

# Individual Path Dependency and Social Inertia: Facing the Crudeness of Sociology

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## Abstract

*Path dependency research focuses on the path dependence of social and economic systems like markets. Different facets of self reinforcement have been tried to identify during their analysis. Recently, scholars transformed path dependency to organizational systems and enlarged the number of facets for self-reinforcement. Interestingly, early and newer path dependency research struggled to explain the role of the individual in path dependent processes but use concepts of human-technique interrelatedness, learning, and power. Thus, this paper provides a framework for individual path dependency leading to a rigidity of social systems.*

**Keywords:** individual path dependency, constructivism, neuro-linguistic programming, systemic consulting, huna

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## Introduction

The construct of path dependence has been introduced to challenge neoclassical economics (David, 1985). By referring to the history of economic processes Paul David explained, that unintended consequences of action can lead to a lock-in which is potentially inefficient. The cause behind these processes leading to inefficiency Paul David named the mechanism of increasing returns. As examples technical interrelatedness (as learning) and system scale economies (as fixed cost reduction) were introduced. The lock-in was described as a point of quasi-irreversibility of investment that evolves due to the increasing returns. Paul David argued, based on his path dependency construct, that historical research in (socio-) economics is essential for understanding economic processes – other scholars support this opinion (Kieser, 1994).

Not surprisingly, researchers believing in the neoclassical paradigm (for the discussion on paradigms see Kuhn, 1996) criticized path dependency research. They pointed out that David's argu-

ments were based on problematic sources (Liebowitz & Margolis, 1990) and that path dependence would only occur rarely due to sponsoring (Liebowitz & Margolis, 1995). Thus, markets do seldom lead to inefficient outcomes.

Contrary, the discussion of (in-)efficiency brought up a 'history matters'-boom (Ackermann, 2001). Researchers supporting the concept of path dependence empirically and theoretically tried to point out more details about the 'increasing returns' especially in a sociological context (Arthur, 1996; Mahoney, 2000; Pierson, 2000). Management scholars recently brought up a broader understanding of increasing returns and named these forces "loops of positive feedback" (Schreyögg, Sydow, & Koch, 2003). They are effective at the organizational level.

Additionally, the discussion of path dependence brought up a 'path creation'-boom (Garud & Karnøe, 2001). Scholars tried to build a model that explains how conscious action may perpetuate a momentum leading to a potential inefficient lock-in. The mindfulness of the actors and their ability to disembed from social structure forming new (political) networks supporting their own idea is the key of this concept.

Due to the roots of path dependency research in history and sociology, most articles according to path dependence or creation research are focused on the social level of analysis. Accordingly, organizations or societies are the focal system. And since the construct of path dependence occurred in the science of economic history (David, 1985) and economics (Arthur, 1989), there has been a wide amount of publications according to the social citation index. It is no secret, that the research made is based on different theoretical paradigms like (new) institutionalism, institutional economics, structuration theory, or systems theory. Some of the major articles are gathered in the following list:

- Technological Paths (Arthur, 1996; David, 1985; Garud & Karnøe, 2003; Hargadon & Douglas, 2001; Stimpert, Wassermann, & Jarayam, 1998),
- Paths in Political Systems (Crouch & Farrell, 2004; Mahoney, 2000; North, 1990; Thelen, 1999),
- Organizational Paths (Bruggeman, 2002; Helfat, 1994; Human & Provan, 2000; Jarren, 2002; Karim & Mitchell, 2000; Langlois & Savage, 2001),
- Paths in Networks or Cluster (Grabher, 1993; Gulati, Nohria, & Zaheer, 2000; Krugman, 1991; Marquis, 2003; Walker, Kogut, & Shan, 1997),
- Strategic Paths (Burgelman, 2002; Cearney & Gedajlovic, 2002; Danneels, 2002; Stimpert et al., 1998).

Interestingly, most paths analyzed at the social level are interwoven with individual behavior (e.g. learning, power, communication and so on) but most researchers of path dependence and creation do not provide a detailed understanding of the individual and its interdependencies with the social domain. There are only some that try to draw back on psychological or cognitive aspects (Denzau & North, 1994 with their Psycho-Nomics or Neshet & Peled, 1986; Haase, Roedenbeck, & Söllner, 2009) to explain the individual role in path dependency research. Only one paper could be identified, that tries to provide a framework of micro-macro-level interdependencies (Haase et al., 2009) and several papers that deal with individual path dependency (Barnes, Gartland, & Stack, 2004; Egidio & Narduzzo, 1997; Grabher, 1993; Hoeffler, Ariely, & West, 2006; Neshet & Peled, 1986; Nooteboom, 1997; Tamborini, 1997).

Unfortunately, they all did not express their model of the individual in very detail. Additionally, they work only at a specific set of questions about individual path dependency instead of focusing on the development of a model of individual path dependency.

Therefore, from the authors' point of view, it needs to be analyzed at first whether there is a possibility to describe individual path dependency and how individual (possibly path dependent) behavior leads (by inter-individual interaction) to (possible path dependent) social processes. As Tamborini pointed out, individual paths are possibly the main drivers behind social processes and constructivism may help to explain (Tamborini, 1997). If it is favorable to describe a model of individual path dependency in detail, the model of micro-macro-level dependency by Haase and her colleagues (Haase et al., 2009) can be used to provide a research framework for the social sciences.

Accordingly, a model of individual path dependency is introduced within the epistemological framework of radical constructivism for the individual perspective of the observer. This model will explain social facets of positive feedback loops being caused by the individual. This model has been developed on the basis of a literature review of theoretical and empirical papers as well as key informant interviews (Gilrichst, 1999). Finally the model is tied to the micro-macro-level model of Haase (2009). A research framework for studying rigidity in social processes due to individual paths is provided.

## **Paths, Individual Paths, and Constructivism**

As introduced above, this paper combines path dependency literature with radical constructivism. The introduction already provided a basic understanding of path dependency as discussed by Paul David. This is now elaborated based on new empirical and theoretical findings and finally, the linkages to the individual level of analysis are provided. Thereafter, the extensions that need to be made due to radical constructivism (providing a detailed model of the individual) are discussed.

## **Path Dependency Research and Individual Paths**

"What is a path?" is the key question that was answered by Paul David and described above shortly: The construct of path dependency describes non-ergodic processes which are characterized by small events with non-ergodic outcomes in the beginning, increasing returns as the driving mechanism, and lock-in as the final state (David, 1985; Mahoney, 2000; Pierson, 2000). Most of all research papers try to support this model without providing a more detailed description.

Sole exception is a group of scholars from organization science who extended this dusty description of David by introducing phases and junctures providing a time-dependent model (Schreyögg et al., 2003): Small events in the beginning take place in the phase of 'increasing selectivity'. These events do build a corridor for future action. This leads to the phase of 'positive feedback' marked by a 'critical juncture'. The feedback loops (as economies of scale, or learning, etc.) are recursively closed circles

where actions or decisions perpetuate themselves. They describe the idea of recursion used in structuration theory (Giddens, 1995), systems theory (Luhmann, 1980), and radical constructivism (von Glasersfeld, 1990; von Foerster, 1994). The critical juncture is the point where at least one of this feedback loops is initiated but where the outcome is non-ergodic. The phase of positive feedback itself leads finally to the second juncture of a 'lock-in' which starts the phase of 'path dependence'. This is a small corridor, where only a few possibilities are open for selection and change is nearly impossible. This corridor may be inefficient.

Business dynamics research (Sterman, 2000) and social simulation studies (Leydesdorff & van den Besselaar, 1998; Roedenbeck & Nothnagel, 2008) showed that the sharp junctures and phases of the theoretical model are too sharp to identify: When analyzing complex systems processes a phase of small events starting these processes is unidentifiable (Lorenz, 1963). This is due to their complexity where human is not able to determine a starting point and its conditions. Accordingly, it is viable to identify a point where the appearance of positive feedback is observable: the 'critical juncture'. Regarding the juncture of 'lock-in' and the phase of 'path dependency' the studies showed that the 'lock-in' can be better interpreted as a probability-phase itself underlying the phase of positive feedback: Processes with positive feedback loops have a decrease in the probability of being overthrown. The probability has been calculated as the possibility to return to the equilibrium distribution by multiplying the probabilities in each step recursively (Roedenbeck & Nothnagel, 2008).

Summarizing how a social path can be described theoretically leads to the following model statements:

- Critical Juncture = Start of at least one positive feedback loop with a non-ergodic outcome,
- Phase of Positive Feedback = Positive feedback loops in action,
- Phase of Lock-In = Decrease of Probability within the Phase of Positive Feedback to leave the process although being possibly inefficient.

Which positive feedback loops can take place seems to depend on the foresight of the researcher. They all have different ideas about those mostly not providing a clear description on how these recursive circles do work (Beyer, 2005; Mahoney, 2000; Schreyögg et al., 2003). There is only one compendium (Sterman, 2000) as well as latest research (Holtmann, 2008) where it is tried to dig deeper into that research questions. One of the latest overviews (Roedenbeck & Holtmann, 2009) provides the following list:

- Social) power, legitimacy, functionality, complementarities, coordination / network effects, conformity;
- Economic) sunk costs, economies of scale and scope;
- Individual) expectation, adaptive expectation, emotion, learning, recognition.

In regard to the model statements from above – that could be extracted out of path dependency research papers dealing with individual path dependency – it needs to be explained how the individual may follow these 'rules' so that individual behavior or thinking can be named 'path dependent'. Several papers could be identified that deal with this question (Barnes et al., 2004; Bassanini & Dosi, 2001; Egidi & Narduzzo, 1997; Grabher, 1993; Hoeffler et al., 2006; Neshet & Peled, 1986; Nooteboom, 1997; Tamborini, 1997) which are analyzed in the following.

Barnes and his colleagues followed a behavioural science approach and tried to show that habits are path dependent (Barnes et al., 2004). Sorely, they did not extend their research on the cognitive domain and, thus, ignoring the possibility of the reflexivity of the individual. Additionally, they did not provide a clear framework of individual path dependency showing how self-reinforcement takes place. They only discussed consumer and producer behaviours locked in instead of the whole process of path dependency.

In regard to Bassanini & Dosi (2001) combinations of irreversibilities and non-linearities are the main determinants of path dependency. They easily describe the irreversibility conditions as whenever past irremediably influences behaviour. This appears when in some future time the individual suddenly reversed back to its actual state. Why and how the individual reverses back and, additionally, how the behaviour developed being a major influence is not studied in more detail.

Egidi and Narduzzo tried to analyze cognitive path dependence on the basis of an experimental card game (Egidi & Narduzzo, 1997). They showed that within a set of configurations which led more easily to the adoption of one strategy players continued to use it more frequently in the second part of the tournament. Additionally, they showed that a subset of players emerged with strongly routinized behaviours what they named 'lock in'. These findings do clearly support the assumption of individual routines but they did not provide or support a model of self-reinforcement.

Within his analysis of regional stability Grabher tried to explain it by using functional, political, as well as cognitive lock-in (Grabher, 1993). It is an interesting study leading into the direction of micro-macro model analysis but Grabher did not provide any clear model on how the cognitive lock-in occurs. Additionally, he did not explain why a political lock-in is not based on cognitive paradigms and how self-reinforcement takes place.

Hoeffler and his colleagues examined the impact of the entry position and favourability of initial (and ongoing) experiences on preference development. They identified that when the initial experiences are favourable, subjects experience only a narrow breadth of possible alternatives, demonstrate less ongoing experimentation, and have a reduction in the amount of preference development (Hoeffler et al., 2006). On the one hand, this quantitative analysis shows that preferences narrow down in number over time if experiences are favourable. On the other hand the generalization of the results leading to a model for future studies is not satisfactory.

Nesher and his colleagues studied paths of learning and showed how students change from a novice's state to that of an expert, in the domain of decimals. They describe the process in terms of explicit, intermediate, and transitional rules which are consistent yet erroneous (Nesher & Peled, 1986). Again it is an experimental study analyzing the fact of erroneous learning rules (lock-in) without providing or testing a broad or complex model of individual path dependency with self-reinforcement.

Nooteboom starts with a clear theoretical development of a model: He used a neuronal network approach and showed that a smaller bandwidth of neurons is activated in regard to specific stimuli over time (Nooteboom, 1997). He explained that confirmed cognitive structures do perpetuate others and the reason is bounded cognitive capacity. Sorely, he extended this simple neuronal model to organization structures

instead of extending his findings on the individual level. He discussed interactions of humans as neuronal interaction over-simplistically and missed explaining the process by which structures do perpetuate others or themselves.

Last but not least Tamborini provided in his theoretical analysis of path dependency the insight, that probably "locked-in" individuals cause social inertia or paths due to their behaviour (Tamborini, 1997). He summarises that mental models may follow path processes within the individual (Ackermann, 2001). He leaves his ideas open for discussion and proposed constructivism as the epistemological framework for analyzing individual path dependency.

Accordingly, when reviewing the studies provided above, there is a need for a clear model of individual path dependency that shows how the model statements taken from the social path dependency debate take place on the individual level of analysis. If this model can be extended with a micro-macro level approach it may be an optimal framework for studying individual path dependency as well as social inertia (possible paths).

Summarizing the model statements provided above, it needs to be shown on the individual level that there is a 'critical juncture' in the individual where at least one positive feedback loop within the individual and with a non-ergodic outcome starts. Secondly, at least one possible 'loop of positive feedback' needs to be shown within the individual that perpetuates thought or action. If it is possible to link the feedback loops provided in the list above (power, legitimacy, functionality, complementarities, coordination / network effects, conformity; sunk costs, economies of scale and scope; expectation, adaptive expectation, emotion, learning, recognition) to the individual level it may be shown, that there is only social inertia due to individual paths. Thirdly, a lock-in needs to be shown as a decrease in probability to leave the process driven by the loop of positive feedback so that the outcome is possibly inefficient.

### **Constructivism Providing Model-aspects for the Individual**

The model statements of critical juncture, non-ergodicity, positive feedback, and lock-in provided above need to be linked to the individual level when providing a model of individual path dependency. Therefore, a model about the individual is needed where these statements can be integrated.

As introduced above Tamborini proposed constructivism as a possible fruitful epistemological framework to answer this question (Tamborini, 1997). There are two main branches of constructivism that can be selected. On the one hand there is radical constructivism (as developed by von Foerster, von Glasersfeld, Maturana, Varela and others) with a clear focus on the construction within the individual itself - this may probably be a good choice. On the other hand there is social constructivism (as developed by Berger & Luckmann, Knorr-Cetina, Schmidt, Luhmann and others). Because social constructivism is mostly focused on choice, decision, interaction, or discourse the literature is not used in regard to the development of a model of an individual path.

Within the epistemological perspective of radical constructivism the decision about the existence of truth or knowledge is shifted into the metaphysical domain and the construction of the reality of an observer (Maturana, 1980) is the focal point of

analysis (von Glasersfeld, 1981). The observer is processing responses of his action (Raskin, 2002) what is described as senso-motoric action (von Foerster & Pörksen, 2001). Accordingly, the observer has a motoric system to act and a sensory system to sense. Each action can be observed from the environmental perspective as a decision (Luhmann, 1988) or choice (North, 1990).

For the sensory or nervous system a biological interpretation has been adopted in constructivism. The nervous system is understood as a closed system (Maturana, 1980). It only transfers signals as clicks from the environment to the observers' cognitive system (von Foerster, 1981). Thus, the observer has a motoric system to act, a sensory or nervous system to sense environmental clicks, and a cognitive system that interprets the signals. All systems are structurally coupled but operatively closed (Maturana, 1980).

Information within the cognitive system of an observer processing responses of his or her action is a distinction (in a symbolic syntax:  $\neg^1$ ) of an observer (Spencer-Brown, 1969)<sup>2</sup>. The distinction is the main act of the observer observing his observations as sensory-motoric action. When a distinction is drawn a form comes into being that divides the indicated and the void, or the form and its environment. A form summarizes therefore all kinds of content<sup>3</sup> the observer construes. Amazingly, the observer is able to regard the indicated and the void as separate entities (Maturana, 1980). By drawing the distinction 'observer' the observers 'environment' is also created.

The indicated and the void distinctions were supplemented by two specific aspects: self-crossing of forms and fundamental-forms. At first, the laws of forms describe the important cross-reference of forms. This means that a form is recursively a producer of and is being produced by forms. This was logically proofed and extended to the self-cross (in a symbolic syntax:  $\square^4$ ). Thereby, a form produces and is being produced by itself. This logic is characterized as combining "[...] both logic and the structure of any universe [...]" (Varela, 1975, p.6) an observer can differentiate. Secondly, in the constructivist debate a specific type of distinctions was made note of: the fundamental or basic-distinction (Maturana, 1980; von Foerster, 1993) providing stability and security (Luhmann, 1977). Kant defined natural laws as imposed laws (made by observers) and not derived ones (Kant, 1783) but space and time as *a priori* constants (Kant, 1787). Later, Vico (1858) also introduced truth as being constructed through action and, accordingly, defined space and time also as human constructs rather than *a priori* given constants. Interestingly, observers store distinctions in regard to space and time. Thus, von Glasersfeld (1994) defined the referential or fundamental distinctions of time and space as 'non a priori' proto-space and proto-time. By that, von Glasersfeld describes the capability of the cognitive system to store a dynamic concept from the environment as a static distinction in reference to fundamental-distinctions mostly unquestioned. Thus, observers need a set of fundamental distinctions to answer unanswerable questions as most religions do. Extending the proto-space and proto-time with the theory of relativity (Einstein, 1905) the personal proto-space-time results meaning that each observer has its own referential distinctions, to which other distinctions are tied and space as well as time are interdependent fundamental distinctions.

The valuation or interpretation of a (self-crossed) distinction of the observer in regard to existing (fundamental-) distinctions is another fundamental aspect for a model about the individual. The newly created distinctions could, for example, be evaluated as 'replicative aspects' (Kelly, 1991) being similar to already existing distinctions or as different. The similarity does not mean that they are objectively equal but that the cognitive system believes in their similarity. These possibilities have been described by three coping strategies of assimilation, accommodation, and equilibration (Piaget, 2003). The cognitive system either transforms the newly made distinction out of the sensed signals according to already available ones (assimilation). Thus, the present distinctions are tied to experience that allows further expectation. It is also possible that the cognitive system evaluates the new distinction as distinct from its present ones. Accordingly, it remembers the new one (accommodation). In addition to accommodation, equilibration describes a series of accommodations of distinctions necessary due to their interconnectedness to one distinction that has been accommodated. An equilibrium between assimilation and accommodation has been postulated (Piaget, 2003).

The distinctions of the observer, created by sensory-motoric action and interpreted in regard to existing distinctions, enable the observer to predict, as expectation. An observer always predicts interaction with his environment based on existing distinctions - for a couple of two observers this has been named a double bind (Bateson, 1996). This means that every observer has its internal distinctions concerning the other observer that lead to a prediction as expectations about the others' behavior (Kelly, 1991). Thus, these expectations have an influence on the observers' action (Bateson, 1996) but also his sensing, and his interpretation of the result (von Glasersfeld, 1994). It gets obvious that distinctions therefore reinforce themselves because they are used three times within the individual: forming action, sensing, and interpretation.

The described process of the sensory, the motoric, and the cognitive systems has been criticized especially from moderate perspectives of constructivism. The main reason was how it ignored unconscious processing of signals and the unconscious creation of distinctions which had not been addressed in radical constructivism (Bruder, 2003; Reich, 1998). Using the unconscious as a not-reflexively observed behavior of the observer providing unknown distinctions to the observer leads to conscious and unconscious (i.e. unobserved) action – thus an important aspect of psychotherapy can be integrated into constructivism.

The above described aspects of constructivistic epistemology provide important aspects for a static model of the individual that can be used to provide a framework of individual path dependency. But especially the learning processes of assimilation and accommodation (as well as equilibration) need a dynamic perspective instead of a static recursive circle with distinctions ( $\neg$ ) and self-crossings ( $\square$ ).

Some radical constructivists saw a time dependent drift of distinctions (Maturana & Varela, 1992) leading to an Eigen-Value (von Foerster, 1994) of the cognitive system. Thus, they interpreted the static recursive circle of sensory-motoric-cognitive activity as a time dependent circle. Sorely, they did not extend their view on static recursive or self-crossed distinctions.

Therefore, a distinction is interpreted as a dynamic concept that is changed over time, although regarded as the same distinction, due to assimilation processes ( $\neg(t)$ ,  $\square(t)^5$ ). The more a distinction is used and newly distinctions are assimilated the higher seems their probability of reuse. Thus, heterogeneity of observers results where each is tracked in its own web of interconnected distinctions.

### **A Model of Individual Paths and its Empirical Extensions**

Out of the named aspects in the prior chapter about the model statements on path dependency as well as about the constructivistic framework for modeling the individual a model of individual paths has been developed (figure 1).

There is an observer in an environment (dashed outer box, figure 1) with a motoric and sensory system (small boxes, figure 1) that are structurally coupled to the cognitive system (dotted inner box, figure 1) and the environment. Action of the motoric system is observable in the environment (arrow from the motoric system, figure 1) and signals from the environment are observable with the sensory system (arrow to the sensory system, figure 1). Within the cognitive system signals from the sensory system are interpreted (small box, figure 1) and distinctions are gathered ( $\square$  with indices  $i, j, k$  from 1 to  $n$ , figure 1) consciously and unconsciously (central white and small dotted box, figure 1). From a dynamic perspective (time  $t$ ), distinctions ( $\neg(t)$ ,  $\square(t)$  with indices  $i, j, k$ ) are used from the cognitive system to guide the motoric ( $t+1$ ), and sensory system ( $t+2$ ) as well as interpretation ( $t+3$ ) due to (higher order) expectations (rhomb on the right, figure 1). If one distinction is used for all three aspects (indices  $i = j = k$ , figure 1) then it reinforces itself because the results of a specific action are sensed in a focused area only and interpreted accordingly. If not, than there is a less strong influence, probably no reinforcement. Assimilation supports self-reinforcement and accommodation (as well as equilibration) leads to change where assimilations occurs more often (graph on the left side, figure 1). The self-reinforcement of distinctions leads to their strengthening or sharpening as a drift (in regard to proto-time) to a strong Eigen-Value (EV) or lock-in that leads to a rise in the probability of their reuse. The fundamental distinction of proto-space-time ( $px, py, pz, pt$ )<sup>6</sup> is similar within each observer (box in the center). Its central moderator is the belief in these fundamental constructions (rhomb on the lower left) because there is no empirical evidence (action and sensing) in regard to these.

Acceptance (rhomb on the left) and higher order expectation (rhomb on the right) are the key-drivers of internalizing the social domain into individual action. Acceptance means the internalization of new distinctions from the environment as true fundamental distinctions (like accepting ideologies) or as true distinctions leading to different fundamental distinctions. Higher order expectations means anticipated obedience (like group cohesion and conformity) where the observer has expectations about others observers' actions or expectations acting accordingly. This interconnectedness between the individual and the social domain are symbolized by the two arrows from the rhombs directing from the observer to the outside environment.

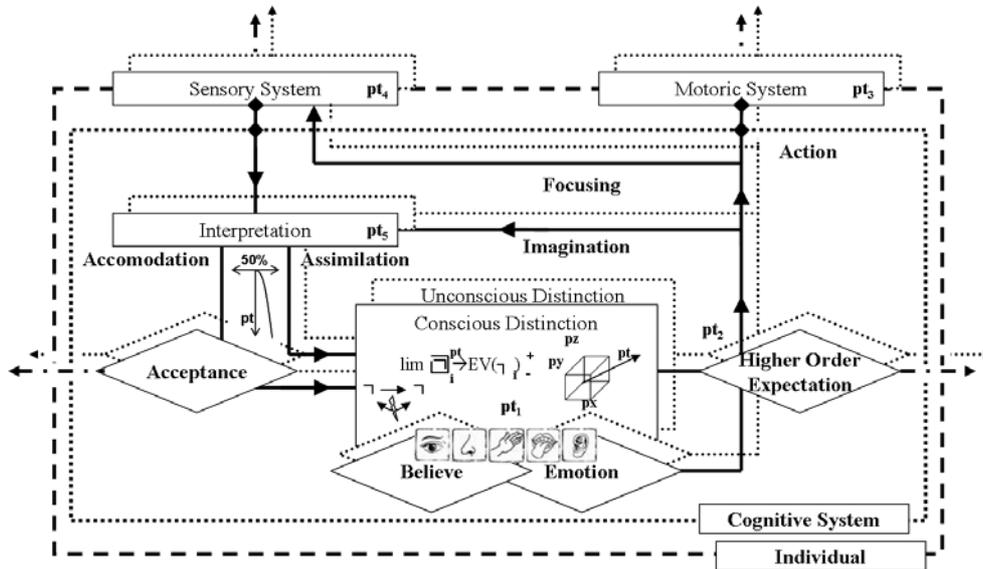


Figure 1. Framework of Individual Paths in Social Systems.

The aspects from above gathered in the described model lead to a model of the individual with an underlying self-reinforcement or feedback loop of distinctions (distinctions influencing the motoric, sensoric, and interpretative system). To call this model a model of individual path dependency there are some more aspects that need to be described by the model than self reinforcement: 'critical juncture', non-ergodic outcome, an inefficient lock-in.

The critical juncture is the point where at least one positive feedback loop within the individual and with a non-ergodic outcome starts. In regard to the described model, the self reinforcement starts with birth so that an observer is possibly always path dependent. Only his assimilation or accomodation as well as his acceptance and expectations can modulate the Eigen-Values that appear.

The aspect of non-ergodicity of an individual seems to be obvious. Cognitive processes are non-ergodic in the beginning and lead to a heterogeneity between observers. But additionally, Eigen-Values of observers make them predictable. This means that locked observers may be ergodic in regard to special distinctions.

The inefficient lock-in is the last aspect that has partly been addressed in the discussion above. The drift of distinctions resulting in an Eigen-Value describes the tracked or locked observer. Accordingly, new distinctions are only assimilated and no change is at hand. The inefficiency of an Eigen-Value can be easily defined according to radical constructivism: Because of the criteria of viability (von Glasersfeld, 1981) an Eigen-Value is inefficient if an observer does not reach its expected goals with its distinctions. Its distinctions are subjectively dysfunctional. Contrary to critiques on path dependency research (Liebowitz & Margolis, 1995) efficiency is thus not objective but seen a system specific evaluation of system states.

The developed model has been discussed with key informants (Gilrichst, 1999) using constructivistic theory in coaching and consulting individuals. These key informants were trained in systemic therapy / counselling, neuro-linguistic programming (NLP), and /or Huna (an approach combining constructivistic psychology and shamanism). The discussion led to some extensions, that are already exemplified in figure 1 and not yet described: the VAKOG-Model, emotions, and imaginary thinking.

At first, the experts of neuro-linguistic programming introduced their VAKOG model of the sensory system in addition to the described model of the individual. By that, a more elaborated distinction of the single clicks internalized from the environment is given (list of senses in the central white box). It is very functional to use it in consultancy, especially in conjunction with the methods of anchoring, reframing, and re-imprinting. These are very important techniques also used in regard to the training of new distinctions of the cognitive system to break the drift or lock-in. The different sensory systems produce different distinctions that are gathered cognitive objects – as grouped distinctions.

The second aspect named by experts of neuro-linguistic programming and extended by experts of Huna is the interconnection of emotions with distinctions and with the body as the motoric system. Because distinctions are often closely linked to emotions and the reactivation of these distinctions leads to an automatic appearance of the emotions, a training of relaxing in problematic situation is necessary. Due to this result, the moderator of emotions has a strong influence. In regard to the upper framework (the lower rhomb on the right) emotions are tied to the distinctions. Because emotions not only are stored with distinctions but also influence expectation and behavior, they are interconnected with expectations and behavior (represented by the linkage from the moderator of expectations to the others).

The third aspect which needs to be added due to the key-informant interviews is the dream reality or the competence of imaginary problem solving behavior. By using katathym-imaginative psychotherapy, the cognitive system seems to have the imaginary capability to deal with conscious and address unconscious distinctions as archetypes and animals. Drawing back on the law of self-crossing it is possible for the individual to construct distinctions only within the cognitive system without sensory-motoric action. Within the provided framework this means that the arrows leading from distinctions to the motoric and the sensory system do not need to be present (a graphical change of the framework is not necessary).

With these extensions the model of 'individual path dependency' is finalized. Each aspect in that model can be transformed into a research proposition, so that it can be used for research. For example: "management X has focused on less different topics over time" or "politician Y has assimilated the arguments more and more in regard to his own paradigm over time" as well as "scientist Z has the Eigen-Value of objectivity". If all aspects from the model can be identified within a process of individual development, the individual path is described. The social paths as well as the social aspects of self-reinforcement are addressed in the last chapter.

## The Model of Individual Paths and the Micro-Macro-Level Model

As described in the beginning of the article, a number of lists about numerous facets of the mechanism of self-reinforcement are provided in scientific literature. Interestingly, they mostly did not provide a detailed explanation on how these facets reinforce themselves. To enlighten the sociological crudeness it needs to be explained how the model of individual paths (as a micro level model) can be tied to the social domain (as the macro level of analysis).

Therefore, the most common facets of self reinforcement, as provided above, are analyzed on the background of the model of individual paths. The facets reviewed are those provided above:

- Social) power, legitimacy, functionality, complementarities, coordination / network effects, conformity;
- Economic) sunk costs, economies of scale and scope;
- Individual) expectation, adaptive expectation, emotion, learning, recognition.

Although this step is not sufficient, it is the first and necessary one on a long road of future research. Enhancing this perspective with social constructivism (which has been put aside during the development of the model) is one of the following steps the need to be made.

Starting with the individual facets it can be summarized that expectation, adaptive expectation (integrated as higher order expectation), emotion, learning (as the drawing of distinctions with assimilation, accommodation, and equilibration), and recognition (as sensing) are already included in the model of individual path dependence. But each is a jigsaw piece only in the big reinforcement loop of the individual. None alone can cause a reinforcement of distinction or decision in regard to the provided model.

When analyzing the linkages of the model of individual path dependence with the one provided by Haase and her colleagues (Haase et al., 2009) it becomes obvious that much more details could be provided. At first, the 'micro-micro reinforcement loop' (learning caused by assimilation and accommodation) is extended, because the process of learning itself could be described in the model of individual path dependence. Secondly, the 'effect of connectivity 1' (the interdependency of distinctions) is extended, because the influence of present distinctions has been described on the conscious and unconscious level.

Interestingly, higher order expectations as well as acceptance are two moderators on the individual level that are – at least from the model of individual path dependence point of view – already linked to the social domain. The acceptance of communicated (as action and sensing) distinctions can lead to 'social knowledge' or 'social institutions' which are commonly accepted (thus social) distinctions guiding action, sensing, and interpretation of the individual. Higher order expectation as expectations of the observer about expectations of other observers may lead to anticipated obedience resulting i.e. in 'social culture' and 'social norms'. These two are similar to what Haase and her colleagues described as 'connectivity 2': individual distinctions have been connected with social-domain knowledge resources (see Haase et al., 2009).

The economic facets of sunk costs and economies of scale and scope can also not cause a reinforcement of distinctions by themselves. From this paper's perspective an individual is needed to evaluate costs, costs as sunk costs, and act according to the

evaluation not throwing good money after bad. Thus, without an observer making the observations and acting according to these no path would develop due to 'economic effects' present as 'natural laws'.

Last but not least the social effects are analyzed whether they provide new insights for a micro-macro level interdependency: power, legitimacy, functionality, complementarities, coordination / network effects, conformity. Interestingly, the social concepts of power, functionality, complementarities, and conformity can all be understood in regard to legitimacy. On the background of the provided framework legitimacy occurs in regard to assimilation and accommodation as the moderators of acceptance and belief – as 'connectivity 2' in the model of Haase. Distinctions provided externally are (un-) consciously internalized by accommodation because they are accepted as being true. Additionally, if 'internal' distinctions are legitimized and regarded as true, new distinctions are assimilated to the internal ones. Therefore, a distinction reinforces itself due to assimilation, or a new distinction reinforces itself after one accommodation, if distinctions are legitimized as true. Legitimacy may therefore itself be a faith when fundamental distinctions are absorbed by the observer – this is already part of the model namely as the moderator of belief. Power, for example, can only take place in regard to another observer if the last legitimizes the power and if the prior acts accordingly (French & Raven, 1959; Raven, 1992). Conformity as group-think (Janis, 1972) also exists due to the observers' legitimacy of the group only: The observer acts according to his expectations about the expectations from other observers regarding him.

The remaining social facet is coordination / network effects. This has been identified as a central driver in early path dependency research (Farrell & Saloner, 1986; Farrell & Saloner, 1985). In regard to the framework of individual paths with a constructivist perspective coordination and networks can not reinforce themselves as long as there is no observer feeling himself tied (acceptance and belief) to these, acting accordingly. It has been shown, that action, or decision, or choice is the only observable action from an environmental perspective. Due to the complexity and opacity of social systems not all actions are observable by each individual observer. Thus, coordination and networks may work as observers' filters so that individual path dependency is at hand faster. In regard to the discussion of the social facets of self reinforcement it could be shown, that there is no social path dependence and no self reinforcement but path dependent individual observers (with inner self reinforcement) producing social inertia.

Essentially, to overcome the crudeness of sociology – at least in regard to path dependency research – providing only unspecific facets of reinforcement within an unspecific description of social process and without addressing the observer, now a complex observer-based research approach of social processes is needed. By that, at first, involved observers can be analyzed in regard to the model of individual path dependence provided above. Then, their interdependencies (distinctions, acceptance, and belief) of action, sensing, and interpretation can be analyzed to show how they support themselves due to multiple bindings (in regard to the nucleus of a society, two observers, it's a double bind). By that, social inertia can be explained as caused by multiple individual path dependencies.

## Conclusive Summary

On the background of the theoretical discussion of path dependency research a theoretical model of individual paths in social systems has been developed. It was extended due to key informant interviews but not tested in an empirical case. It has been shown that according to this framework individual action, behavior, as well as social systems are not self-reinforcing. Reinforcement only takes place if reflexivity of the individual guides action, sensing, and interpretation. The main aspects that need to be addressed are the distinction of the observer into a motoric system, a sensory system, and an interpretative realm within a cognitive system. Once a distinction is made it guides the three systems so that assimilation of other distinctions result. A distinction reinforces itself and drifts into a lock-in over time (Eigen-Value). The lock-in is individually evaluated and inefficient only if the individual goals can not be achieved due to existing distinctions. First and higher order expectations lead observers to adaptive behavior that supports the status quo. The internal legitimacy (acceptance) of externally provided distinctions and the belief in these lead to the possibility of common individual paths. The major distinction into the conscious and the unconscious within a cognitive system showed that drifts of distinctions and lock-ins can be a blind spot of the observer.

Accordingly, path dependency research should not just be focused on the social domain but needs to analyze individual behavior according to the provided framework (complex observer-based approach). Although social inertia (stability) is possible as repetitive action of many individuals for the dominant solution the reasons behind stability reside within the individual level. Although some may doubt, extending the claimed research for mechanisms (Mayntz, 2005), this paper guides future research focusing on the individuals, their inner constructions, and their interaction in small as well as large innovative systems. Micro-policy, emotions, and constructions lead to big collective innovations and not a system itself. 'Facing the crudeness of sociology' leads to a research of thinking and interaction from a radical constructivistic perspective. By that (research based on the individual constructions and interlinking mechanism) social constructivism research needs to be reworked, and can fruitfully enhance the micro-macro-level perspective.

Additionally, this paper faced the 'crudeness of radical constructivism': Commonly the distinctions between the unconscious and conscious part of the observer as well as emotions of the observer are missed. Here, they are part of the provided model. Thus, the modern sociology of complex thinking and interaction needs to be based on the extended version of radical constructivism.

To show the practical relevance of the developed model empirical studies should be conducted with that model. This can be done either by observing observers within a social system like an organization. The provided framework can be used to guide the observation or the foundation for a questionnaire or interview guideline. Additionally, the re-analysis of already conducted studies in the field of path dependency is another possibility. By that it can be shown, whether the model provides different insights or not. Another possibility would be action research where a voluntary organization with inertia is consulted according to the model (methods in regard to the model can be

taken from Roedenbeck, 2009). Simulation studies may support the distinction between individual paths and social inertia.

Theoretical research may on the one hand extend the model in regard to interaction characterized by expectation, acceptance, and belief. On the other hand, theoretical research may enhance the model of path creation – where the concepts of mindful deviation and momentum are used to describe the conscious emergence of a path only – with the model of individual paths. It seems that the creation of distributed individual path dependency may lead to a social momentum.

If the model can be validated empirically, it can also be used for forecasting and strategic management. If path dependence shall be created, the facets within the model can be stimulated. If it shall be interrupted, the facets need to be stimulated so that the process is disturbed. If it shall be used in regard to planning, the facets shall not be touched or conditions shall be frozen so that individuals do not change behavior.

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## Notes

1. By introducing a symbolic syntax, Spencer-Brown was able to provide short but meaningful equations of his epistemology. The symbol for the distinction ( $\neg$ ) represents the indicated (on the left side below the lines) and the rest, or void, (on the right side).
2. Because constructivistic epistemology is recursive the constructivistic epistemology itself (as well as all others) is only a distinction of the observer.
3. Forms itself might be separated by observers into forms describing declarative and procedural aspects (see Ryle, 1949). Other observers might divide these forms into explicitly known and silent or tacit ones (Polanyi, 1966).
4. Varela also used the short but meaningful symbolic language introduced by Spencer-Brown. He additionally extended the language with the symbol of recursion ( $\square$ ). By that symbol it is expressed, that a distinction (once made) reproduces itself. This is, because once you define a difference between a and b seeing a or b would support the correctness of the difference once made.
5. At this time, the symbolic language of Spencer-Brown and Varela is extended in regard to physics. For example: speed ( $v$ ) is dependent from way ( $s$ ) and time ( $t$ ) being written as  $v(s, t)$ . Because a distinction and recursion are also seen as being dependent from time, they are further written as  $\neg(t)$  and  $\square(t)$ .
6. Because space-time is expressed by three coordinates  $x$ ,  $y$ , and  $z$  as well as time, the proto-space-time is expressed in proto- $x$  ( $px$ ), proto- $y$  ( $py$ ), proto- $z$  ( $pz$ ), and proto-time ( $pt$ ).

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