Institutions, Distributed Cognition and Agency: Rule-following as Performative Action

by

Carsten Herrmann-Pillath

Academic Director, East-West Centre for Business Studies and Cultural Science
Frankfurt School of Finance and Management

Sonnemannstraße 9-11
60314 Frankfurt am Main, Germany
Email c.herrmann-pillath@fs.de

Formatiert: Deutsch (Deutschland)

Abstract

Aoki recently proposed the concept of substantive institutions, a concept which relates the outcomes of strategic interaction with public representations of the equilibrium states of games. I argue that the Aoki model can be grounded in theories of distributed cognition and performativity, which I put into the context of Searle's philosophical account of institutions. Substantive institutions build on regularized causal interactions between internal neuronal mechanisms and external facts, shared in a population of agents. Following Searle's proposal of conceiving rule-following as a neuronally anchored behavioral disposition, I show that his corresponding notion of collective intentionality can be grounded in recent neuroscience theories of imitation as the primordial process in human learning. I relate this to Searle's concept of status function and the neuronal theory of metaphors. This results in a precise definition of rule-following as performative action. I present two empirical examples of this, firstly, the institution of money and secondly, status hierarchies in markets.

Keywords: Aoki's concept of substantive institutions; Searle; collective intentionality; emotions; imitation; performativity; sign systems

JEL classification: B52, D02, D87

1. Introduction

During recent debates over the rise of neuroeconomics as a new foundational field in economics, four strands of thought have emerged evaluating its position in established theoretical structures:

- Leading neuroscientists tend to apply the standard economic model of choice in the neuroscience context, aiming at a unified theory of choice. This, however, can be regarded as a naturalistic version of the standard model, which is seen as underpinned by neuronal mechanisms (Glimcher 2003, 2009, 2011).
- Leading behavioral economists working in the field of neuroeconomics argue that the new results point towards a revision of the standard model, with far-reaching implications e.g. for normative economics (Camerer et al. 2005, Camerer 2006).
- The third position is to claim that neuroeconomics is totally irrelevant for economics ("mindless economics"), because the standard model of revealed preferences is a purely mathematical description of observed choices, and therefore needs no reference to the inner states of individuals whatsoever (Gul and Pesendorfer 2008).
- The fourth position takes this claim into account, but reaches a different conclusion. The conclusion reached in this case shows that the standard economic model refers not to the ontological level of individuals, but rather to the level of systems, with the standard model as an emergent property ascribed to 'individuals', or in fact to any other computational mechanism. In this framework, neuroeconomics is taken to be valid as a description of the underlying physical mechanisms in the particular context of brains, and may be redescribed using the standard model (Ross 2005, 2007b, 2008).

In this paper, I wish to present yet another approach, proceeding from the fourth position. This proposal is informed by recent developments in the cognitive sciences, economic sociology and the philosophy of mind. I propose a *distributed cognition* model as a framework for neuroeconomics and related approaches (cf. Wilcox 2008). The distributed cognition model is no stranger to economics, as it plays a central part in Hayek's evolutionary thinking, which has been cited as a possible framework for integrating the new trends in economic research by Vernon Smith (2003) among others. However, so far the implications have not been further explored, presumably because this requires moving far beyond the conceptual frontiers of economics and thus laying oneself even more open to attack from to the protagonists of the third strand of thought mentioned above, which strives to maintain the axiomatic independence of economics.

The central idea of a distributed cognition approach to economics that individual agency emerges at the interface of two ontological levels, not only at the level of neuronal processes in the brain, embedded into its physical substance, but also at the level of the external physical facts with which the brain interacts in a regularized and systematic way. This view differs in two ways from existing approaches. Firstly, the neuroeconomic agenda remains a core feature, although at the same time it can never be posited as a full explanation of human choice. Because the supposed causal mechanisms are incomplete, this view ignores the systematic role of external phenomena in human cognition. Secondly, the emergentist view on the standard model as a system descriptor is recognized. At the same time it is given a naturalistic interpretation, implying that causal interactions with neuronal facts continue to be seen as essential alongside the physical complements of the system level phenomena. In a nutshell, this corresponds to Hayek's (1979) view that human knowledge, which underlies human agency, is distributed across physical features (genetic dispositions, brain structures etc.) and external facts (cultural patterns, market signals etc.), and is only to a very limited degree accessible to individual conscious thought and decision-making (cf. Oullier and Basso 2010, Basso et al. 2010).

I propose a theoretical notion imported from recent research in economic sociology to analyze this interaction between the neuronal and the external level, the notion of performativity (Herrmann-Pillath 2010). As I will argue in detail, performativity is an aspect of human agency which provides the microfoundations for distributed cognition. This conceptual role corresponds to the role of the term both in linguistics and in the philosophy of language, from which it is borrowed (for a survey, see Lycan 1999). A performative speech act refers to an act which creates a social fact, such as a promise or a declaration. This act is an expression of individual agency, but at the same time it depends essentially on the irreducible social nature of language, both in the sense that the meanings of words cannot be arbitrarily changed by individual choice, and that the implications of the meanings become binding commitments against the background of the defining rules of the language game. I develop a generalization of this concept of performativity and argue that economic behavior is performative to a large degree, if not in principle. Agency, in the economic context, is performative as it is driven by the interaction between processes which are internal and external to the individual and defined by the physical boundaries of the body. I go beyond standard notions of performativity to offer an explicitly naturalistic account, which follows corresponding naturalistic approaches in the philosophy of mind (for a survey, see Papineau 2007).

In doing this, I refer to findings from different fields and domains of research. The concept of performativity has been introduced into economic sociology in the context of the more specific question of how far economic theory is performative, with financial markets as a vehicle (MacKenzie 2006, MacKenzie et al. 2007). Extensions have already been proposed in the literature, mainly focusing on specific economic phenomena, such as price, which, in this view, is seen as a concrete material fact in communities of economic agents acting in physical space and time (Callon 2007, Callon et al. 2007). My approach is also related to the general trend in economic sociology which is reconsidering the materiality of the economy (Pinch and Swedberg 2008). I relate this line of thinking to the general program of naturalism in social sciences in general. As this, in turn, is highly diverse, it offers in many respects a rich source of inspiration. I mainly draw on the work of John Searle (1995, 2004, 2005), in particular, to provide the essentials of a naturalistic theory of institutions. I am aware of the fact that this approach manifests many family resemblances to other approaches to a realist ontology in economics, especially with its focus on a generalized criterion of causality (Bhaskar 1989), and with regard to assigning a 'real' status to institutions (Lawson 1997). I connect this with an externalist concept of distributed cognition.

My approach is closely connected to the most recent attempts at establishing a 'social neuroeconomics'. This recognizes the centrality of neuroeconomics, as I do, but argues that neuroeconomics remains incomplete if the patterns emerging from interactions between neuronally constituted systems are ignored (e.g. Oullier, Kirman and Kelso 2008). This literature must be seen in the context of the vast field of the philosophy of mind and the related debates over reductionism and supervenience, so far neglected in neuroeconomics. My approach is particularly informed by the debate on externalism, both in philosophy and cognitive sciences (for overview, see Wilson 2004 and Schantz 2004).

As I will show in the next section, there are different ways of building bridges between my argument and the standard economic model. I draw on two connections in particular. One is the discussion on preferences, and the possible need for the introduction of group-level preferences, which involve identification between the individual and a group, with a shift in the locus of preferences to the collective level (e.g. Sugden's 2000 theory of 'team preferences'). The other is game theory, especially as applied to institutions, and in the specific context of epistemic game theory (Brandenburger 2007). Game theory in its current form is mentalistic and builds on an inferential concept of knowledge processing. In the distributed cognition framework, knowledge is seen as embodied in material structures, which, as we shall see, has important implications for how the identities of players in interactions are

conceived. This relates directly to the concept of 'types' in game theory. Many paradoxes in game theory result from its exclusive reliance on inferential knowledge. These evaporate in a distributed cognition framework in which action is not triggered by inferences from knowledge, but where knowledge is not regarded to be a 'mental fact' but is seen as supervening on the physical structures which cause action.

The paper starts with the discussion of Aoki's game-theoretic conception of institutions, thus referring my argument to established approaches in economics. I connect his analysis of 'public representations' in games to an externalist approach to the identity of players. In section 3 I show how this 'substantive view of institutions' relates to Searle's theory of institutions, and I offer a social neuroeconomics explanation of his notion of collective intentionality, taking imitation as a central phenomenon. In section 4, I draw on the neuronal theory of metaphor to analyzing Searle's status function and show that performing institutions relate to distributed somatic markers in a population of rule-following agents. In section 5, I outline two empirical case studies concerning money and status orders in competitive markets to show how neuronal states and institutions relate causally to each other. I conclude in Section 6 with a summarizing reformulation of the Aoki model.

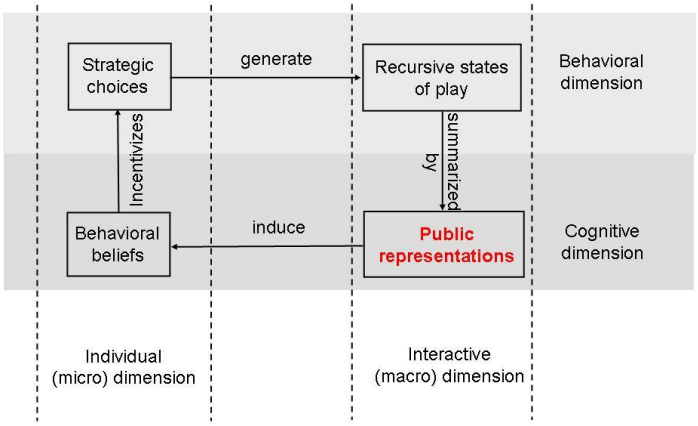
2. Distributed cognition and the theory of institutions

The distributed cognition (also: extended cognition, extended mind) approach claims that human cognitive capacities are essentially externalized (Hutchins 1995, 2005; Sterelny 2004, Clark 2007; for a critical assessment, see Sprevak 2009). The media of externalization are manifold and include memory techniques, tools and devices leveraging human movements, or other individuals with whom regularized interactions take place. On a more fundamental level, we can say that human language is a prime medium of externalization, as the meanings of language, following Wittgenstein's (1958) classic argument, are necessarily bound to shared patterns of language use in communities of speakers. Thus, using a word relies on knowledge about proper use which can only be assessed in the context of uses of words by others.

This insight allows the establishment of a direct connection with certain theoretical conceptions in economics. For ease of argument, I pick out one specific example which corresponds to my thoughts on the subject. This is Aoki's game-theoretic conception of institutions (Aoki 2007, 2010, expanding on Aoki 2001). Aoki proposes a dynamic framework which is summarized in fig. 1, and which he refers to as a 'theory of substantive

institutions'. A substantive institution is more than just an emergent equilibrium and coordination of the mental states of individuals, but attains the status of 'reality', thus transcending the purely inferential approach in standard game theory. The objective of this analysis is to grasp the complexity of the interaction between individual decisions and institutions. On the one hand, individual decisions are the drivers of social action, including the emergence of institutions (e.g. in social contract theories). On the other hand, institutions are constraints on individual decisions (e.g. in North's 1990 approach). This ambivalence is also reflected in different game-theoretic conceptualizations of institutions, where institutions can be both emergent states of equilibrium in games, and also the rules of the game.

Figure 1: Aoki's circular-causality approach to substantive institutions



In order to analyze institutions, Aoki proposes distinguishing between the individual and the aggregate level, and the behavioral and the cognitive dimension. Standard game-theoretic approaches to institutions put strategic choices at the center. Choices generate states of the game which are recursive if in equilibrium. The choices themselves are generated by certain beliefs, which are summarized in the given set of common knowledge about the structure of the game, the payoffs etc. So, beliefs provide the incentives for choices, and choices generate how the game is played. Here Aoki introduces a new theoretical conception which opens up the black box of common knowledge. He argues that the states of the play are summarized in certain public representations perceived by all players and influencing their individual beliefs. These summary representations do not reflect full and perfect information about the state of

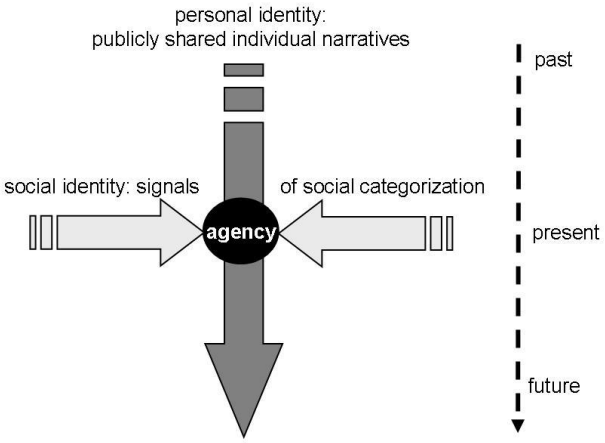
the game, but evolve in such a way that the equilibrium state of the game is reproduced until major disruptions of the implied states of knowledge occur.

Interestingly, Aoki assigns the public representations to the cognitive dimension of his model. This justifies an interpretation in the more general distributed cognition framework. In other words, I claim that Aoki's model is a distributed cognition model of institutions. The representations of the states of the game are not simply individual and inner mental states, but rely essentially on external means of representation. These public representations, however, do not need to be interpreted in the same way by the different parties involved, and they do not simply represent inner mental states, as they are independent triggers of such states. We can even say that the individual interpretations are irrelevant in equilibrium, because what counts is only whether the implied behavior results in recurrent sustainable states of play (for a related argument, see Skyrms 2004: 65ff.). In other words, a shared and interactive pattern of interactions and public representations can co-exist with many different internal mental states or interpretations (this differs fundamentally from North's 'shared mental models' approach, see Denzau and North 1994, North 2005). These mental states become relevant when equilibrium collapses, and new equilibrium needs to be established. This is the moment for institutional innovation, in which, however, we cannot speak of institutions at all. Once institutions are settled, public representations return to their pivotal role of anchoring the entire structure.

I propose to relate this view to an argument made recently by Don Ross (2005, 2007a, c), building on work by Ken Binmore (1994). Ross argues that many games need to be analyzed in a three-level structure, unless the structure of interactions and the resulting payoffs is directly determined by exogenously enforced rules. One is the level of the strategic interaction in a particular setting, which are the bread and butter of game-theoretic analysis. The other, the foundational level, is the level on which certain fundamental agent characteristics are determined. This corresponds to the biological setting, i.e. certain biological features of human behavior, cognitive capacities and so forth. This is a 'game of life' in turn (cf. Binmore 1994), because those features evolve in more generic and long-run patterns of intra-species and inter-species interactions. Ross argues that there is a third, intermediate level, on which the identities of players are determined. This level is essential in human social interaction because of the existence of language. Language is an important device in cheating, as players can suggest any possible information about themselves they like and are only limited by the inferential capacities of their counterparts, who analyze the context and the implications for incentives (which is the focus of the 'cheap talk' literature, Farrell and Rabin 1996). However,

at the same time, language is the only medium in which reflections about the game can take place, and in which many strategies such as announcing commitments can be formulated and implemented. Therefore, language becomes the central medium through which players' identities are fixed (which would correspond to the concept of 'types' in epistemic game theory). This is possible because of the historicity of language, which means, in real world circumstances, where individuals play recurrent, interconnected and embedded games, individual identity emerges from shared narratives about the history of interactions. These narratives impose certain constraints on the linguistic arbitrariness of identities, and ultimately fix identities.

Figure 2: The externalist approach to identity and agency



I argue that this notion of identity is an integral part of the summary public representations in Aoki's model. Identities emerge as public facts, and constrain the range of possible outcomes of games, thus making them sustainable in the long run. So, the individual agent entering into institutionalized interactions with others carries an identity which is essentially external. On the one hand, a set of public indicators of identity exist, conventionally called the 'social identity' (relating to Akerlof and Kranton 2000). On the other hand, the narrative of the individual history also exists. This is also public, with a different reach and scope as well as central to individual projections of future states emerging out of the developmental trajectory (for related arguments, see Davis 2007, 2008, and Kirman and Teschl 2006). Identities trigger

certain choices, to such an extent that the 'beliefs' part of the Aoki diagram could, up to a point, be deleted, because the identities, in the average of a population sharing an identity, correlate directly with action patterns, even with diverse beliefs in the sense of inner mental states (for example, the identity in a caste system generates certain behavioral patterns which stabilize the caste system, even if individual beliefs about the self may not be in full correspondence to them).

This externalist account of identity reflects recent developments in different fields of social science. One strand of thought builds on the empirical research into agency, which shows that human individual will is very often and systematically guided by determinants which are not accessible to conscious reflection and which connect self-perceived agency with the external environment (for a conceptual framework, see Davies 2007). This research mainly builds on the neurosciences. Interestingly, it concurs with an entirely independent strand of thought developed in the context of actor-network theory, and also invoked in theories about performativity (Latour 1995, Callon 2008). This sees agency as an 'agencement' which emerges from networks of interaction, involving both other individuals and physical facts, especially artifacts. Both lines of thinking end in a conception of 'distributed agency' in which individual agency is superimposed on patterns of interactions between internal facts. I conceive of these facts as neuronal facts in a naturalistic framework and also as external facts. These patterns of interaction can be further analyzed, with the concept of 'imitation' at the core of this analysis.

3. Rule-following and imitation: Towards a social neuroeconomics

My reconstruction of the Aoki model already contains defining features of a distributed cognition model. In the concept of distributed agency, the observed behavior of agents cannot simply be seen as an expression of inner mental states, but rather as flowing out of the internal mechanisms which link public representations and actions. I will now look more closely at these mechanisms, in order to reach an initial definition of performativity. I claim that the individuals in Aoki's model conduct performative acts when they are playing the games they are involved in.

My claim requires the mobilization of further intellectual support from another influential scholar, John Searle. John Searle (1995, 2005) proposes a theory of institutions which expands on the following basic ideas (for a more detailed argument, see Herrmann-Pillath

2010). He argues that all institutions are built on linguistically mediated transfers of meaning (which he calls a 'status function'), resulting in the assignment of certain powers to certain individuals. Language is central for two reasons. One is that the transfer of meaning operates via language; the other is that language is the medium of collective intentionality, because of its very social nature, referred to above. Collective intentionality emerges from the linguistic process and implies that the intention of following an institution is shared by the relevant group in the sense that the individual intention reflects the collective intention. Further, Searle proposes a direct neuronal mechanism for this phenomenon of following an institution or a rule in general. Rule-following is not conceived of as a conscious or rational act, but is a disposition to act which is rooted in neuronal structures (a central point that is often ignored by his critics,together with the pivotal role of language, see e.g. Smit, Buekens and du Plessis 2011) .

This concept of a neuronally anchored disposition is a central building block for a theory of performativity to complement Aoki's theory of institutions. This is because it makes implicit what underlies the notion of 'inducement' which links beliefs and public representations (see fig. 1). A disposition is the structural possibility of triggering a certain action on meeting certain environmental cues, so that for the fully-fledged action pattern to emerge, neither in the inner states nor in the external environment do a full representation of the reasons for actions need to exist. For example, if a basketball player takes a certain action that corresponds with the rules of the game, it is neither necessary to have a full internal description of the rules which are explicitly followed by the player, nor to have a full description of those rules externally. Rules are embodied in signs that have a certain meaning (such as lines demarcating the playing field), and in the actions that are produced recurrently during the game. They result in patterns that are followed by all players. In the Wittgensteinian view, it is the meaning of the signs which forms the patterns,

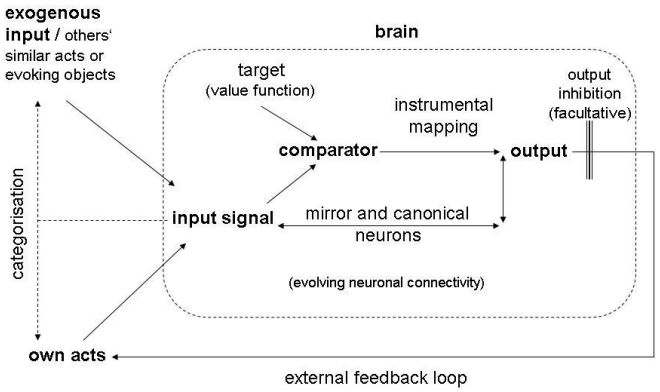
The latter point needs to be emphasized. Rule-following is a behavioral disposition that is shared by almost all members of a population and which is activated by imitation as the foremost causal mechanism leading to converging and matching action patterns in a population of agents. This insight has been especially emphasized by recent research in social neuroeconomics which focuses on the mechanisms through which human actions are coordinated between individuals by following the actions of others, beginning with the coordination of physical movements and ending in more complex mechanisms of cognitively mediated copying (Oullier et al. 2008, 2009, Oullier and Basso 2010, Basso et al. 2010). In this context, recent research in the cognitive sciences has provided strong empirical support

for a theory of co-action. This theory recognizes that the human self-perception of agency is very often systematically misleading and hides the actual mechanisms of copying and imitating the behavior of others, as this behavior is mediated by a large range of signals and cues (Wegner 2002, Wegner and Sparrow 2007). This results in the surprising empirical observation that the brain triggers action in advance of the consciously perceived perception of taking the decision to act (for an early philosophical discussion, see Dennett 1991). This offers an exact and empirically traceable approach to collective intentionality as posited by Searle. Individual intentionality is embedded into collective intentionality emerging from co-action.

This perspective is vindicated by current neuroscience models of imitation which go back to much earlier thinking, especially to Vygotsky (Moll and Tomasello 2007), and which emphasize the biological uniqueness of the human capacity to imitate (Tomasello 2008: 25ff.). In modern conceptions of the 'social brain' (Frith 2007), and in current attempts at explaining the specifically human capacities for culture, imitation stays at the center of attention. Imitation underlies the mechanisms of human social learning in networks of interactions (Bentley and Shennan 2003, Richerson and Boyd 2005: 68ff.), which is underpinned by neuronal mechanisms and brain structures seemingly specific to humans (Tomasello et al. 2005). This is because imitation is in fact a very complex cognitive process, involving the reconstruction and de-contextualization of observed actions and imputed intentions of others. In these models, the perceived comparison between one's own observed actions and the actions of others drives the process of internalizing certain behavioral patterns and builds up the capacities which underlie agency, thus actually reversing the causal flow in the ontogeny of agency. The imputed intentionality of others (the Dennettian 'intentional stance') is projected back onto the perception and conceptualization of Ego's intentionality and agency. The individual learning of certain patterns relies exclusively on external phenomena, and inner mechanisms are merely enabling structures. In particular, one's own actions are also perceived external phenomena, which only in the course of ontogeny are transformed into perceived inner states, and, in particular, into intentions (in neurosciences, this is the link between motor output and sensory inputs, for a survey, see Fogassi 2011). This process is underpinned by specific neuronal structures, especially the so-called mirror neurons and the specifically human capacity of 'mentalizing' (Frith and Frith 2003, Frith and Singer 2008). The resulting mechanism has been put into one canonical model by Hurley (2008) (see fig. 3). The essential elements of this model are neuronal structures that enable an organism to observe Alter's actions and Ego's actions and to compare them in an evolving system which

categorizes sensory inputs. This system is anchored in evolved value functions which assign value to observed behavioral outputs and has the capacity to internalize actions as a result of learning (output inhibition), so that more complex imitation need also not involve direct action.

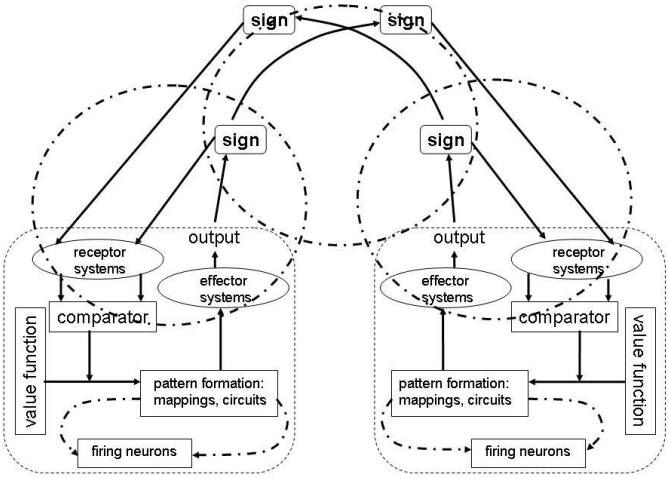
Fig. 3: Neuronal structure of imitation (modified after Hurley 2008)



This model is reframed as a 'social' model in fig. 4. We visualize two individuals, who manifest the basic feedback loops of imitation, in which the behavioral output of each is related to the behavioral outputs of Alter by means of comparators. In a distributed cognition frame, the outputs obtain the status of signs. That means, for example, that outputs correlate with stable physical patterns in the environment of the agents, such as repetitive actions, or certain symbolic features such as ways of dressing, or with certain physical items such as tools and devices being involved. These physical patterns are activated by the agents' actions, and they operate as signs impacting on Alter's neuronal system. Their effect is twofold. Firstly, the physical patterns activate short-cut feedback loops in which agents continuously monitor their own actions relating to those patterns; secondly, they interact with physical patterns that are generated by Alter, which operate as signs impacting on Ego, in turn. This interlocking process of proprioperceptive comparisons (right and left circles in fig. 4) and the mutual perception of sign patterns (central circle in fig. 4) forms the basis for a naturalization of Wittgenstein's classic argument that meaning rests on usage patterns in communities of

speakers (here: senders and receivers of signs) (for a more detailed argument, see Herrmann-Pillath 2011: 58ff.).

Figure 4: Distributed cognition and neuronal structure



I propose that Searle's notion of collective intentionality essentially describes the outcome of the fundamental process of imitation, in the sense of collective intentionality supervening on the ongoing dynamic processes of imitation. Imitation is the pivot of the distributed cognition approach, as it establishes the causal connection between external facts and inner neuronal states. In this very specific sense, collective intentionality is a model of distributed cognition. The notion does not involve any sort of 'group mind' (cf Wilson 2004: 286ff.), but refers to regularized patterns of causal interaction between external facts and internal neuronal states. Collective intentionality can be empirically determined in the co-action phenomenon resulting from imitation.

To complete this framework, I propose a further generalization of this hypothesis with reference to the theory of somatic markers, which I will refer to in the next section to complete the theory of performativity. In the Hurley model, the value functions play a pivotal role, because they drive the evolution of patterns. Value functions can be genetically stored, or can emerge from learning. The emergent patterns can be identified with 'somatic markers' in the sense of Damasio et al. (Damasio 1995, Bechara and Damasio 2005). A somatic marker is a particular state of the neuronal system, possibly also involving circuits which connect

brain and body. This somatic marker triggers certain behavioral outputs, or 'choices' in economic parlance, following primary and secondary inputs, the latter emerging from internal neurocognitive processes such as classifications or associations. It is important to recognize that the somatic marker hypothesis is central to the analysis of rational behavior, without relying on the standard conception of utility functions. The latter has been moved to the center of a possible neuroeconomics paradigm by Glimcher (2011). Glimcher focuses on the possibility of a strict reduction of utility functions to neuronal processes, mainly centered around the dopaminergic expected reward processing structures. In contrast, the somatic marker hypothesis includes those structures into its comprehensive account of both choice and valuation, without invoking the utility formalism (Reimann and Bechara 2010).

This larger emergent pattern of valuation and action can also be called an 'emotion' (distinctly different from subjectively perceived 'feeling') (compare Tooby and Cosmides 2005: 52ff.). So, we can say that 'following a rule' emerges from a disposition which is physically embodied in sets of somatic markers, and the resulting actions are triggered and accompanied by emotional states. These states operate as a memory for the organism and link past and present actions. In spite of being internal organismic (but not 'mental') states, they can be shared among individuals, because the triggers involve external facts, which are public, and which operate as signs. The meanings of signs are not mental facts, but are the emerging regularities in actions, which in turn are public facts, and converge through the ongoing process of imitation. In this sense, institutions build on shared emotions (cf Pham 2007 on the ecological rationality of emotions).

4. Performativity and metaphors

I will now finalize the definition of the concept of performativity. My claim is that rule-following in terms of convergent action patterns is 'performing' an institution. In a nutshell, this means so far that individual behavioral regularities ('habits') correspond to larger patterns of behavior in a population of agents. This behavior must be built on external cues, or signs. I now argue that these signs result from the fundamental process of metaphors, which is enabled by the nature of the external facts being signs relative to the neurocognitive systems (for more detail, see Herrmann-Pillath 2010).

Searle uses the notion of 'status function' to refer to this process. In his approach, this means treating a pre-existing fact as something else, depending on the context. So, for example, in a

certain society a piece of paper is treated as money, or an individual is treated as a judge. This is a transfer of meaning in the first place, which is reflected in a fundamental shift of action patterns observable when people use either just a piece of paper or use it 'as money'. In the cognitive sciences, we can approach this transfer of meaning in many different ways. I distinguish between purely cognitive approaches and neuroscientific ones. The first fit into a generalized connectionist framework (see Strauss and Quinn 1997) and conceive of metaphors as one example of the more general phenomenon of conceptual blending (Fauconnier and Turner 2002, 2008). Conceptual blending happens when two concepts from different domains are related to each other and projected onto a new domain of application, thus creating a new meaning. As such, conceptual blending underlies all semantic creativity in human language, such as the coining of new words by merging old words to form new words.

However, I argue that the mechanisms underlying Searle's notion of rule-following must be made more specific. This requires the transition to Lakoff's (2008) neuronal theory of metaphor (which is part of a general theory of embodied concepts, e.g. Gallese and Lakoff 2005). Lakoff's theory is also connectionist, not only on the semantic level, but also and primarily on the neuronal level. Transfers of meaning directly reflect certain neuronal processes, such as mappings, circuits and other forms of projection. We do not need to go into the details of this approach here. I see the central hypothesis as follows. In a metaphor, the conceptual blend is more directly based on a shift in neuronal connectivity so that somatic markers are connected with different signs. Thus rewiring takes place, with the same somatic marker connecting with two different signs involved in behavioral regularities. This is what Searle, in his approach, refers to as 'brute facts'. An example of this can be seen in the emergence of certain social institutions that deal with violence (for a general naturalistic reconstruction of early human symbols, see Burkert 1996). The use of symbols for physical prowess, application of physical force, and the will to apply it, involve a shifting connectivity of somatic markers so that the original connectivity relates to the specific experiences of physical violence, and possibly activates related memories, whereas after the shift the symbol activates the somatic marker (see Bechara and Damasio 2005 on the distinction between primary and secondary inducers involving different parts of the brain, in particular the amygdala and the ventromedial prefrontal cortex respectively). So, the metaphor that is activated in the use of the symbol actually means that the symbol 'is' what it is seen as representing. This applies for all types of metaphors, as has been elucidated in Lakoff's original theory, even more abstract ones. For example, treating time as movement in space

would actually activate neuronal connectivities which are causally enmeshed with movements, so that, to a certain extent, time 'is' movement in space.

This implies that in a metaphor, there is not simply a conceptual blending in a semantic space, but also more strictly a transition into a real equality between the source and the target domain in terms of the underlying neuronal responses. This is what actually underlies Searle's notion of a disposition guiding institutionalized behavior, and offers a neuroscience explanation of the link between status function and disposition.

We can conclude with the following definition of performativity. An action is performative if it involves a conceptual blend crossing different domains, so that the resulting action is linked with particular somatic markers which reflect a sustainable disposition to this action, and so that the action correlates with the regular occurrence of external facts, operating as signs which trigger somatic markers. As a result, following an institution does not involve an intention to follow, in the sense of a mental fact, but results from a closed causal feedback loop between signs, inner neuronal states, and actions that are signs in turn. As the signs are shared in a population of agents, these patterns reflect collective intentionality supervening on the underlying causal patterns.

5. Two case studies of performativity

We have now developed a naturalistic theory of 'following an institution', which I define as a performative act. In this section, I will analyze two case studies of performativity to give empirical support to my argument. The first is the example of money; the second is the example of brands and status. In both cases, it is possible to show how a certain regularity in the economic process is anchored in specific neuronal mechanisms, which in turn have consequences for the aggregate behavioral patterns connected with certain external facts, here artifacts, and which result in real consequences for the economic process which, within a certain range of variations, stabilizes an established pattern of interaction through time. In the first example, this is the recognition of a certain currency as money, in the second this is the reproduction of a status order in competitive markets. In both cases, performative action means that something which does not have this property originally is made 'real'.

5.1. Performing money

Money plays a central role in economic theory. The standard conception of money assigns it no intrinsic value, i.e. 'money is a veil'. This assumption is in stark contrast to the approaches

of experimental economics and neuroeconomics, where money is commonly used as a simple primary reinforcer to incentivize test persons (Camerer et al. 2005, Knutson and Wimmer 2007, Phelps 2009). Indeed, money triggers the same reward circuits in the brain as other primary reinforcers, such as seeing beautiful faces or delicious-looking food. In economics, there are different responses to this observation. One response eschews its relevance, arguing that this merely reflects the indirect utility of the goods money can buy (Harrison 2008). The other response accepts the fact that money proper manifests utility. This latter position has gained great validity beyond the field of neuroeconomics.

A number of results of psychological research reveal certain special features of money, when compared to other goods. Lea and Webley (2005) have proposed what they call the 'tool and the drug theory of money'. They argue that in real-world uses of money, both aspects intermingle, and either may be dominant depending on the context. The tool aspect fits the standard economic conception. The drug aspect comes to the fore when the psychology and neuroeconomics of money are considered. Glimcher (2011: 423f.) asks why money is the most central and universal institution of human economies in spite of the fact that, on first sight, it was a cultural innovation without any relation whatsoever to genetically endowed predispositions. He (obviously unaware of their work) proposes a hypothesis that had already been expounded in great detail by Lea and Webley. This hypothesis relates money to the more fundamental human capacity and need for social exchange which has been highlighted in evolutionary psychology. Cosmides and Tooby (2005) summarize the evidence that humans seem to have a special cognitive module that enables them to monitor and exploit situations of social exchange. This results in distinctly different cognitive performances, for example, in the estimation of probabilities in social exchange contexts as compared to other contexts (compare the seminal analysis of Gigerenzer 1996). There is neuroeconomic evidence for the activation of distinctive brain areas in social exchange (Ermer et al. 2006), which relate to other results about the specifically human capacities to imagine the mental states of others ('mentalizing', 'theory of mind', for a survey, see Frith 2007). Lea and Webley propose that the addictive properties of money result from money latching onto this genetically endowed cognitive instinct, symbolically activating the need and representing its fulfillment.

They propose a special concept, that of 'perceptual drugs' to cover all kinds of drugs which do not involve direct psychopharmacological effects. However, this distinction is not generally recognized in the literature on addiction (for a survey, see West 2006). In fact, the role of money as an incentive that comes close to a primary reinforcer appears to be less special if it is considered that the distinction between primary and secondary reinforcers loses

much of its relevance once we consider the basic neuronal mechanisms. Then, eventually, all incentives relate to the dopaminergic circuits that underlie reinforcement learning (for an overview, Schultz 2009), and thus may conflate into one 'single currency' in any case (Landreth and Bickle 2008). Addictions can result from diverse 'vulnerabilities' (Redish et al. 2008) in this learning system, resulting in specific behavioral expressions, so that there is no need to conceptually separate special sorts of addictions. For example, and comparable to the case of money, gambling can become addictive. The neuroscientific literature on gambling (Clark 2010) shows that the addictive effects of gambling are related to the dopaminergic circuits in the human brain, which guide reward expectations and concomitant behavior. Raised dopaminergic activity is a source of satisfaction on its own, such that the mere pursuit of a goal, in spite of recurrent failures, drives actions. A gambler constantly perceives the positive incentives resulting from being close to expected gains, which is often supported by the 'illusion of control', giving the impression that even pure games of chance involve certain skills. We can speculate that this might relate to the underlying behavior patterns of hunters pursuing a goal under complex circumstances and thus might be rooted in certain genetic endowments of the human species.

In the case of money, similar observations can be made with relation to the activation of dopaminergic circuits. This implies that the pursuit of money can be decoupled from the indirect gains that accrue from using the money. In our current context, we can restate the standard economic argument as follows. Money is not just a tool which can be used to buy other goods, but becomes a metaphor for these other goods. This metaphorical status is very different from the mere use of money as a tool, because it is underpinned by the activation of the same reward circuits as in the case of all other goods. Money does not simple indicate utility, it represents it metaphorically in the sense of Lakoff's (2008). This comes close to the standard idea that money represents goods, but adds the fundamental difference that as a metaphor, money is a universal symbol that directly activates neuronal mechanisms of reward expectations. The distinctiveness of money as a metaphor may result from its connection with the social exchange module, which implies that there is no need to search for a special 'money organ' in the human brain, envisioned by Glimcher (2011: 424).

One of the strongest results confirming this view is recent research on money illusion, which synthesizes psychological and neuroscience approaches. Money illusion is a fact established by numerous psychological experiments (Shafir et al. 1997). Recently, money illusion could be shown to relate to distinctive patterns of brain activation (Weber et al. 2009). Test persons are not able to distinguish properly between real and nominal values of money, and they show

much higher satisfaction with rewards that are higher in nominal value, even if the underlying real value is the same as in rewards with lower nominal value, because of different and transparent price levels. This distinction shows up in the differential activation of the reward processing areas in the brain. This result clearly demonstrates that money does not simply represent other good indirectly. Lea and Webley summarize a large number of empirical observations to underpin this view. In our current context, this implies that money as an institution involves a fundamental shift of neuronal response patterns as compared to the physical entity that represents money. The institution of money is anchored in somatic markers that can be discerned by means of neuroeconomic methods. Therefore, we cannot just say that the money illusion is 'irrational', because money has no intrinsic value. The value of money lies in its being a metaphor that signals the vast opportunities of social exchange in societies that manifest the money institution. The metaphor, neuronally encoded, is the essential condition for the stability of the money institution beyond the fact that money seems to be a mere convention. This renders the distinction between the 'tool' and the 'drug' aspect obsolete. Using money is performing money: So, what makes money a 'drug', is essential for institution that enables its use.

5.2. Performing brands

Many markets manifest the distinctive property of a hierarchical order of status. This is true for many consumer goods markets, but also, for example, for financial markets. At the one end of the hierarchy, there are a few companies which have a particularly strong reputation and dominate the market as leaders and trend setters, and on the other hand there are producers with no independent brand identity, catering for the needs of low-end and low-price market segments. These hierarchies are reflected in many physical characteristics of the business process, such as the location of the headquarters, the organization of the distribution process, and, of course, the products themselves. There is also a whole gamut of signals that communicate the hierarchical position, which is observable, for example, in the distinctive uses of advertising.

Joel Podolny (1993, 2005) has presented a theory of status in market competition which argues that status cannot be simply explained by standard economic theories, but must be assigned an independent theoretical role. This is tantamount to proposing an institutional theory of status, as emergent informal institutionalization (informal in the sense of North's 1990).

The standard explanation goes back to information economics and signaling theories. Status would appear to be a solution to the problem of how to communicate true quality to consumers when facing certain fundamental limits to credible communication. The central argument is that a high-quality producer will use signals that are costly to the high quality producer, but can only be produced at a higher marginal cost by low-quality producers. This prevents the low-quality producer from imitating the high-quality producer, or even cheating over the quality signals. The market hierarchy results in a separating equilibrium with truthful signaling of quality.

However, Podolny argues that these arguments do not suffice to explain the observations. One essential part of the phenomenon is lacking. Status does not only have effects on the distribution of information about a given level of quality, but also changes the level of accessible quality. The reason is that all high status producers can access all inputs at a lower comparative cost and can produce high quality with lower relative costs than any other competitor (for example, suppliers are keen to maintain the relationship with them, and so accept lower prices). This results in an objective barrier to entry for non-status producers. Even if they were also able to produce the high quality goods, they could not do so at the same cost. However, the high status producer could produce any level of quality with lower relative cost. But this would imply that its own behavior would undermine the perceived status hierarchy. Thus, the high status producer will avoid doing anything to undermine its position and thus effectively support the segmentation of the market.

Podolny's theory can be interpreted as providing a specific example for performative actions. High status is a performative action because it contributes to the conditions of its own actualization (which is an example of the so-called Matthew effect). As well as this, status is a positional good, so that signals of status can only be used by a limited number of users. In this view, the status hierarchy on the market is no longer endogenous to market actions, but becomes an exogenous determinant of actions, i.e. is an (informal) institution. Status is 'real', in the first place, because there are real differences in quality, and because the barriers to entry on both the high and the low level segment of the market are sustained endogenously both by the properties of the production process (high quality can be produced at the lowest relative cost by the high status producer) and by the status signs (which can only be communicated credibly if the high status producer does not exploit its cost advantages in the low status market segment).

This performative action is also anchored in neuronal patterns which directly underpin the hierarchy of status. One of the celebrated results of neuroeconomic applications in marketing

is the discovery that brands elicit different neuronal responses to those produced by non-branded goods even if of similar quality. The seminal study is McClure et al. (2004) who compared the effects of the Coke and Pepsi brands with each other and with non-branded goods. They showed that brands activate different parts of the brain to those activated by non-branded tastes. In the latter case, the preferences of the test persons were reflected in differential activity in the ventromedial prefrontal cortex. In the former case, more complex patters emerged which involved the Hippocampus, the Dorsolateral prefrontal cortex and the midbrain. The VMPFC activation reflects the activation of the standard reward systems in the brain, so sensory inputs (tastes) activate reward expectations, especially in the case when test persons are presented with anonymized drinks and recognize the taste differences of their preferred drinks. Brand knowledge changed this pattern substantially. In particular, Coke had a direct effect even on subjectively experienced taste differences. Interestingly, this brand effect was only strong for Coke, but not for Pepsi. Only Coke elicited a very strong shift of brain activity to the aforementioned areas. McClure et al. hypothesize that this results from the activation of specific memories, especially involving affective bias.

This result has been confirmed in other studies and reveals a 'winner takes all' effect in brand loyalty (overview in Plassmann et al. 2007, Hubert and Kenning 2008). There is a clear difference between individually favored brands and all other brands in terms of brain activity. In case of standard brands, the brain activates those parts which are typically related to rational decision-making, reward expectations and choice. In case of the favored brand, activities prevail which are related to emotionally grounded memories. As a hypothesis, one can therefore say that favored brands connect causally with somatic markers in the sense of Damasio (1995).

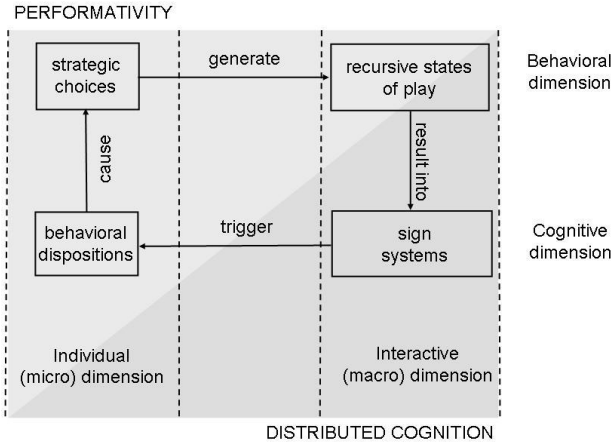
Therefore, I argue that the status hierarchy in markets is causally connected with distributed somatic markers in a population of consumers. The neuroeconomic research into this explains why status hierarchy is exogenous to the market process as long as the branded producers orient their activities to maintaining their competitive edge. Changes in the status hierarchy are major market disruptions. One factor is that they would require substantial changes in the distributed pattern of consumer behavior rooted in neuronal mechanisms.

We can conceive of brands and the corresponding status hierarchies in markets as outcomes of performative actions. Performativity results from the fact that the brand order is causally connected with two processes which have immediate physical consequences. One is that status hierarchy is anchored in distributed somatic markers on the consumer side; the other is the effect on the relative costs of producing a given quality of goods.

6. Conclusion

In the previous pages I have developed a naturalistic conception of rule-following which posits, in very general terms, that institutions are rooted in neuronal states. This is a perspective which stands in direct contradiction to most rational choice approaches to institutions, such as contractarianism. Further, I argue that states of neuronal systems are causally connected with external physical facts, which exist in a sign relation to the neuronal system. Institutions depend essentially on sign systems. This is the distributed cognition dimension of my approach, which is Hayekian in spirit.

Figure 5: Aoki's model, naturalized



In figure 5 I relate this position back to Aoki's model. The basic structure is maintained, but there are two fundamental changes. The line separating the behavioral and the cognitive dimension runs diagonally and therefore connects the individual (micro) and the aggregate (macro) dimension. This is because we now distinguish between performativity in the behavioral dimension and distributed cognition in the aggregate dimension. Performativity refers to the action patterns generated on the individual level and which emerge from the feedback loops between individual neuronal states and those generated on the population level by means of the mechanism of imitation. Distributed cognition refers to the sign systems which trigger individual actions, and which emerge in population level dynamics, i.e.

basically diffusion dynamics driven by imitation. The sign systems achieve causal force because they are causally connected with particular neuronal states. As a result, we can no longer separate the individual and the aggregate level analytically, because individual actions are essentially driven by phenomena of distributed cognition that directly connect the levels. This results in a huge advantage, namely that the problem of reduction, up to now always discussed in the context of the 'microfoundations' issue, loses its bite. If individual cognition relies essentially on external mechanisms which are population-level physical phenomena, we can directly explain why in turn those aggregate phenomena result from convergent individual behavior displayed in performative actions.

This evaporation of the microfoundations problem is by no means mysterious. The entire feedback circle is based on a naturalistic account of causation, which is the second difference to the original Aoki model. There are minor, but essential, changes in wording, as I do not use terms which relate to intentionality and mental states, such as 'incentivizes'. Sign systems trigger the activation of dispositions, and dispositions cause choices, with the possibility of random variations and errors. Recursive states of play do not generate 'public representations', as the latter term suggests reference to mental states and represented facts, but they result causally in certain signs becoming physical facts. The microfoundations problem only arises if we want to reduce aggregate phenomena to rational individual choices that are based on mental models and processes. This has led researchers into the trap of posing difficult solutions such as the 'representative agent with rational expectations'. In his original model, Aoki proposed that public representations channel those mental models in a way that equilibria are confirmed by the resulting choices. My reconstruction of the Aoki model is similar in spirit, but argues in a purely externalist fashion by eschewing all references to inner mental states at all. I put Searle's concept of a neuronally anchored disposition in the place of mental models, and I posit that dispositions are directly activated by the perception of signs, corresponding to cognitively enriched stimulus-response models of learning.

One special advantage of this approach is that change can be explained in a straightforward manner, because dispositions do not exclude the possibility of individual variations in responses. In this context, it is important to see that sign systems can include many different things, such as the artifacts representing money or the logos of brands, but can also include the behavior of others. This means that one central mechanism which links performativity and distributed cognition is imitation, which I have also conceived as a neuronally embodied process that does not in essence involve mental models (only as emergent phenomena in more

complex reflective states of the brain). Imitation can thus also drive institutional change, once individual variation of the expression of dispositions is taken into consideration.

Finally, and beyond the discussion of institutions, we can reach a general methodological insight. I think that this view on rule following as performative action opens a new way of to integrating neuroeconomics with economics. The almost exclusive focus of current neuroeconomics on choice in the microeconomic sense neglects the fact that almost all human behavior is guided by habits, norms and institutions, and that it is embedded into language (Herrmann-Pillath 2009). A naturalistic economic theory of human behavior must take account of this fact and pay attention to the resulting complexity of systems which causally connect neuronal processes and the external world of other human beings, artifacts and other entities. Neuroeconomics as a pure theory of choice (as proposed by Glimcher 2011) would finally fall back on positions in economic theory which need to be overcome precisely as a consequence of the naturalistic revolution in economics.

References

Akerlof, George A. and Kranton, Rachel E. (2000): Economics and Identity, Quarterly Journal of Economics CXV(3): 715-753.

Aoki, Masahiko (2001): Toward a Comparative Institutional Analysis, Stanford: Stanford University Press.

Aoki, Masahiko (2007): Endogenizing Institutions and Institutional Change, Journal of Institutional Economics 3(1): 1-31.

Aoki, Masahiko (2010): Between Game Theory and Institutional Studies: The Dual-Dualities of the Institutional Process, forthcoming in: Journal of Economic Behavior and Organization.

Baltes, Paul B. / Staudinger, Ursula M., eds. (1996): Interactive Minds. Life-span Perspectives on the Social Foundation of Cognition. Cambridge et al.: Cambridge University Press.

Basso, Frédéric / Guillou, Laurent / Oullier, Olivier (2010): Embodied Entrepreneurship: A Sensory Theory of Value, in: Stanton et al. (2010): 217-232.

Bechara, Antoine / Damasio, Antonio R. (2005): The Somatic Marker Hypothesis: A Neural Theory of Economic Decision, Games and Economic Behavior 52: 336-372.

Bentley, R. Alexander / Shennan, Stephen J. (2003): Cultural Transmission and Stochastic Network Growth, American Antiquity 68(3): 459-485.

Bhaskar, Roy (1989): The Possibility of Naturalism. A Philosophical Critique of the Contemporary Human Sciences, New York et al.: Harvester Wheatsheaf.

Binmore, Ken (1994): Game Theory and the Social Contract Volume I: Playing Fair, Cambridge / London: MIT Press.

Formatiert: Englisch (Großbritannien)

Formatiert: Englisch (Großbritannien)

Brandenburger. Adam (2007): The Power of Paradox: Some Recent Developments in Interactive Epistemology, International Journal of Game Theory 35: 465-492.
Burkert, Walter (1996): Creation of the Sacred. Tracks of Biology in Early Religions, Cambridge and London: Harvard University Press.
Buss, David M., ed. (2005): The Handbook of Evolutionary Psychology, Hoboken: Wiley.
Callon, Michel (2007): What Does It Mean to Say That Economics is Performative? In: MacKenzie et al. (2007): 344-357.
Callon, Michel (2008): Economic Markets and the Rise of Interactive Agencements: From Prosthetic Agencies to Habilitated Agencies, in: Pinch / Swedberg (2008). 29-56.
Callon, Michel / Millo, Yuval / Muniesa, Fabian, eds. (2007): Market Devices. Malden et al.: Blackwell.
Camerer, Colin (2006): Wanting, Liking, and Learning: Neuroscience and Paternalism, The University of Chicago Law Review 73: 87-110.
Camerer, Colin / Loewenstein, George / Prelec Drazen (2005): Neuroeconomics: How Neuroscience Can Inform Economics, in: Journal of Economic Literature Vol. XLIII: 9-64.
Clark, Andy (2007): Soft Selves and Ecological Control, in: Ross et al. (2007): 101-122.
Clark, Luke (2010): Decision-making During Gambling: An Integration of Cognitive and Psychobiological Approaches, Philosophical Transactions of the Royal Society B 2010 365: 319-330.
Cosmides, Leda / Tooby, James (2005): Neurocognitive Adaptations Designed for Social Exchange, in: Buss (2005): 584-628.
Damasio, Antonio R. (1995): Descartes' Error. Emotion, Reason and the Human Brain. New York: G.B. Putnam's Son.
Davies, Paul Sheldon (2007): What Kind of Agent Are We? A Naturalistic Framework for the Study of Human Agency, in: Ross et al. (2007): 39-60.
Davis, John B. (2007): Akerlof and Kranton on Identity in Economics: Inverting the Analysis, Cambridge Journal of Economics 31(3):349-362.
Davis, John B. (2008): Identity and Individual Economic Agents: A Narrative Approach, ssrn.com/abstract=1151325
Dennett, Daniel C. (1991): Consciousness Explained, Boston et al.: Little, Brown and Company.
Denzau, Albert T./North, Douglass C. (1994): Shared Mental Models: Ideologies and Institutions, in: Kyklos, 47: 3-32.
Ermer, Elsa / Guerin, Scott A. / Cosmides, Leda / Tooby, John / Miller, Michael B. (2006): Theory of Mind Broad and Narrow: Reasoning About Social Exchange Engages ToM Areas, Precautionary Reasoning Does Not, Social Neuroscience 1(3-4): 196-219.
Farrell, Joseph / Rabin, Matthew (1996): Cheap Talk, in: Journal of Economic Perspectives 10(3), 103-118.
Fauconnier, Gilles & Turner, Mark (2002): The Way We Think. Conceptual Blending and the Mind's Hidden Complexities. New York: Basic Books.
Fauconnier, Gilles / Turner, Mark (2008): Rethinking Metaphor, in: Gibbs (2008): 53-66.
Fogassi, Leonardo (2011): The mirror neuron system: How cognitive functions emerge from motor organization, Journal of Economic Behavior & Organization 77(1): 66-75
Frith, Chris (2007): The Social Brain? Philosophical Transactions of the Royal Society B, 362: 671-678.
Frith, Chris D. / Singer, Tania (2008): The Role of Social Cognition in Decision Making, Philosophical Transactions of the Royal Society B, 363: 3975-3886
Frith, Uta / Frith, Christopher D. (2003): Development and Neurophysiology of Mentalizing, Philosophical Transactions of the Royal Society B, 358: 459-473
Gallese, Vittorio / Lakoff, George (2005): The Brain's Concepts: The Role of the Sensory-Motor System in Conceptual Knowledge, Cognitive Neuropsychology 22(3 & 4): 455-479

Gibbs, Raymond W., ed. (2008): The Cambridge Handbook of Metaphor and Thought, New York et al.: Cambridge University Press.
Gigerenzer, Gerd (1996): Rationality: Why Social Context Matters, in: Baltes / Staudinger (1996): 319-346.
Glimcher, Paul W. (2003): Decisions, Uncertainty, and the Brain. The Science of Neuroeconomics, Cambridge / London: MIT Press.
Glimcher, Paul W. (2009): Choice: Towards a Standard Back-pocket Model, in: Glimcher et al. (2009): 503-522.
Glimcher, Paul W. (2011): Foundations of Neuroeconomic Analysis, Oxford and New York: Oxford University Press.
Glimcher, Paul W. / Camerer, Colin F. / Fehr, Ernst / Poldrack, Russel A., eds. (2009): Neuroeconomics: Decision Making and the Brain, Amsterdam et al.: Elsevier.
Gul, Faruk / Pesendorfer, Wolfgang (2008): The Case for Mindless Economics, in: Caplin, A. / Schotter, A., eds. The Foundations of Positive and Normative Economics, Oxford: Oxford University Press, 3-41.
Harrison, Glenn W. (2008): Neuroeconomics: A Critical Reconsideration, Economcs & Philosophy 24(3): 303-344.
Hayek, Friedrich August von (1979): Law, Legislation and Liberty. A New Statement of the Liberal Principles of Justice and Political Economy. Volume 3: The Political Order of a Free People. Chicago: University of Chicago Press.
Herrmann-Pillath, Carsten (2009): Elements of a Neo-Veblenian Theory of the Individual, Journal of Economic Issues XLIII(1): 189-214
Herrmann-Pillath, Carsten (2010): A Neurolinguistic Approach to Performativity in Economics, Journal of Economic Methodology 17(3): 241-260.
Herrmann-Pillath, Carsten (2010/11): The Economics of Identity and Creativity. A Cultural Science Approach, St. Lucia: University of Queensland Press and New Brunswick and London: Transactions.
Hubert, Mirja / Kenning, Peter (2008): A Current Overview of Consumer Neuroscience, Journal of Consumer Behavior 7: 272-292.
Hurley, Susan (2008): The Shared Circuits Model: How Control, Mirroring and Simulation Can Enable Imitation, Deliberation, and Mindreading, in: Behavioral and the Brain Sciences 31(1): 1-21.
Hutchins, Edwin (1995): Cognition in the Wild, Cambridge and London: MIT Press.
Hutchins, Edwin (2005): Material Anchors for Conceptual Blends, Journal of Pragmatics 37: 1555-1577.
Kirman, Alan / Teschl, Miriam (2006): Searching for Identity in the Capability Space, Journal of Economic Methodology 13(3): 299-325.
Knutson, Brian / Wimmer, G. Elliott (2007). Reward: Neural Circuitry for Social Valuation. In Harmon-Jones, E., Winkielman, P. (eds.) Social Neuroscience, New York: Guilford Press, 157-175
Lakoff, George (2008): The Neural Theory of Metaphor, in: Gibbs (2008): 17-38.
Landreth, Anthony / Bickle, John (2008): Neuroeconomics, Neurophysiology and the Common Currency Hypothesis, Economics & Philosophy 24(3): 419-429.
Latour, Bruno (2005): Reassembling the Social. An Introduction to Actor-Network.Theory, Oxford et al.: Oxford University Press.
Lawson, Tony (1997): Economics and Reality, London: Routledge.
Lea, Stephen G. / Webley, Paul (2006): Money As Tool, Money As Drug: The Biological Psychology of a Strong Incentive, Behavioral and the Brain Sciences 29: 161-209.
Lycan, William G. (1999): Philosophy of Language. An Introductory Text. London & New York: Routledge.
MacKenzie, Donald (2006): An Engine, Not a Camera. How Financial Models Shape Markets. Cambridge and London: MIT Press.
MacKenzie, Donald / Muniesa, Fabian / Siu, Lucia, eds. (2007): Do Economists Make Markets? On the Performativity of Economics, Princeton and Oxford: Princeton University Press.

Formatiert: Englisch (Großbritannien)

Formatiert: Deutsch (Deutschland)

Formatiert: Englisch (Großbritannien)

McClure, Samuel M. et al. (2004): Neural Correlates of Behavioral Preference for Culturally Familiar Drinks, Neuron 44: 379-387.
Moll, Henrike / Tomasello, Michael (2007): Cooperation and Human Cognition: The Vygotskian Intelligence Hypothesis, Philosophical Transactions of the Royal Society B, 362: 639-648.
North, Douglass C. (1990): Institutions, Institutional Change, and Economic Performance, Cambridge et al.: Cambridge University Press.
North, Douglass C. (2005): Understanding the Process of Economic Change, Princeton and Oxford: Princeton University Press.
Oullier, Olivier / Basso, Frédéric (2010): Embodied Economics: How Bodily Information Shapes the Social Coordination Dynamics of Decision-making, Philosophical Transactions of the Royal Society B 2010 365: 291-301.
Oullier, Olivier / Kelso, J.A. Scott (2009): Social Coordination, from the Perspective of Coordination Dynamics, in: Encyclopedia of Complexity and Systems Sciences, ed. R.A. Meyers, Berlin: Springer.
Oullier, Olivier / Kirman, Alan P. / Kelso, J.A. Scott (2008): The Coordination Dynamics of Economic Decision Making: A Multilevel Approach to Social Neuroeconomics, IEEE Transactions on Neural Systems and Rehabilitation Engineering 16(6): 557-571.
Papineau, David (2007): Naturalism, The Stanford Encyclopedia of Philosophy (Spring 2007 Edition), Edward N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/spr2007/entries/naturalism/>.
Pham, Michel Tuan (2007): Emotion and Rationality: A Critical Review and Interpretation of Empirical Evidence, Review of General Psychology 11(2): 155-176.
Phelps, Elisabeth A. (2009): The Study of Emotion in Neuroeconomics, in: Glimcher et al. (2009): 233-250.
Pinch, Trevor / Swedberg, Richard, eds. (2008): Living in a Material World. Economic Sociology Meets Science and Technology Studies, Cambridge: MIT Press.
Plassmann, Hilke / Ambler, Tim / Braeutigam, Sven / Kenning, Peter (2007): What Can Advertizers Learn From Neuroscience? International Journal of Advertising 26(2): 151-175.
Podolny, Joel M. (1993): A Status-based Model of Market Competition, in: American Journal of Sociology, Vol. 98, No. 4, S. 829-872.
Podolny, Joel M. (2005): Status Signals. A Sociological Study of Market Competition, Princeton and Oxford: Princeton University Press.
Redish, A David / Jensen, Steve / Johnson, Adam (2008): A Unified Framework for Addiction: Vulnerabilities in the Decision Process, Behavioral and Brain Sciences 31: 415-487.
Reimann, Martin / Bechara, Antoine (2010): The Somatic Marker Hypothesis as a Neurological Theory of Decision-Making: Review, Conceptual Comparisons, and Future Neuroeconomics Research, Journal of Economic Psychology 31: 767-776.
Richerson, Peter J.and Boyd, Robert (2005): Not By Genes Alone. How Culture Transformed Human Evolution. Chicago: University of Chicago Press.
Ross, Don (2005): Economic Theory and Cognitive Science: Microexplanations, Cambridge and London: MIT Press.
Ross, Don (2007a): The Economic and Evolutionary Basis of Selves, in: Ross et al. (2007): 197-226.
Ross, Don (2007b): The Economic Agent: Not Human, But Important, http://www.uab.edu/philosophy/faculty/ross/The-economic-agent-Not-human-but-important.htm
Ross, Don (2007c): *H. sapiens* as Ecologically Special: What Does Language Contribute? Language Studies 29: 710-731.
Ross, Don (2008): Two Styles of Neuroeconomics, Economics & Philosophy 24: 473-483.
Ross, Don / Spurrett, David / Kincaid, Harold / Stephens, G. Lynn, eds. (2007): Distributed Cognition and the Will. Individual Volition and Social Context, Cambridge: MIT Press.
Schantz, Richard, ed. (2004): The Externalist Challenge, Berlin: de Gruyter.
Schultz, Wolfram (2009): Midbrain Dopamine Neurons: A Retina of the Reward System? in: Glimcher et al. (2009): 323-329.

Formatiert: Englisch (Großbritannien)

Searle, John R. (1995): The Construction of Social Reality, New York: Free Press.
Searle, John R. (2004): Social Ontology: Some Basic Principles, http://socrates.berkeley.edu/~jsearle/articles.html
Searle, John R. (2005): What Is an Institution?, in: Journal of Institutional Economics 1(1): 1-22.
Shafir, Edward / Diamond, Peter / Tversky, Amos (1997): Money Illusion, Quarterly Journal of Economics CXII(2): 341-374.
Skyrms, Brian (2004): The Stag Hunt and the Evolution of Social Structure, Cambridge et al.: Cambridge University Press.
Smit, J.P. / Buekens, Filip / du Plessis, Stan (2011): What is Money? An Alternative to Searle's Institutional Facts, Economics & Philosophy 27(1): 1-22.
Smith, Vernon L. (2003): Constructivist and Ecological Rationality in Economics, The American Economic Review 93(3): 465-508.
Sprevak, Mark (2009): Extended Cognition and Functionalism, Journal of Philosophy CVI(9): 503-527.
Stanton, Angela A. / Day, Mellani / Welpe, Isabell M., eds. (2010): Neuroeconomics and the Firm, Cheltenham and Northampton: Edward Elgar.
Sterelny, Kim (2004): Externalism, Epistemic Artifacts and The Extended Mind, in: Schantz (2004c): 239-254.
Strauss, Claudia/Quinn, Naomi (1997): A Cognitive Theory of Cultural Meaning, Cambridge et al.: Cambridge University Press.
Sugden, Robert (2000): Team Preferences, Economics and Philosophy 16: 175-204.
Tomasello, M., Carpenter, M., Call, J., Behne, T., & Moll, H. (2005): Understanding and sharing intentions: the origin of cultural cognition, Behavioral and Brain Sciences, 28: 675-735.
Tomasello, Michael (2008): Origins of Human Communication, Cambridge and London: MIT Press.
Tomasello, Michael / Carpenter, Malinda (2007): Shared Intentionality, Developmental Science 10(1): 121-125.
Tooby, John / Cosmides, Leda (2005): Conceptual Foundations of Evolutionary Psychology, in: Buss (2005): 5-67.
Weber, Bernd / Rangel, Antonio / Wibral, Mathhias / Falk, Armin (2009): The Medial Prefrontal Cortex Exhibits Money Illusion, Proceedings of the National Academy of Sciences 106(13): 5025-5028.
Wegner, Daniel M. (2002): The Illusion of Conscious Will, Cambridge: MIT Press.
Wegner, Daniel M. / Sparrow, Betsy (2007). The Puzzle of Coaction, in: Ross et al. (2007): 17-38.
West, Robert (2006) Theory of Addiction, Oxford: Blackwell and Addiction Press.
Wilcox, Nathaniel T. (2008): Against Simplicity and Cognitive Individualism, Economics & Philosophy 24(3): 523-533.
Wilson, Robert A. (2004): Boundaries of the Mind. The Individual in the Fragile Sciences: Cognition, Cambridge et al.: Cambridge University Press.
Wittgenstein, Ludwig (1958): Philosophical Investigations, Oxford: Basil Blackwell.

Formatiert: Englisch (Großbritannien)