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# Institutional Rigidity and Lock-in of Individual Mental Models: On the Role of Knowledge and Ideologies.


## ABSTRACT

Taking the works by North (1990) and Denzau/North (1994) as starting point, the paper analyzes classical views of Hayek, Williamson, and North on institutional rigidity and change. It shows that there is a major lack in explaining how individual actors are involved in the process of change. At first, we clarify our understanding of institutions, knowledge and ideologies as social constructs. We then analyze the individual's mental modeling procedures with reference to radical constructivism and the path dependency approach. From our point of view, institutional rigidity, as a social phenomenon, has its main source in micro-level path processes. The interconnection between mental models and social constructs like knowledge and ideologies ties the individual lock-in to social rigidity. Within our conceptual framework based on theories from economics, social theory, psychology, and philosophy of science, we provide an analysis of institutional rigidity caused by path processes located at the individual or micro level that gives rise to a broad range of empirical questions.


## I INTRODUCTION

Institutions are defined as the rules of the game (North 1990, p. 3). Their main purpose is often seen in a reduction of uncertainty. Because institutions are a source of reliable expectations concerning the behavior of others, they are a central foundation for human cooperation. However, changing circumstances may require institutional change. Although our understanding of the comparative efficiency of different governance structures has increased during the last years, our knowledge about institutional change is still very limited. Not surprisingly, institutional imperfectness conjoined with institutional inertia is widespread even in situations where change is urgently required (cp. Hargadon and Douglas 2001, Eggertsson 2005).

In our paper we claim that there is a research gap, on the one hand, with respect to the processes of institutional change as well as its drivers and, on the other hand, with respect

to its barriers. Emphasizing the old saying that 'it's all in the mind'[1], we argue that ideologies and their effects on learning processes are a cause of institutional rigidity. North (1990, p. 103) as well as Denzau and North (1994) have emphasized the role of ideologies but have not specified in detail the connection between mental models, ideologies and paths that may lead to institutional inertia. Therefore the task remains to explain institutional rigidity and to overcome it in practice.

Building on research results from the new institutional economics, constructivism and path dependence theory, we first introduce three classical views on institutions and institutional change. We will discuss their strengths and weaknesses with respect to conscious change. Second, we introduce central understandings of the terms ideology and knowledge in order to provide definitions which are adequate for the analysis of mental models. Third, we suggest a theoretical framework for the analysis of mental models based on radical constructivism. This analysis refers to rigid ideologies and knowledge. By introducing path dependency the mechanism of positive feedback provides hints on how institutional rigidity can occur. Fourth, we tie together our framework with path dependency to provide loops of positive feedback on the micro level that foster rigidity on the social level. Finally, we give a conclusion with further research questions on how lock-ins, can be avoided and where to focus further research on breaking these lock-ins.

## II INSTITUTIONS AND INSTITUTIONAL CHANGE – THREE CLASSICAL VIEWS

In this section, it is our goal to discuss three classical views on institutional change. For each view the particular understanding of institutions and their change is introduced. It follows a discussion of the strengths and weaknesses of the views concerning conscious change.

Generally, if institutions are stable, they can reduce uncertainty. This depends on the extent to which institutions are able to guide expectations concerning the behavior of actors within an economy. However, institutions may also be subject to change. This seems especially necessary, when changing circumstances require institutional change. But due to their

[1] 'A man's sense is falsely asserted to be the standard of things; on the contrary, all the perceptions both of the senses and the mind bear references to man and not to the universe, and the human mind resembles those uneven mirrors which impart their own properties to different objects, from which rays are emitted and distort and disfigure them' (Bacon 1902, p. 21).

rigidity change is often not possible (or not possible in the required degree). Until now, a clear explanation of institutional rigidity and inefficiency can not be found in the new institutional economics and its contributions to the understanding of institutions and change (Eggertsson 2005). In economics, the works of Hayek, Williamson and North may serve as prominent examples for dealing with institutional change (Table 1).

| | Measure of Success | Impetus for institutional change | Search and evaluation of institutional designs | Implementation of institutional change |
|---|---|---|---|---|
| **Theory of spontaneous order (Hayek)** | Success for the individual, success for the group | The desire to experiment and the wish to improve ones well-being | Evolutionary trial and error | Diffusion within and among groups; elimination of errors |
| **Transaction-cost theory (Williamson)** | Transaction costs | Change in the relevant characteristics of transactions | Intended rational search and evaluation | Problem solution within organizational settings |
| **Theory of institutional change (North)** | Wealth, profit, growth | Situational changes and changes in the relative prices | Individual cost-benefit calculation | 'Transactions' on the 'Market for Institutions' |

**Table 1: Institutional Change in the Work of Hayek, North and Williamson**

### *II.1 Hayek's understanding of institutions and their change*

According to Hayek institutions are forces of order, or rules, that control the behavior of the elements from which orders are formed (von Hayek 1994, p. 144). On the one hand, the rules can be articulated by legal regulations (*Rechtsregel*) like written codices (von Hayek 1994, p. 176). On the other hand, they can be articulated as moral regulations (*Moralregel*) like social behavior (von Hayek 1994, p. 40). Individual action according to these rules results in higher level order. The origins of these rules are biological inheritance and cultural learning processes.

Against this background, institutional change is very much an evolutionary process in which the better solution survives (von Hayek 1981, p. 211). The selection and elimination of inferior solutions lead to the survival of institutions that offer to individuals and groups advantageous action opportunities (von Hayek 1971, p. 34, 69). The driving force behind institutional change, however, is not the well-planned new design of institutions but rather the human desire to experiment. The process can be best described by trial and error. This

makes it hard to manage institutional change at all or to overcome inefficient institutions by deliberate action.

### *II.2 Williamson's understanding of institutions and their change*

Contrary to this, Williamson distinguishes four different levels or facets of institutions (Williamson 2000): The notion of embeddedness describes informal institutions like customs, traditions, and norms. The institutional environment consists of the formal rules of a society, e.g. property, polity, judiciary, and bureaucracy. Governance is the process of aligning governance structures with transactions. In doing so, the possibility of cooperation among market participants is increased, due to a reduced behavioral uncertainty. Finally, institutions align incentives for employees and others, defining rules for resource allocation and employment at the level of organizations.

Williamson argues that the process of evolutionary elimination given by Hayek is rather the result of individual bounded rationality, foresight and the ability to solve transaction-cost related problems (Williamson 1999). However, the process of change is not a mayor aspect of Williamson's approach. Thus, although Williamson (2000) stated that change is possible, at the different institutional levels it needs different amounts of time: Changes within the institutional environment may take more time than changes at the level of organizations or market transactions. The process of change, however, is not dealt with in detail.

### *II.3 North's understanding of institutions and their change*

According to North, institutions are the 'rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction' (North 1990, p. 3). Like Hayek he distinguishes between formal rules which are devised and informal rules like conventions or codes of behavior (North 1990, p. 4).

Quite in contrast to Williamson and Hayek, North has explicitly addressed the process of institutional change in his work. He deals with the question why institutions remain unchanged for a long time although they do not benefit the society. His answer is that goals of individuals and societies are not necessarily congruent. If something that might be advantageous for society is not beneficial for an individual too, the individual will not

spend time or effort on implementing new rules. Individual cost-benefit calculations of human actors are thus a starting-point for analyzing institutional inertia.

However, a closer look at the cost-benefit approach makes clear that it is both too general and too specific for an explanation of institutional inertia: It is too general because an individual cost-benefit calculation means all and nothing if there is no theoretical framework that classifies costs and benefits in relation to institutional change. On the other hand it is too specific, because North discusses very interesting cases with examples for determinants of individual costs and benefits of institutional change. But these cases and the analyses of cost-drivers as well as benefit-drivers are hard to generalize and can therefore not be easily applied to other cases. For this reason North concludes that his approach is 'far from providing for the kind of hypothesis testing that must ultimately be done' (North 1990, p. vii).

Notwithstanding, one aspect in the work of North seems to be extremely promising for understanding the logic behind institutional inertia and rigidity. As stated in the new institutional economics (North 1990, p. 76, 96), the main drivers towards rigidity, on the one hand, and self reinforcement, one the other, are strongly influenced by the interaction among mental models and ideologies. According to Denzau and North 1994, p. 4), ideologies are (parts of) shared mental models. This proposal leads into a promising direction but does not yet explain the interconnectedness of mental models and ideologies in detail and how they support self reinforcement. By extending Denzau/North's (1994) approach on ideologies as a framework of shared mental models, we want to elaborate on the interconnectedness of ideologies and mental models as well as their effects on learning processes.

## III ON THE DISTINCTION BETWEEN IDEOLOGY AND KNOWLEDGE

In this section, it is our goal to find a defendable distinction between ideology and knowledge.[2] We refer to this distinction because we think that it is the most important distinction with respect to the 'internal-to-the-mind structure'. We claim that our distinction between ideology and knowledge with respect to cognitive framework of individuals is

[2] We do not make for example a distinction between, on the one hand, ideology and value judgments (Katouzian 1980) and, on the other, knowledge. With it, it is not implied that knowledge is unaffected by values or that value judgments have no relation to knowledge. To keep things more simple, we do not elaborate on these issues.

fruitful in particular with respect to different applications of mental model-based analyses in institutional economics.[3]

Therefore, we begin with a (very) short and surely incomplete introduction in the historical development of the concept of ideology. After this, we provide a distinction between the concepts of ideology and knowledge that is assumed as fruitful for the further discussion.

### *III.1 Francis Bacon on ideology and knowledge*

The term 'ideology' appeared relatively late on the stage in the history of philosophical concepts. Throughout the history of ideas, the terms 'science' and 'ideology' have been interpreted with mutual reference to each other. The term 'ideology' entered the stage in a historical period which can be characterized by the success of the natural sciences and the emergence of British empiricism (Bacon, Locke, Hume). It can be traced back to Francis Bacon's (1561 – 1626) lessons on *idols* (Bacon 1902, p. 11 ff.). For Bacon, knowledge is based on empirical evidence or what he calls 'true induction'.[4] Because 'true' knowledge is empirically approved knowledge, beliefs, convictions, metaphysics, etc. which are empirically unauthorized, can never achieve the status of knowledge. His belief in the possibility of knowledge and its source in empirical evidence notwithstanding, Bacon did not equate the human mind to a tabula rasa or an ideal plane which can deliver perfect representations of the external world. According to him, the human mind is perceived rather as a crooked mirror. For this reason, human minds are a source of errors and mistakes which systematically distort the processes of cognition and assessment. Idols are the expressions of these errors and mistakes which result from the characteristics of the human mind but also from the societal aspects of human recognition. Bacon (Bacon 1902, p. 20 ff., Klein 2003) made a distinction between four different kinds of idols:

1. Idola tribus (idols of the tribe) have their origin in the above described characteristics of the human nature which distort the reflection of the external

[3] Denzau/North (1994, p. 15) refer to 'positive mental models in a ideology that tend to focus on the actions and valued outcomes defined as crucial to hindering or fostering the vision embodied in the ideology.'

[4] 'The formation of notions and axioms on the foundation of true induction is the only fitting remedy by which we can ward off and expel these idols' (Bacon 1902, p. 20).

world.[5] As described in Footnote 1, according to Bacon, the human mind does not possess the preconditions to provide an undistorted image of the subject matter of recognition; rather, it works like a crooked mirror.

2. Idola specus (idols of the cave, or den): fallacies which result from the unconscious in individual thinking and acting.[6] These fallacies are influenced both by the personal characteristics or dispositions, on the on hand, and by the individual's 'education and intercourse with others' (Bacon 1902, p. 21).
3. Idola theatri (idols of the theatre): prejudices based on the doctrines of traditional philosophical systems, or the uncritical acceptance of what authorities say, or any kind of dogmatism.[7]
4. Idola fori (idols of the market place): false concepts or errors stemming from public communication or the use of language in general.[8]

Bacon's approach to idols paves the way to our discussion of the phenomenon of a lock-in between mental models and ideologies:[9] Socially, politically, philosophically, methodically unjustified or 'wrong' convictions often emerge from tradition and societal prejudices. They exert influence on the individual mental models. Problems related to the interplay between idols of the individual and the social level are thus anticipated by Bacon. They are later discussed in terms of individual and shared mental models.

### *III.2 Antoine L. C. Destutt de Tracy on ideology and knowledge*

Antoine L. C. Destutt de Tracy (1754 – 1836), a French philosopher of enlightenment and director of the Institute de France, coined the term 'ideology.' Contrary to Bacon, Destutt de Tracy equated 'ideology' with 'science of ideas.' From his point of view, ideas have their origin in sensation and empirical evidence (Schlette 1973, p. 720). Because of this,

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[5] 'The idols of the tribe are inherent in human nature and the very tribe or race of man; for a man's sense is falsely asserted to be the standard of things' (Bacon 1902, p. 20).
[6] 'The idols of the den are those of each individual; for everybody (…) has its own individual den or cavern' (Bacon 1902, p. 21).
[7] '(T)here are idols which have crept into the men's minds from the various dogmas of peculiar systems of philosophy, and also from the perverted rules of demonstration' (Bacon 1902, p. 22).
[8] 'There are also idols formed by the reciprocal intercourse and society of man with man, (…) from the commerce and association of men with each other' (Bacon 1902, p. 21).
[9] According to Bacon, the delusions and fallacies based on the unconscious are too manifold and clouded to become subject of systematic analysis. In the meantime, for example Freund and Festinger have dealt with such phenomena.

ideas were seen as a subject of scientific assessment: unbiased historic-empirical generalizations should evaluate ideas and support prediction and expectation.

As Katouzian (1980, p. 150) has pointed out, this was a 'declaration of war on metaphysics, and religious beliefs.' Like Bacon, Destutt de Tracy argued against a legitimation of knowledge on the basis of religion, metaphysics, or authority. Accordingly, he connoted the term 'ideology' positively and equated it with empirically approved knowledge about ideas. Interpreted in this manner, under the term 'ideology' is subsumed knowledge in the meaning of those strands of epistemology which assume sensation and empirical evidence as the most important sources of knowledge.

### *III.3 A Conclusion in between*

Nowadays, 'ideology' carries the negative image of non-science (Popper 1945). Empiricism, positivism, and critical rationalism all maintain the idea of a demarcation between science and non-science or between knowledge, on the one hand, and unjustified or wrong convictions, on the other. In this context, it has been argued that the demarcation line must be marked by the use of particular methods legitimated by a community or scientific community (Feyerabend 1975).

What we want to keep in mind from our discussion is: First, 'ideology' is equalized with scientifically or methodically not (sufficiently) legitimated, or unauthorizable, or (from the perspective of another person's belief system or a scientific community's recognition) 'wrong' convictions. Second, as emphasized by Bacon, such convictions are, on the one hand, related to the individual's belief system (idola tribus and idola specus). On the other hand, ideologies are a social phenomenon because the acceptance of demarcating methods is made within communities – not necessarily scientific ones – as emphasized by Feyerabend. Bacon has expressed this influence in his idols of the theatre and the market place: methods and decisions can be accepted uncritically (idola theatri) or their acceptance can be based on errors due to communication (idola fori). This results in system-specific or community-based differences of the demarcating lines between knowledge and ideologies. Thus, ideologies cannot be kept 'alive' or 'survive' without reference to groups or society. Third, knowledge is generated by the use of particular methods and by means of them separated from ideologies. Both ideology and knowledge are thus tied to the use of methods. Finally, since methods are accepted (legitimized) by social (scientific)

communities (as claimed and criticized by Feyerabend), knowledge is a social phenomenon, too.[10]

# IV IDEOLOGY AND KNOWLEDGE LINKED TO MENTAL MODELS

In this chapter we provide at first a definition of the concept of mental model which are related to the individual level of analysis. Radical constructivism, as a theory of recognition, provides the conceptual framework for this attempt. Then we discuss how mental models and social phenomena, like knowledge, institutions, and ideologies, are linked. For this purpose, we draw on the conception of the duality between structure and action by Anthony Giddens. According to this approach, structure influences individual action and *vice versa*. Finally, we provide a reason for the differences in individual behavior appearing even in cases where the individuals face the same social structure.

## *IV.1 Radical constructivism and mental models*

Despite its origin in biology and cybernetics radical constructivism is an approach on human cognition and belongs to epistemology. Radical constructivism is a theory of knowing not of knowledge (von Glasersfeld 1995, p. 113). It puts the ontological thesis of common-sense or scientific realism (Devitt 1980, p. 22), according to which 'the world exists independently of the mental' (Devitt 1980, p. 14), into the metaphysical realm. In contrast to cognitive psychology, radical constructivism allows us to deal with self-referential and paradox cognitive systems[11] which evolve from learning processes embedded in, or reacting to, their social as well as physical environment.

We define the concept of mental model as 'an internal to the mind representation arising from an individual cognitive system.'[12] These representations are described with reference to Ryle's (1949) distinction between *knowing that* and *knowing how* or *declarative knowledge* and *procedural knowledge*, respectively, that, after criticism from artificial

[10] Feyerabend did not criticize the use of methods as such but rather the legitimation that is ascribed to scientific methods compared to what is called non-scientific methods or no method at all.

[11] Cognitive systems are observers in radical constructivism where emotions do not play a major role. Within the development of our model we stick to these basics. But surely introducing emotions into the model will be a future benefit.

[12] Cognitive systems are observers in radical constructivism where emotions do not play a major role. For this model we stick to these basics but surely introducing emotions into the model will be a future benefit.

intelligence, cognitive psychology and philosophy, has been modified (Barr/Feigenbaum 1981; Anderson, 1983; Carr 1981). The most important consequence of these criticism for our work on the mental models is the abolition of a clear-cut distinction between declarative and procedural knowledge that allow us to use the term 'representation' for both kinds of knowledge.[13] Declarative knowledge can be always made explicit (although an individual does not need to be permanently aware of all of its declarative knowledge); procedural knowledge is often not explicitly known or the subject of representation. Some parts of procedural representations can remain what Polanyi (1966) has called *tacit*.[14]

According to the radical constructivism, the construction of individual mental models is based on signal processing capacities and experiences related to individual senso-motoric action (von Foerster 1973, 1981, 1994, 1995a). Within signal processing the nervous system, conceived as a closed system (Maturana 1980), internalizes the undifferentiated clicks of signals. Information or sense is onlyinternally added by the cognitive system. The individuals' experience results from the recursive usage of prior existing mental models which are conceived of as the individuals' presuppositions (von Foerster 1995b, p. 3). By means of this self-referential procedure, networks of mental models are created.

From the perspective of radical constructivism there are two coping strategies of which individuals make use if they internally create a new mental model due to self-reference or processing signals from their environment: assimilation and accomodation (Piaget 2003b, Piaget 2003a). Assimilation takes place if information resulting from signal processing is selected and adapted in a manner fitting to available mental models. Accommodation means that the observer reacts to new aspects in the information which lead to new mental models or to a modification of present ones.[15]

According to Denzau/North (1994), it is useful to explain the influence of mental models on individual decisions by starting with the construction of a problem space (Denzau and North 1994, p. 4; Holland et al. 1986, p. 12) – or simply an economic problem. Against the background of radical constructivism, which signals are observed and which ones are neglected for the construction of the problem, depend on the cognitive system in

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[13] 'The most pervasive response to Ryle's position analyzes know how in terms of conscious, explicit representations of procedural knowledge' (Wallis 2004: n p.).

[14] The distinction between explicit and tacit knowledge adresses the separation of conscious and unconscious constructions. This is a major aspect missed in radical constructivism (Reich 1998).

[15] Cognitive psychology has already adapted some of Piaget's findings and presented evidence for the similarity of new mental models to prior ones (Holland et al. 1986, p. 345). Prior models enable and restrict the search for new ones (Choi 1993, p. 48). In general, old models can be reused, modified, or withdrawn (Denzau and North 1994, p. 13ff.).

accordance with its presuppositions. In order to become identified as a problem, the constructed information (developed from the signals provided with sense) needs to be assessed as being inconsistent with previously constructed expectations (Morse 1953; North 1990, p. 104). The difference between the expected information and generated information exerts influence on the assessment of a problem or its significance. It is exactly this interaction between an individual's mental presuppositions and the generated information that paves the way for our later discussion of paths within mental models due to knowledge and ideologies. According to our conceptual framework, the individual's analysis results in its mental model of a problem ($MM_p$).

After the construction of a problem has taken place, there are three possibilities of reaction[16]: First, the cognitive system can internally deconstruct the problem, because it values the problem as an internal construction only. Second, it is possible to search for other internal representations or external signals that provide a positive assessment of the problem. In both cases the problem internally disappears. Third, the cognitive system can start its search for a solution of that problem ($MM_s$). Its presuppositions can be used unmodified or a new representation can be created from perceived signals. Now the cognitive system can act according to its solution and evaluate result ($MM_r$) perceived by it. According to the two coping strategies introduced above, first, the result can irritate the cognitive system and subsequently lead to a new representation due to accommodation. Second, the cognitive system can internally assimilate the result to its already present presuppositions. In any case, if the reaction is accompanied by individual action, it is observable by other cognitive systems.

The generation of $MM_p$, $MM_s$, and $MM_r$ are influenced by the individual's reference to knowledge and its inclination to ideologies. Their mental models are thus expected to be imperfect, or incomplete, or simply wrong (Eggertsson 2005, p. 22). Knowledge and ideology do not only execute their influence on the individuals' choice sets at the individual level of analysis but also, or mostly, at or intermediated by the social level of analysis. This aspect is addressed in the following.

### *IV.2 Structuration theory and mental models*

[16] These three alternatives draw on the theory of cognitive dissonance (cp. Festinger 1957; Aronson et al. 2004, p. 189).

As emphasized by Eggertsson (2005, p. 23), economics is 'lacking a unifies theory of economic systems – one that explains how diverse economic systems operate, how they are nested in a wider social system, and how their internal dynamics create paths through time – social science relies on specialized theories.' To provide our analysis with a conceptual framework that is able to link the individual and the social level of analysis, we draw on conception of duality between structure and action by Anthony Giddens.

As introduced above Denzau and North (1994) have already addressed the relevance of shared mental models for the occurence of institutional rigidity. From the perspective of structuration theory, there are two aspects to discuss concerning the connection of mental models to social phenomena (Giddens 1995): On the one hand, it is the influence of the social domain with respect to knowledge, institutions, and ideologies, on individual action. On the other hand, it is the impact of individual action on the social domain.

Starting with the influence of the social domain on individual action, we firstly need to address our understanding of the concept of shared mental models. From the perspective of cognitive science mental models can be shared within a group or society (Klimoski and Mohammed 1994, p. 414). Contrary to this, from the perspective of radical constructivism, individuals cannot have the same (*das Selbe*) mental model but only similar mental models (von Glasersfeld 1996, p. 353). Accordingly, the internal declarative or procedural representations of knowledge, institutions, and ideologies differ between individuals. The more specific and unique the signals are from the environment, the more similar are the mental models. Which ideologies, knowledge, and institutions within a social group are internalized by a cognitive system depends on which ones it accepts due to its presuppositions or fallacies.[17] It also depends on the coping strategies in use by an individual. Because knowledge, institutions, and ideology are entities of the social domain which are, though in a different manner, taken up by the individuals[18], radical constructivism can admit influence of the social domain on the individual level of recognition or knowing.

According to structuration theory, there is also the influence of individual action on the social domain. Mental models are not observable to individuals but individual action is.

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[17] In path dependency research, the adherence to shared mental models is addressed with reference to legitimacy (Mahoney 2000). Legitimacy can also be tied to the concept of social power (French and Raven 1959; Raven 1992), which also plays a role in path dependency research.

[18] Denzau/North (1994) as well as North (1990) characterize 'ideologies' as a 'shared framework of mental models.' We do not share this terminology, since socially derived knowledge or ideologies are not necessarily a part of every individual's framework.

According to radical constructivism, decisions are expressions of individual action and each decision follows other decisions (Luhmann 1988, p. 166); this is tantamount to choice in the new institutional economics (North 1990, p. 104). Because the individuals' observable behavior sends signals into the social domain, knowledge, institutions, or ideologies are supported by their usage. These signals are subject to transformation into information which then subsequently can support a specific ideology within the individuals' mental models. Any rise in the number of individuals who refer to and thus legitimize knowledge, or an institution, or an ideology, will increase the probability that others will refer to them, too.[19] With it, the socially approved knowledge, institutions, or ideologies are kept 'alive.'

The connection between the individual and the social domain exerts different influences in regard to the above introduced constructions of problem space, solution, and the assessment of the result. According to the internalization of knowledge, institutions and ideologies, the individual has the option of legitimating social aspects within the three phases of constructing a problem, a solution, and a result. The cognitive system can address the social domain 'just-in-time' within each of the three phases or it can draw back on mental models which are earlier internalizations of knowledge, institutions, and ideologies.

It is assumed that all decisions referring to the social domain release signals into the environment and give rise to an increase in the number of individuals who refer to and thus legitimize knowledge, institutions, and ideologies. Consequently, individuals' decisions lead to a fortifying effect in the social domain. In the social domain, rigidity results from the continuity based on the selection of one alternative (or of sufficient similar alternatives) out of many alternatives. Mechanisms for this process of rigidity can be found at the individual level of analysis.

Therefore, in the next section, we introduce our understanding of path processes. We also address the dynamics resulting from the mechanism underlying rigidity in the social domain. Then we connect path dependency theory with our model of social rigidity and individual mental models in order to explain how individual lock-in can take place.

# V THE DYNAMICS OF PATH DEPENDENCY THEORY

[19] In deterministic terms it means that an increase in A in time t ($A_t \Uparrow$) will lead to a further increase in A in t+1 ($A_{t+1} \Uparrow$).

From a radical constructivistic point of view, individual action is a cause for social phenomena.[20] We stated above that single action can exert influence on the social domain leading to rigidity. In order to provide a connection between the individual level and the social level of analysis, and thus between the individual and the social domain, we draw on path dependency research that provides one mechanism leading to a lock-in. Because in path dependency research the role of individual action is not sufficiently addressed, we apply the main concepts of path dependency theory (namely reinforcement and inefficient lock-in) to the individual level. Based on it, we analyze social-level rigidity as caused by multiple lock-ins within individual mental models according to their reference to knowledge and ideologies.

### *V.1 Path dependency research provides a mechanism leading to lock-in*

The path dependency approach addresses the question why change processes often do not take place although they seem necessary (e.g. North 1990, p. 90ff.). Historical analyses (David 1985, 1994, 2000) or economics (Arthur 1989, 1994, 1996), have proposed three indicators for the occurrence of path dependency: small events with non ergodic outcomes, increasing returns, lock in. Recently, management scholars have adapted the approach to their problems (Schreyögg et al. 2003) and developed a phase model of path processes (Figure 1) to which the subsequent discussion refers. Their model of path dependency includes three phases (increasing selectivity, positive feedback, path dependence) and two turning points (critical juncture, lock-in).

[20] Radical constructitism, of course, adds in this regard nothing to methodological individualism.

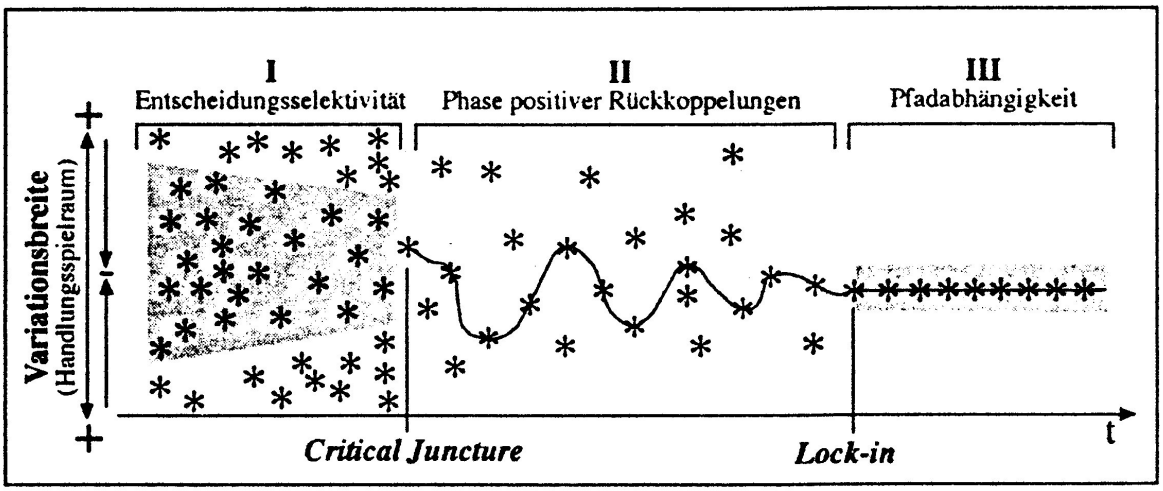


**Figure 1: Phase Model of a Path (Schreyögg et al. 2003, p. 272)**

According to Figure 1, initial small events give rise to increasing selectivity (Phase I) that leads to a critical juncture initiating a phase of positive feedback (Phase II). Within social systems, the effects of such small events are unrecognized in the beginning. Multiple alternative results are thus possible. Although initial conditions for starting a process are required for the statistical simulation of path dependent processes (Arthur 1989), a general necessity for the selection of a starting point is not at hand. As stated in complexity theory (Lorenz 1963), the initial conditions of highly complex systems – like economics systems – are hardly determinable. We assume thus that small events are less relevant than the availability of multiple alternatives in the beginning of a path process (Arthur 1988, p. 17).
The second phase in Figure 1 is characterized by the effect of positive feedback. This effect rests on the increasing reinforcement of the occurrence of singular events or phenomena (Schreyögg et al. 2003, p. 269). Additionally, this mechanism is also assumed to be responsible for the decreasing variety of scope of actual choices as indicated by an increase of similar or identical choices. As emphasized in historical analysis, technical interrelatedness, economies of scale, or quasi-irreversibility of investments represent such reinforcement in the case of QWERTY-nomics (David 1985). They result from different kinds of positive feedback loops all harking back to the same mechanism of reinforcement. In the case of other technological paths, (consumer) learning effects, network effects, fix-

costs, and coordination effects have been suggested as main reinforcing loops (Arthur 1988, Arthur 1996).[21]

As shown in Figure 1, the process of positive feedback paves the way to the second turning point to (an often inefficient) lock-in. From this point on, path dependence (Phase III) is at hand. In this last phase, within social systems remains only a small corridor of decision options; it is thus hard to switch even if the current situation is inefficient. A technology can be locked when it is the dominant alternative (as expressed by, e.g., 90% market share of MS Windows) but not necessarily the most efficient one (David 1985).[22] In the long run lock-ins can be broken up due to economic activities such as sponsoring and entrepreneurship. But the height of the switching costs can be a long lasting barrier of change (Arrow 2004).

Path dependence research addresses attributes of non-ergodic systems which may arise due to for example learning effects but does not elaborate on how the effects come into being. In particular, it is not clear whether the different kinds of positive feedback loops take place at the social or the individual level. In the following, we address some of the positive feedback loops of the mechanism of reinforcement in our framework. Additionally, we clarify how and where the lock-in occurs. The connection between social entities like knowledge, institutions and ideologies with individual reinforcement of learning processes is at stake here.

### *V.2 Increasing reinforcement and mental models*

North (1990) has already dealt with individual action and its anchoring in mental models with respect to institutional change or inertia. Although his analysis specifies learning processes and ideologies as main drivers for inertia (North 1990, p. 94), he does not address in detail how reinforcement takes place. In addition, Denzau/North (1994) have also addressed the influence of culture and communication on mental models leading to shared mental models but they did not elaborate on how reinforcement takes place. Within our

[21] Social scientists have proposed different summaries of forms for the mechanism of reinforcement that is responsible for paths in social systems like organizations and economies (c.p. Mahoney 2000; Sterman 2000; Beyer 2005).

[22] According to the potential inefficiency of a lock-in there is an ongoing debate. Some scholars (Liebowitz and Margolis 1990; Liebowitz and Margolis 1995) have challenged the idea that an inefficient lock-in can occur in an economy. We will not dig deeper on this issue but will advocate an understanding of efficiency as an improvement from a relative standpoint as adaptive efficiency (North 1990).

theoretical framework and the provided definitions of the concepts of knowledge, institution, and ideology, we introduce now our understanding of the concept of reinforcement. As stated above, the connection between the individual mental models and the social domain is provided by a mechanism. At first, we analyze the mechanism's appearance in the social domain; second, we elaborate on its basis within individual mental models.

From a radical constructivist point of view, and quite in accordance with methodological individualism, individual action is assumed to be a cause for social phenomena. In the social domain, individual action is a phenomenon observed and thus interpreted by other actors. Rigidity appears as a side effect of repetitive actions characterized by a decrease in the variety of actions. Radical constructivism assumes that a recursive process is going on when two adopters are referring to each other in a vicious circle – a double bind (Bateson 1996). With respect to the linkage between the individual and the social level of analysis, not all individuals interact directly but through media. Not all choices of all individuals are necessarily observable by each individual due to a lack in transparency (asymmetric information) and the costs resulting from the attention (or time) required for this. Therefore, if the interaction of different individuals in the social domain is disrupted, we name it the coordination effect. This is an effect based on recursivity but not on the increase in the one or other measure.

In the following, we relate the reinforcement process to the issue of micro-level learning. Generally speaking, institutional rigidity is a social phenomenon. It has its source in (multiple) individual path dependencies. We expand the conceptual framework of path dependency as introduced above with respect to the influence of presuppositions or individual mental models, on the on hand, and the two coping strategies of assimilation and accommodation, on the other. The influence of these two strategies distinguishes our model from that of, e. g., Eggertsson (2005, p. 24) who emphasizes that actors rely on 'simple and incomplete (mental) models of their physical and social environments but then act rationally on the basis in terms of their mental constructs.' We do not, however, dissent with the assumption of (bounded) rationality but rather dig deeper into the structure of individual mental models and their relations to social phenomena.

According to our framework, presuppositions are mental models consisting of declarative or procedural representations. Individuals can only define or identify new problems on the basis of mental models available to them. With it, new mental models are necessarily close

to existing ones. If an individual addresses the social-domain entities knowledge and ideology in order to find a problem solution, it faces search or information costs.[23] If the problem is successfully solved, the solution ($MM_s$), and therefore the new mental model of the result ($MM_r$), are maintained as viable mental models with linkages to the prior ones. If the problem has not been solved, the individual might remember the malfunction in the next period and redirect its search with respect to external knowledge and ideologies. But because of its presuppositions, the individual searches for social phenomena which are close to its prior mental models. Subsequently, this leads to a selection process among available alternatives and, in effect, to a reduction of possible alternatives over time. It also leads to highly connected presuppositions or mental models, respectively. Such a selection process can only generate incremental learning processes which we name 'loop of connectivity.'

The loop of connectivity addresses the manner individuals refer to social-domain entities. According to it, only incremental learning processes can be generated. In the following, we refer again to assimilation and accomodation and their effects on the individual level of analysis. As stated above, assimilation and accommodation have some influence on learning processes: Assimilation leads to an adjustment of the results $MM_r$ in order to fit to prior mental models whereas accommodation leads to the internalization of the results $MM_r$ that might lead to a transformation of other available mental models. Piaget has suggested that a more or less stable equilibrium between assimilation and accommodation is at hand (Piaget 2003a, p. 57), i. e., individuals use both strategies in a – for them – balanced manner. Especially assimilation fosters the available mental model used and thus grants the continuity of structure (Piaget 2003a, p. 55).[24] The available mental model is no longer the subject to reflexion; rather, experiences are interpreted in a manner that confirms the model. In addition, the range of possible experiences becomes narrowed to an increasing degree. We state that assimilation is used to a higher degree than accommodation and name it 'loop of continuity.'

Accommodation is assumed to be a source of learning costs (search costs and decision costs) while assimilation tends to result in their reduction. It is easier to rely on already approved mental models or to compare already approved mental models to each other,

[23] 'When dealing with social systems or the physical world, actors actually have an incomplete understanding of the relevant causal relations and may not even know elements in the choice sets' (Eggertsson 2005, p. 24).
[24] This supports the second major need of safety in the hierarchy of needs (Maslow 1970).

respectively, than to modify or rebuild them. The individuals' expectation of search costs in case of a mental reorientation leads to an increase in the choice of the assimilation strategy. This strategy is right, if an individual draws on the 'right' knowledge and experience with respect to its actions. The more an individual refers to its own sources, the more problems it solves based on them, the less it addresses the social domain in order to search for new knowledge, institutions and ideologies. We name this the 'loop of capacity.'

### *V.3 (Inefficient) lock-in in mental models*

Above we addressed how learning processes can be described as loops of positive feedback. Learning processes can be locked or on a path approaching a lock-in. The repetition of similar actions by individuals (due to learning processes approaching or tantamount to a lock-in at the micro-level), is a cause of macro-level rigidities.

According to path dependency research, the lock-in is a turning point followed by a small corridor for action where change is hardly at hand. From the perspective of radical constructivism, a lock-in is tantamount to what is called an Eigen-Value of cognitive systems (Portele 1994, p. 117; von Foerster 1995a, p. 55). This means, that the individual always sees the same problems, finds the same solutions to them, and thus refers to the same knowledge, institutions, and ideologies.

Contrary to the opinions of many in path dependency research, there is no reason why a lock-in should generally be a source of negative consequences for an individual: If an individual's world view and the problem solutions to which it gives rise coincide with (economically) successful action consequences, then, from a consequentialist view on the matter, a lock-in is not in a need to become surmounted. As a lock-in can be a related to a solution to problems in a specific setting, an Eigen-Value can be compared to a medal with a positive (efficient) and a negative (i.e. inefficient) side. Accordingly, if the individual recognizes that the selected problem-solving behavior does not generate the intended outcome but is not able to adapt its mental model or adequately utilize social-domain resources like knowledge, institutions, or ideology, then a path at the individual level is emerging or already available. We assume that the more complex the legitimized institutional structures and individually created mental models are (i.e., the more linkages can be drawn to already present presuppositions), the faster a lock-in can appear and the harder it is to break it open.

Individuals do not necessarily recognize that they are on a path. Often, the recognition of a lock-in (or its becoming) results from an external shock which renders the individual unable to act according to its established mental model. But it can also be a consequence of less dramatic events like paradoxical situations or internal sense shifting.

# VI ON THE DIFFERENT INFLUENCE OF KNOWLEDGE AND IDEOLOGY

Institutional rigidity resulting from the lock-ins of individual mental models is an intermediary result from our last chapter. From the radical constructivist point of view, individuals internalize knowledge, institutions, and ideology in the form of individual representations based on sensomotoric action. These internal representations differ inter-personally. In order to dynamize this static picture, we used the mechanism of self-reinforcement from path dependence research and interpreted it on the background of assimilation and accomodation. Due to the three loops of connectivity, continuity, and capacity, the reinforcement of learning processes promotes a lock-in. This lock-in is assessed as positive as long as the individual itself does not value its Eigen-Value as negative because results aimed at are not achieved or achievable. The use of a mental model also confirms the knowledge, institutions, and ideologies enshrined in it. The different theoretical backgrounds of our analysis are illustrated in Figure 2:

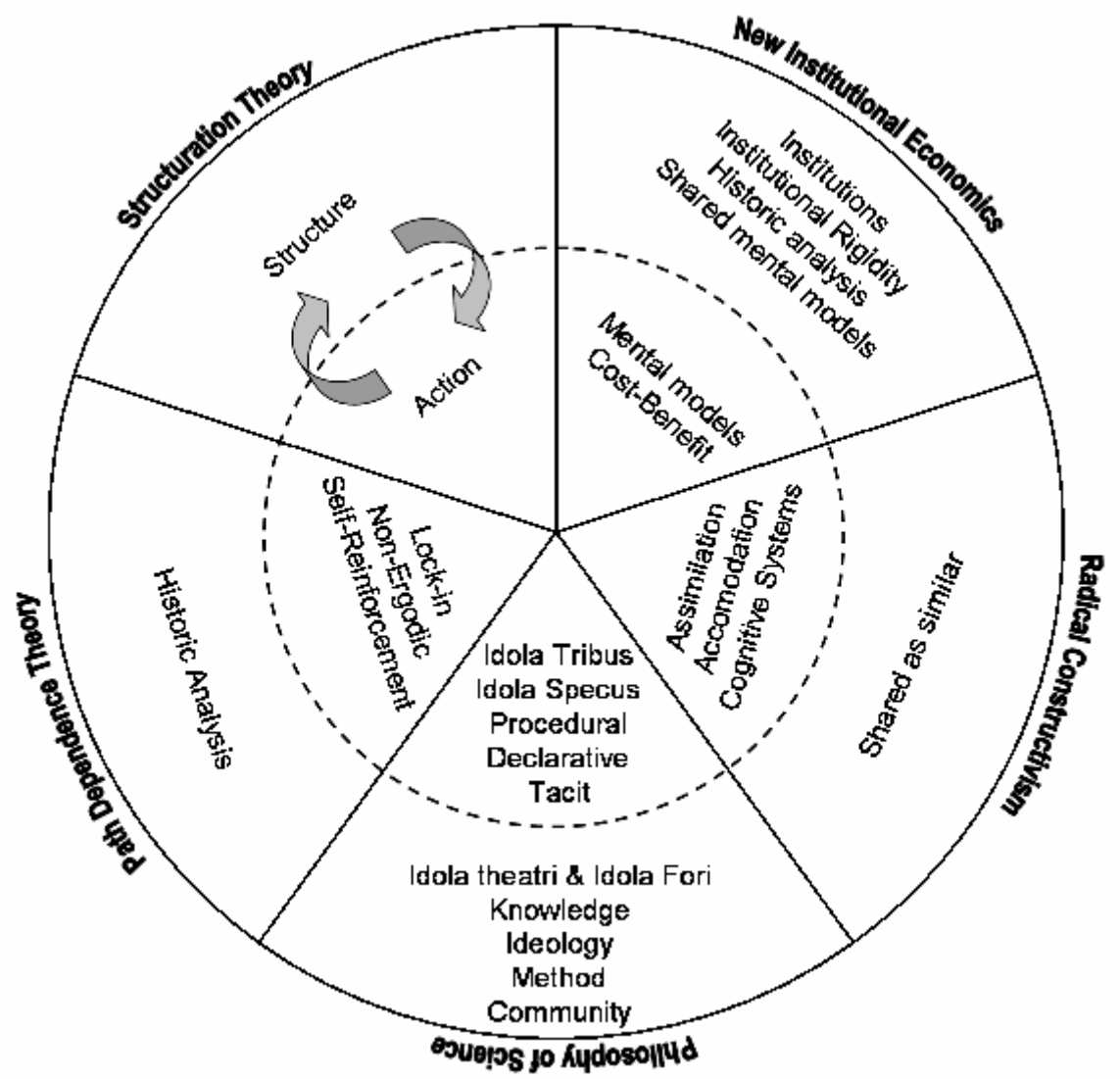


**Figure 2 – Theoretical Frameworks linked in the Analysis of Institutional Rigidity**

From our point of view, the less close an individual's mental modeling procedure is to decision procedures of experts, like scientific communities, the less clear is the distinction between knowledge and ideology. This does not mean that a decision can not be drawn; rather, it means that usually not much time is invested in analyzing the difference. As long as the assumed connections, patterns or continuities work, an individual is not enforced to invest additional resources in the analysis of its environment or action opportunities. The more ideologies are in use, compared to knowledge, and thus interconnected with experience, the more individuals get or remain locked. Independently of the distinction between knowledge and ideology, or the different kind of influence both can execute on learning processes, a series of successful problem solutions contains the germ of a path

process. Individual reference to knowledge instead of ideology is only better in cases where its applicability or practicability is reappraised and the mental models based on it are adapted if necessary.

Our hypothesis, which is open to empirical criticism, is that mental models of non-experts are mainly based on ideologies instead of knowledge. Both are the source out of which the problem space and the problem solution are constructed and thus the subsequent re(action) of the individual is guided. Recursivity, however, does not become superfluous; furthermore, it expresses that the individual's experience always refers back to its internal mental representations.

## VII. SUMMARY AND CONCLUSIONS

Our paper addressed the relation between individual mental models and institutional rigidity. According to it, paths can emerge at the individual level of analysis, approach a lock-in and thus pave the way for the appearance of institutional rigidity at the social level.. In order to provide this answer, we combined particularly path dependency theory, radical constructivism and the theory of structuration which provide a fruitful framework for this analysis.

We developed a framework of individual action in a social domain. In the social domain knowledge and ideologies are separated by methods which are legitimized within a community. Besides knowledge and ideologies, institutions are part of the social domain addressed by individuals. The individual has been characterized as a cognitive system. It creates information from internalized signals; with it, mental representations come into being. With respect to each creation of a problem, a solution, and a result an individual can draw on its own experience, on the social domain, or on either of them. Throughout our paper, the interconnection between the individual and the social domain has been conceptually framed by the theory of structuration. Individuals perpetuate the existence and therefore the rigidity of institutions, knowledge, and ideology by their reuse over time. This reuse takes place due to individual path processes based on the loops of connectivity, continuity, capacity paving the way to an individual lock-in or Eigen-Value.

This paper provides a theoretical framework for the understanding of institutional rigidity due to individual lock-ins. It contains a series empirical hypotheses which can be the subject to empirical criticism.

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