basic concepts and ideas of Niklas Luhmann's theory of social system. We started with Luhmann's general concept of autopoiesis explaining how it was derived from the originally biological concept by Maturana and Varela. We went on to explain the concept of social system as an autopoietic system of communications, where communications reproduce communications. We highlighted as one of the central ideas in this context the clear distinction between social and psychic systems. We have tried to clarify this often misunderstood idea. From there we went on to describe the three types of social systems – society, interaction and organisation. In our last section we introduced the calculus of distinction by Spencer Brown and demonstrated how it could be and has been applied to the theory of social systems.

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