

How Networks Self-organize Through Complexity

While trying to wrap my head around writing a suitable introduction to systems theory I received a bulletin from my MySpace friend Niklas Luhmann (<http://www.myspace.com/luhmannniklas>). The bulletin, which is of course not written by Luhmann himself but by a group of enlightened students, beautifully sums up the main points necessary to introduce Niklas Luhmann's sociological theory of social systems:

*"Sociologists have failed to produce even a partially adequate theory of society. Epistemological obstacles and humanist concerns for rationality and justice have prevented true progress in the discipline. With the "radically antihumanist, radically antiregional, and radically constructivist" social system theory, it intends to bring about a sociological enlightenment. Die Gesellschaft der Gesellschaft (****) focuses on communication as the only genuinely social phenomenon. Social systems differentiate and evolve as they communicate in three separate dimensions: the social, temporal, and functional. The path of evolution results from a history of variation, selection, and restabilization within these dimensions. Communication, bit by bit, produces social structures that, recursively, produce future structures. Society is communication. Sociology, as the science of society, is communication about how different societal systems operate, communicate, evolve, and maintain their boundaries."*

(Slightly modified, but from URL [http://links.jstor.org/sici?sici=0735-2751\(200007\)18%3A2%3C320%3ATSOSTG%3E2.0.CO%3B2-P](http://links.jstor.org/sici?sici=0735-2751(200007)18%3A2%3C320%3ATSOSTG%3E2.0.CO%3B2-P))


In this context the systems are, of course, communication networks, and in this perspective the bulletin has two main points. In the first order, it establishes communication as the only truly social action (or that all social actions can be treated as communication, which is an equally fruitful conclusion). In the second order, the point is that I did not actually have to come up with the text myself. The text came up with me in the sense that I am part of the social communication network in which this text is a communicative part. 'I' am only a position in this communication network and the whole notion of 'I' is defined in how I relate to the text. The network defines me and not the other way around. In this case the part of my network, which is mediated through mySpace.com.

And this is what networks are all about: I don't have to come up with a text that introduces systems theory. I don't even have to look for the text in a library or even on google. All I have to do is

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network with the right people (in this case a German Ph.D. in social studies who calls himself 'Herr P.' and a few others I don't know so well) who share my interest in systems theory, martial arts, and electronic music on mySpace.com and the text finds me. To illustrate I just got the following bulletin from Niklas Luhmann on mySpace.

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From:	 Niklas Luhmann
Date:	23 Sep 2007 12:33
Subject:	You want to be in my top-friends list? You could be ...
Body:	<p>different conditions:</p> <ul style="list-style-type: none">- condition no. 1: I'm in your top-friends list; <p>even better-conditions:</p> <ul style="list-style-type: none">- you are supporting systems theory somehow (like Eilicec e.g.);- you are Jacques Derrida or Keridwan or Edmund Husserl or Peter Fuchs or Dirk Baecker ... <p>Write a message or comment with your application. No fraud. Der Rechtsweg ist ausgeschlossen.</p> <p>yours sincerely, N.L.</p>

[Reply To Poster](#) [Delete From Friends](#)

<http://bulletins.myspace.com/index.cfm?fuseaction=bulletin.read&messageID=4470657514&MyToken=637edf9b-4356-4e09-8084-27453bde8c28>

09.24.2007

SELF-ORGANIZATION

intro

The backbone of Niklas Luhmann's theory of communication is observation. Observation takes place when something is distinguished as system that is different from 'the rest', which in systems theory is called the environment (Luhmann 1998 p. 168).

Through observation the system is dependant on this distinction. The dependency occurs in that observation of a given object deprave a number of possibilities the possibility of becoming probable, and probabilities from actualisation. This is the caricature formulation of continental academia. In other terms it means that you cannot chose a name for a given phenomenon, which is outside the linguistic categories that conventionally refer to its class of phenomena. Or in human terms it means that it does not make sense to call a flat digging instrument with a shaft a horse. You must call a shovel a shovel.

So basically *distinction* means choosing to focus on something rather than 'the rest', and *Bezeichnung** giving it a name. Together these two concepts make up what Luhmann calls observation (Luhmann 1998 p. 169). Having established this (and mind you having read his systemic predecessors such as Bateson, Maturana and Varela carefully) he asks the question: how can realization [erkendniz****] through observation be possible when systems are supposed to function autonomously from their environment?

The answer he came up with is that true realization** does not take place *despite* of systems being operationally closed, but *because* they operate autonomously. So the precondition for any observation by a system is its detachment from the environment it observes. This gives the system its own privileged point of observation as a starting point for distinction and Bezeichnung* of phenomena in its environment (Luhmann 1998 p. 164). Or in other words, you cannot observe something 'different' without knowing what it is different from.

Observation reduces complexity in the system's environment, and increases complexity within the system. When a system observes things around it, it learns about external phenomena. This learning increases complexity in the system and enables it to observe an even greater part of its environment. This is basically what Luhmann calls realization.

In systems theory the notion of complexity starts with coupling. A system has a given set of possible couplings to its environment. If this set of possible couplings in the environment is greater than the system's coupling capabilities, the environment is said to be complex (Luhmann 2000 p. 160). Put differently complexity is when a system sees more possibilities than it can realize. The system's remedy for this is reducing complexity by only observing a part of the environment and disregarding the rest. This operation creates realization* and internal complexity in the system while reducing complexity in the environment. A key point in the investigation of systems and complexity is that by reducing complexity in its environment, the system builds capabilities for even more observation actually projecting an increased complexity in its

environment. In increasing its internal complexity, the system also increases its set of possible couplings. Or in more common terms: when you get smarter you can observe a greater part of your environment and 'see what you could not'. We all know the feeling of being confused at higher level.

Katte **** or something completely different..

The first step in defining a system is to identify the difference between something that makes up a system, and something else outside the system. Luhmann calls this 'something else' the environment (Luhmann 1984 p. 176 ff.). The concept of the environment covers everything outside the observing system. The environment is complex by the definition explained in the introduction, as the vast number elements, things, and processes etc. that are not part of the system does not allow for every element to connect with every other element. In fact, the un-



observed environment is infinitely complex, as it is not limited by any particular boundaries. Only when observed by a system will this complexity be reduced as a part of the environment is identified and observed as a system. This is what Luhmann refers to as form. That like footprints in the sand some part of the complexity of the environment is observed as a form (the imprint of a foot) in a medium (the complex medium of 'sand'). The sand, in turn, is observed as a form from (land) in the complex medium of the sea, and the sea is a form in the even more complex medium of the atmosphere, and so on. Systems lack the 'requisite variety' that

would enable them to react to every state of the environment. The system is therefore by definition less complex than its environment as a point-by-point correspondence would abolish the difference between system and environment (Luhmann 1984 p. 25). If the sea looks just like a sky, is probably *is* the sky and then it does not make sense to call it the sea.

Luhmann's systems emerge through the observation of a difference between what is observed, and what is not. Between what is complex and what is not. Between what is a medium, and what has

form. But a form does not quite qualify as a system on its own rite. A footprint is not a system. Systems are defined in that they are operationally closed, self-referential, and recursively auto-productive. In sum this is what Luhmann calls autopoiesis. This concept is the corner stone of how systems emerge, and counter intuitive as it is, it needs a little further attention if we are to understand how networks as social systems emerge and function.

EMERGENCE

**** Intro****

"Emergence is when the output of a system is greater than the sum of its components. Emergence is the duplication low-level order on a higher systemic level." (Johnson 2001 p. 26)

**** Intro****

Autopoiesis is the process that produces and reproduces systems. An autopoietic system autonomously produces and reproduces the element of which it consists (Kneer & Nassehi 1997 p. 63). In other words, the system does not exchange input and output with its environment as linear systems would. And this is a key difference in the emergence of dynamic, social systems:

Technological systems are causal and linear, social systems are dynamic and autopoietic.

This means that a medium such as speech organs, air, and hearing, telephones, and the Internet cannot be classified as 'dynamic' in itself. What may or may not be dynamic is the way we use the media. So, there is a basic difference between linear input-output based systems and dynamic autopoietic systems. The linear systems, Luhmann refers to as autarchic (Luhmann 1984 p. 185, 473). This is the fundamental difference between technological and social systems. But if social systems are operationally closed, and do not have input-output interaction with its environment, how do they interact with anything? The answer is cybernetics. Or in other words: they don't. Not at the cybernetic level of the system itself, anyway. Interaction between two autopoietic (psychic, social, or societal) systems will form another autopoietic system of a higher cybernetic order. For instance, interaction between two psychic systems will inevitably happen through communication. This will result in the emergence of a social system in the environment of the

two psychic systems. The social system is therefore a system of a higher cybernetic level than the psychic subsystems. What this means exactly is explained by one of the founders of systems theory Gregory Bateson in his paper on 'The Logical Categories of Learning and Communication' first published in August 1968 at the Conference on World Views held by the National Institute of Mental Health (Bateson 1972 p. 279-308). Inspired by the Euclidian paradoxes unfolded in Bertrand Russell's 'Principia Mathematica', he set out to restore order in the categorization of systems in the process of learning and communication. He starts with the most basically functioning system: input-output equivalent systems, or linear systems, and ends his exploration of the logical categories in the cultural stratosphere. Here is a brief overview of the logical categories of learning and communication, which he calls 'Learning Zero-III'.

Learning Zero – Causality: The best description of categories of learning and communication starts with what it is not. In this case a strictly causal response to a certain stimuli is not learning or communication. When I let go of the coffee mug in my hand, it will inevitably fall on the floor leaving a nasty stain. I cannot condition the mug to hover or levitate to a soft landing on the table. This is not learning. Or communication.

Learning I – Linearity: Gregory Bateson exemplifies Learning I by describing Pavlov's famous psychological drawing dogs experiment. Every time he fed the subject dogs, he first rang a big brass bell. Every time he rang the bell, he recorded the dogs' saliva excretion. At first the dogs drawled only at the exact time they were fed and got a scent of the food, but after a while the dogs connected the ringing bell with feeding time and began drawling when the bell rang. Eventually he had conditioned the dogs to start drawling whenever he rang the bell regardless of whether it feeding time or not. What Pavlov did was conditioning a certain input-output equivalence in the drawling system of the dogs. They were taught that *if* the bell rings *then* dinner will be served shortly. This is something algorithms of digital media do very well. Correction of response in linear causality is consequently what Bateson calls 'Learning I'. Still, complexity is such that the set of alternative responses can be comprehended and is not in need of further classification.

Learning II - Complexity: Learning II has had many names including 'Deutero Learning', 'set learning', 'learning to learn', and 'transfer of learning'. It is change in the process of Learning I, e.g.

a corrective change in the set of alternatives from which choice is made (Bateson 1972 p. 293). So when a change in the set of possible alternative responses is learned it will fall under the category of Learning II. In other words if the dogs learn to learn to correct their response to a given stimulus they will have classified the contexts of learning I. Or more precisely, if Pavlov's dogs were placed in a conditioning experiment under completely different circumstances and needed less time to correct their response to the stimulus, this would be Learning II. Learning II is learning to learn.

Learning III - Hyper-complexity: Learning III is change in the process of Learning II, e.g. a corrective change in the system of sets of alternatives from which a choice is made. It works much as Learning II but on a higher level of abstraction. Bateson points out that this level of learning is never achieved by dogs and very rarely by humans, but as we will see a bit further on larger social systems have much greater capacity for handling the complexity at level III than any human. In fact, we are about to dismantle the notion of a 'human'.

But first back to what systems really is and how they interact with their environment. Well, the relationship between a system and its environment function on another cybernetic level of reality than the system itself. Relations between two autopoietic systems can thus be viewed as a system per se and represent another emergent systemic level, why it must be analysed as such. This is the reason why Luhmann characterizes systems as autonomous. The autonomy is an effect of a systems autopoietic nature and does not take complete closedness from the system's environment as a prerequisite. Autopoietic systems are not autarchic (Luhmann 1986 p. 185, 473). Systems are autonomous in that they are self-organizing and self-reproducing, but they are still at some cybernetic level dependant on relations to the environment in which they exist.

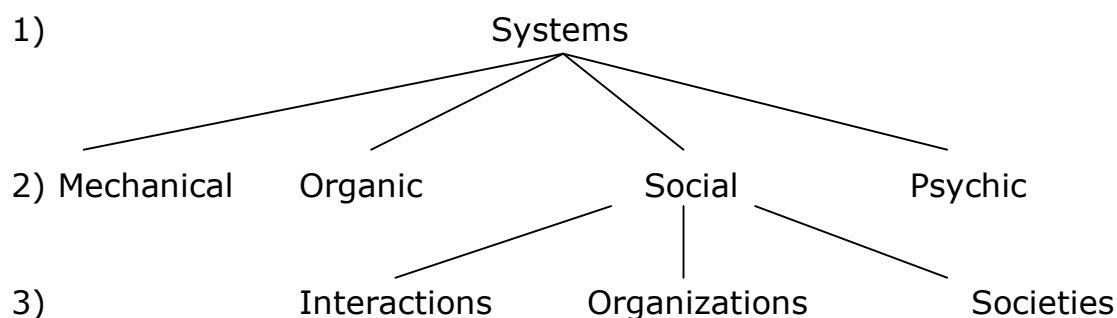
This system-environment relation is what Luhmann defines as operational autonomy. Operational autonomy lets systems operate autopoietically on their specific level while being connected to (and dependant of) their environment at another level.

The conclusion is that systems are not material objects in any ontological sense. In stead they are conceptual analytical abstractions to perceive the processes in different operational domains (Luhmann 2000 p. 37)

Luhmann distinct between differences in these processes, and concludes several different types of systems: Mechanical, organic,

psychic and social systems. Social systems are subdivided into three types: interactions, organizations, and societies. Luhmann speaks of this categorisation as the three emergent systemic levels, where the first level is simply 'systems', which is subdivided into mechanical, organic, and social systems on a lower level. Finally, social systems are divided into interactions, organizations, and societies as shown in Luhmann 2000 p. 37 (Danish edition):

The Systemic Levels



As illustrated mechanical systems are in a category of their own. Luhmann is primarily concerned with autopoietic systems, why mechanical systems (which are autarchic in contrast to autopoietic systems) are all but ignored. The remaining categories of autopoietic systems to which Luhmann pays considerably more attention are organisms, psychic systems, and social systems. The trade that Luhmann uses to distinguish the different types of autopoietic systems is their operational mode, or in other words the way their processes work. What they reproduce and what raw material their processes feed on. Organic systems reproduce life, psychic systems reproduce consciousness, and social systems reproduce communication (Luhmann 2000, p. 36ff, 221ff). Organic systems reproduce life as their basic function. They are made up of organic material, that autopoietically reproduces itself. We all know this from plants, animals and human organic systems which all have reproductive capabilities. Psychic systems are made up of thoughts and patterns of thought and reproduce consciousness. Social systems operate by way of communication. This means that social systems form an emergent cybernetic level of their own right that reduces and produces the vast complexity of a myriad of psychic and organic systems. Psychic and organic systems have no way of relating to one another. Only by serving as environment for social systems can they begin to guess what other psychic systems are 'thinking'. This is one of the basic anti-humanist elements of the theory of social systems: that there is no individual, but only a construct of social systems, that observes a number of

psychic and organic systems as 'a human'. But of course humans exist. Systems theory does not dispute the classification of our species as 'human'. What it does is taking a fundamentally different approach to the classification of its object. Systems theory does not try to describe things or object in the world, but *processes* such as communication or consciousness or life. In taking this fundamentally different approach, the classification of a 'human' as a privileged standpoint does not really make sense as other than a position in a communicative social system. And in the context of trying to understand communication networks this is exactly what we are looking for: a description of the processes in communicative systems. In this case only organised in a network.

According to Luhmann, social systems operate by way of communication, and as there are different types of communication processes, social systems are subdivided into three different categories; interactions, organizations, and societies. Luhmann made this categorization from the reality he experienced in the 1970'ies and -80'ies, and later we will see how it might need a slight adjustment in order to fit our understanding of network structured communication systems. But for now, lets look at Luhmann's three different types of communication systems.

Interactions are characterized by participation of at least two psychic systems interacting by communication. According to Luhmann these two psychic systems must be present at the same time at the same place. Because they dissolve as soon as these premises are not met, interactions form the least complex and least stable type of social communication systems. (This is of course one of the points that need revising after the spread of digital networks such as the internet.)

Organizations have a built-in common goal or purpose. This means that there are a number of preconditions to be fulfilled by communicators in an organization if exclusion is to be avoided. In organizations there is a connotative understanding of purpose that is defined and negotiated through communication. In practice the system often delegates the responsibility of defining its purpose to special members, which it calls management, or to a general assembly.

In Luhmann's theory of social systems *societies* form yet another emergent systemic level analogous to the three systemic levels illustrated above (Kneer & Nassehi 1997 p. 46 ff.). A new emergent level emerges cybernetically when a system is something more, or rather different, than the sum of its components. Societies are made up of a hyper-complex number of organic, psychic, and social systems making them so complex that a new level of observation is needed in order to reduce their complexity in a meaningful

observation. In other words societies function differently from the other types of systems while still containing members of those types. This is where Luhmann gets a bit vague in his definitions, and as the theory of societies, which demands a study of its own, is a peripheral point in the context of communication networks it would not be worth the effort to investigate further here. What is the point is the relationship between the different types of systems i.e. physical, organic, psychic, and social systems.

The interdependence of otherwise closed systems is what Luhmann calls structural coupling (Luhmann 2000 p. 220 ff.). For example thoughts in a psychic system are depending on the operation of the brain's organic system. If you do not have a brain, no consciousness is possible (Unless, of course, you believe in ghost and spirits). Analytically thoughts belong to the reproduction of consciousness in psychic systems while the brain as part of the organism belongs to the category of organic systems. So it is necessary for psychic systems to relate to organic systems in their environment and vice versa. This is a structural coupling (Kneer & Nassehi 1997 p. 65 ff.). Those claiming that thought are constructed socially through language and conventions would say there is a necessary structural coupling between the organic systems of brain cells, thoughts in psychic systems and communication in social systems even though they analytically and cybernetically must be observed at different systemic levels. This brings us close to a useful definition of communication.

Communication is when at least two psychic systems exchange signs through a physical or organic medium.

Depending on the context, communication processes that meet these criteria will be classified as interactions, organizations, or societies.

Communication in Networks

Lkashdfkakah

THE COMMUNICATIVE LEVELS OF NETWORKS

Lkh

I. Physical level – Linearity:

II. Communicative level – Complexity:

III. Meta level - Hyper-complexity:

Communication networks are

THE THREE SELECTIONS OF COMMUNICATION

As we saw above, social systems operate through communication. That means that the communication is the basic cornerstone of interactions, organizations, and societies. But to best illustrate the basic mechanics of Luhmann's theory of communication, the most basic social system, namely interaction systems, illustrates this point best. According to Luhmann, at least two psychic systems must be interacting for there to be communication. The communicator is called *alter* and the addressee is called *ego*. In Luhmann's theory, social action and communication is one and the same thing. Because social systems operate through communication any social action will be communication (Luhmann 2000 p. 207ff.). We will get to how this works exactly in a moment. The process of communication is divided into three fundamental steps, or selections. Selections are related to observation in that observation includes a selection of focus on something rather than on something else. So selection basically means making a choice and is a by-product of observation and distinction. The three selections include selection of message, selection of form, and selection of understanding.

The selection of a message, or information, includes the selection of one unit of meaning rather than another. In layman's terms it means choosing to say something rather than something else. Luhmann views the message purely as information as defined in the previous chapter. He adopts the definition of information from Claude E. Shannon and Warren Weaver's information theory.

On this background information is seen as a selection of a part of a known or unknown repertoire of possibilities (Luhmann 2000 p. 181). This means that the selection of a message means choosing to say something rather than something else you might as well could have said or communicated.

The selection of form is a logical consequence of the first selection; if you choose to say something you logically have to say it in a certain way. Other than that Luhmann does not get specific about selection of form, but he does speak of two different types of media in relation to communicative form: distributive media, and symbolically generalizing media. In systems theory the role of the media is to give form to realization. Making the improbable (i.e.

that knowledge is constructed through observation) probable (Luhmann 2000 p. 201). This increase in communicative probability is achieved through the utilization of symbolically generalized media such as language. In order for communication to be successful, a system of signs must be shared for psychic systems to exchange meaningful information through a physical distribution medium. This sign system is based on socially negotiated conventions. This way communication is reproduced through communication. This is also what is called autopoiesis. An example of the function of symbolically generalizing media is that they give the notion of 'movement' a relatively constant form in the form of the word 'movement'. In this case language is the medium for the form of the notion of movement.

So because of the highly eclectic and at times somewhat ephemeral use of the medium concept, Luhmann introduces two categories of media: distribution media, and symbolically generalizing media. Distribution media are technological media such as mass media or digital network media. Symbolically generalizing media are social structures that give communication systems a binary code. The function of distribution media is to decompose linguistic units and recompose them in the highest resolution (Luhmann 2000 p. 202ff.). That means that they break observations into the smallest possible units, distribute them and reconstruct them in another location or other locations. For example a TV camera encodes the photographer's observation, the TV network distributes the information to the living room of TV viewers, where a TV receiver decodes the signal. All this is happening at a physical level. Symbolically generalizing media present selection and motivation as a unity. That means that they so to speak give form to otherwise amorphous observations by making a selection seem like the true, good, powerful etc. This happens by way of binary coding. For example the code of the political system is power/not power, the code of the scientific system is true/false and so on.

What both types of media have in common is that they are characterized by including a loosely and a tightly coupled substrate. The loosely coupled substrate serves as a medium for the form of the tightly coupled substrate (Luhmann 1999 p. 176 [DK]). After this Luhmann gets somewhat unspecific in his definition of media, but in relation to the second communicative selection of form this will suffice for now.

The selection of a symbolically generalizing form in a given distribution medium gives the loosely coupled substrate, i.e. the message, a form. Here it would be tempting to jump to the conclusion that Luhmann's argument is that every message must necessarily have a form, adopting the classic dichotomy between form and substance. But Luhmann's main point here is that focus

must shift from static objects and elements in the process of communication to the process of observation of the difference between what alter chooses to communicate, and his exact words. Luhmann's point is that the essence of what is communicated is not in the choice of neither information nor form, but in the difference between the message and form. Consequently communication is viewed as a recursive process of its own right rather than as a step-by-step progressive sequence.

The last selection of communication is the selection of understanding. Where the two previous selections were ascribed to the communicating Alter, the selection is detached from the communicator and placed with Ego. The selection of understanding is inevitable in that Alter in the presence of ego performs a communicative social action including both psychic systems. This means that a social system emerges on a higher cybernetic level than the psychic systems. Luhmann calls the relation between alter, who selects information and form, and Ego, who selects understanding, *perturbation*. When someone (Alter) utters something in a certain way to one or more others (ego), alter creates a disturbance of ego's psychic system. Ego can then relate to this irritation by choosing an understanding. Choosing an understanding includes disregarding the perturbation as noise. In both cases an understanding is selected. Perturbation takes place when the disturbance from Alter does not correspond with ego's criteria for understanding. This means that ego is forced to reconstruct his internal complexity or try to reduce the complexity inflicted on him from his environment by disregarding it as noise. Paradoxically this reconstruction functions through a so-called systemic detachment, or operative de-coupling from the environment (Luhmann 1999, p. 165). Perturbation and reconstruction of criteria for understanding happens because the system is operationally closed rather than despite it is. The reason for the greater degree of reconstruction of internal complexity is found in the reflexive nature of communication processes, which we will get back to shortly.

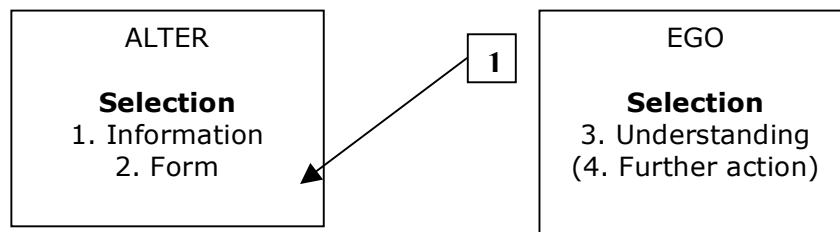
This is actually one of the more radical points in Luhmann's process theory: whether ego tries to attach to the communicative disturbance or chooses to disregard it as noise he is forced to make reflect on its relevance according to his internal criteria for selecting an understanding. In other words it is impossible to select a non-understanding as such would always be relative to the internal criteria of the system itself.

As an addition to the three basic selections some readings of systems theory add a fourth selection; ego's selection of new communicative action (Qvortrup 1998 p. 166-167). Whether this

selection should be ascribed a single turn of communication or is in fact a turn of its own is a matter of the relevance of turn taking as described by Robert Nofsinger (1991) in his work on everyday conversation to the analysis at hand. If the focus is on everyday practical communication or on the structure of communication processes.

In addition to the three basic selections Luhmann views communication in different cybernetic and systemic levels of observation. This means that several observations and selections take place simultaneously on different levels of the communication process. These different levels of observation are called orders. Observations of the first order include the three selections. First, the communicator, alter, must select a message, and then a form in which to communicate it. The message has now been sent in a certain way. Finally ego must observe alter's perturbation and select understanding, and as mentioned disregarding the communication is also an understanding. The context of the three selections is a social action, which in Luhmann's optics equals communication. At the level of first order observation, ego observes alter's perturbation in the shape of selection of information and form as a precondition for his selection of understanding (Qvortrup 1998 p. 164ff.). Simple schematics of first order communication could look like this:

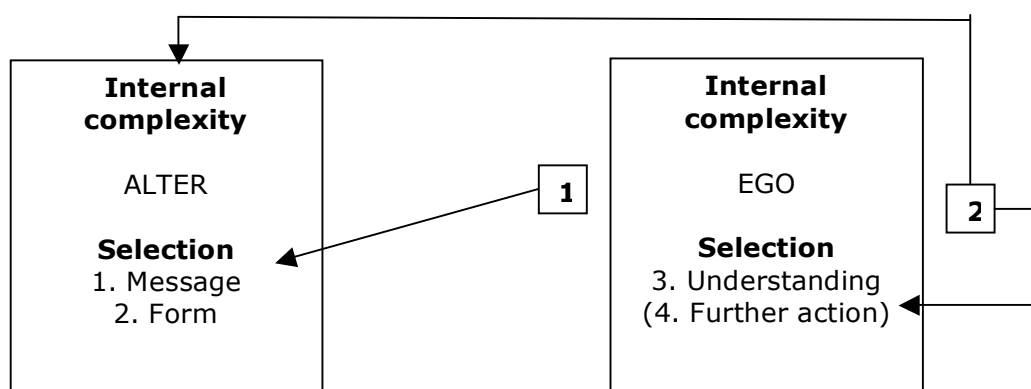
First order communication: Perturbation



The difference between first and second order communication is that first order communication so to speak takes place 'on stage', while communication in the second order happens 'back stage'. An example of this is presented in John Austin's (1962) book "How to Do Things With Words". Austin illustrates a point of linguistic pragmatics by using the example of the utterance "Can you reach the salt?". In the first order the question is about whether or not ego has sufficient range to reach out and touch the salt. But by simultaneous observation of alter's internal criteria of wanting salt for his chips, ego can select a pragmatic understanding and pass the salt. Second order observation exceeds the three selections of first order communication. In the second order, ego observes alter's

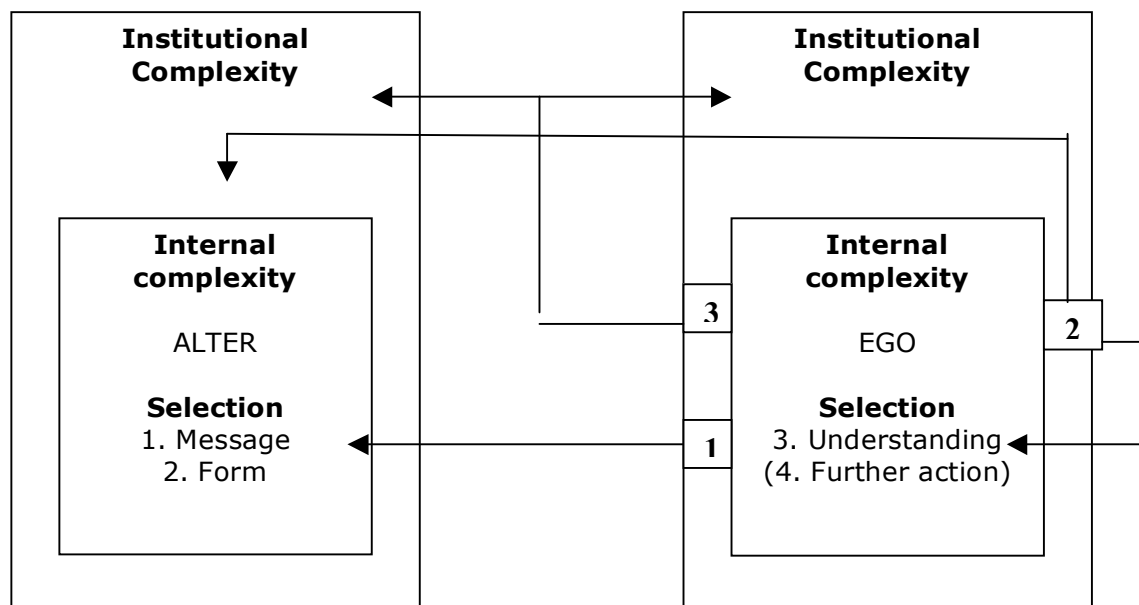
internal complexity in order to understand the motives of alter's perturbation. In the second order ego can also reflectively observe his own internal complexity and relate this to observations of alter's internal complexity (Qvortrup 1998 p. 167). This mutually establishes context for the communicative action. So the internal complexity of both communicators is observed in the second order to establish a context for the three communicative selections. This operation reduces complexity in the environment (i.e. Alter's perturbation) and increases internal complexity. Luhmann calls this double contingency. Consequently observation and communication in the second order approximate what was earlier referred to as communicative reflexivity. This means that reflexivity is the criteria for observation regarding a certain communicative, i.e. social, action is observed on the level of the social system – in the second order. Schematically second order communication functions as illustrated underneath where arrows represent observations and numbers 1-4 represent selections:

Second order communication: Reflection



Communication of the third order does, if such exists, function at the level of institutional context of communication (Qvortrup1998 p. 169). The argument does not, however, extend to an explanation of the unique institutional nature of this context as other than another second order observation at the level of organizational systems. I still describe it here mostly to show the scalability of systemic analysis across systemic levels. Third order observation is directed at the so-called institutional criteria of understanding in much the same way as observation of the second order. At this level organizations and institutions have criteria for understanding. Institutional complexity is coupled to organic and psychic systems only through interactions in the organization. Or institution.

Third order communication: Context



This is a clear expansion of Luhmann's notion of an organization on the hand of Lars Qvortrup, maybe inspired by Bateson's logical categories of learning and communication (Bateson 1962). In fact, Bateson's logical categories of communication 1-3 is parallel to Luhman's two communicative orders with the addition of Qvortrup's third. So let us take a look at how this works. (This leaves out the dummy-category of 'Learning Zero', but in this case we will take this level for granted as it is connected to the basic laws of physics from which technological systems like computers have advanced long ago).

First order communication – Perturbation: This is the level of the three basic selections and observation of perturbation that represents the basic functioning of social action and therefore communication.

Second order communication – Reflection: This level contains the observation of the communicative actors' criteria for performing the selections of first order communication. Second order communication provides communication with reflection and motivation. According to Luhmann this results in communication being poly-contextual. In the second order systems in the social system's environment (in this case the internal complexity of the psychic systems coupled with Alter and Ego) are observed. During this operation several contexts are observed at once, i.e. Alter's perturbation and the internal criteria of Alter and Ego. This is what Luhmann refers to as poly-contextual communication.

Third order communication – Context: At the third cybernetic level of communication concepts get a little bit more abstract and complicated as it refers to contexts of second order communication. According to Qvortrup third order observation approximates observing the internal complexity that form the criteria for selection on an institutional level. The closest to a definition of the 'institutional level' that can be read out of Qvortrup's argumentation is that it refers to an organisation or a system of organizations. So, third order observation has the same basic operations as the second order with the slight difference that it takes place at a different cybernetic level.

In somewhat cryptic but more common terms the cybernetic levels basically function so that the first order represents a basic observation, the second order an observation of the first order observation, and the third order of an observation of the second order observation of the first order observation.

But it does not have to be quite as difficult. The consequence for communication could be described much simpler from the pivotal point of Ego who 1) observes the perturbation from Alter, 2) reflects on the underlying motivations for the communicative action, and 3) observes the formal and informal institutional context surrounding the communication. An example could be a scientist who in his capacity of an environmental scientist gives recommendations to the proper minister from scientific studies. The recommendation disturbs the minister as they are not entirely in line with his political standpoint. The minister reflectively (in the second order) observes the scientist's motivation for communicating the findings of his study and finds that the scientist is in a committee established by a previous government with a completely different political programme. He therefore finds that the scientist's communication belongs to an institutional context that does not correspond with the current government's policies. The minister disregards the recommendations and dissolves the committee. So, institutional complexity establishes a wider context for communication processes. In Qvortrup's optics institutional complexity can be made up of connotative structures that form the context of even small social systems. But Luhmann has a similar concept at hand. Only he calls it *functionally differentiated systems*. Functionally differentiated systems are formed by subsystems to societies such as the health care system, educational system, the political and scientific systems etc. They emerge when over time communication stabilizes in certain patterns. These patterns show themselves through the repetition of certain communicational themes and codes (Qvortrup 1998 p. 175ff.). This stabilizes a certain function within

the functionally differentiated system. Themes are dictated by the overall functional purpose of the societal subsystem. Themes could be such as educating students, treatment of patients, government of a nation etc. The theme of a given system is not finite, but is constantly reproduced within the boundaries of the system's code. Standing on Luhmann's and Bateson's shoulders Qvortrup suggests that these codes are binary by nature, i.e. power/weakness, ill/well, passed/failed etc. In academic terms the code works a subjectivation of the general theme. But this just means that the internal complexity, like the minister, observes communication in the context where it takes place. The minister observed the scientist's recommendations as working against his powerful position. If he had been in another functional system or at home he might have listened, as he would not be ruled by the power/weakness code. Like themes, codes help reduce the number of possible actions and thus reduce internal complexity. The communication that is actually realized in the system as meaningful in relation to the themes and codes is called the *programme*. Noise is communication that is eliminated from the programme.

In other words themes in a set of potential communication, the code defines what communication has the probability to be realized, and the programme is where part of the probable communication is actually communicated.

This is how communication reduces complexity in three easy steps.

In conclusion there is a number of organizational and societal structures that determine which communication is actually realized as perturbation. We have explored the systemic take on communication and confined it to three levels of observation:

Perturbation, reflection, and context.