Towards a memory of the firm

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In this paper, applications of different systems ideas in one specific research area (regional implementation of sustainable development) are being transferred into the organisational realm. The systems' ideas are taken from social systems theory (Luhmann), structuration theory (Giddens) and cognitive neurosciences (Maturana, Singer and others) and combined into a transdisciplinary synthesis of the concept of memory: a learning architecture, with memory being thought of being the key element in any system's autopoiesis. The transdisciplinary learning architecture is then applied to the context of organisational learning, creating a rough outline of an organisational learning architecture.

You have to begin to lose your memory, if only in bits and pieces, to realize that memory is what makes our lives. Life without memory is no life at all, just as intelligence without the possibility of expression is not really intelligence. Our memory is our coherence, our reason, our feeling, even our action. Without it, we are nothing.

-- Luis Buñuel

The initial problem

The starting point for the theme developed in this paper was a research endeavour aimed at the problem of how implementation processes of sustainable development can be institutionalised on the regional level. The main research object consisted of regional sustainability networks with heterogeneous actors from different societal backgrounds. Embedded in this research object are different subobjects, all adding to the problem's complexity. With the regional level, elements like identity and responsibility, as well as the territorial (physical), symbolic and cognitive shape of the region were of importance – the sense of place felt and understood by the actors. The task of implementing sustainability involved human actors in the centre of things as well as the maintenance of socio-ecological couplings through self-control and participation, thus requiring as well as enabling learning processes. Networks as the main institutional instrument to make it all happen are in itself complex enough and demand a certain "management philosophy" apart from "command and control". This is due to their distinct qualities and characteristics like interdependence and reciprocity, emergent phenomena and self-organisation, the role of trust and power as well as their loose couplings.

To solve the problem, a new way of organising the whole implementation process was sought. A way that could deal with the research object's as well as the task's complexity, able to handle a vague goal (sustainability) and actors' heterogeneity (different backgrounds: economical, political, societal etc.). This holistic 'assembly' is constitutive for sustainability networks and it is the only environment in

which sustainable solutions (just, long-term, holistic i.e. economical, ecological, social etc.) can be found. It is a highly creative but conflict-laden arena and at the heart of it are learning processes:

(i) about the concept of sustainability as well as (ii) about self-organising for sustainability projects. Therefore, learning processes are the main managerial 'key' to control in order to self-control such networks. The key factor to trigger this complexity is structure (order). This suggests that learning processes (and any kind of management of them) has to be embedded within a structural framework, with reference to the initial conditions: a regional learning architecture. In order to provide a feasible solution to "get the job done", a transdisciplinary approach was chosen: from a complex everyday-life problem situation, cooperation between disciplines is providing for a solution. Therefore, methods of problem solving are not to be picked from a disciplinary ex ante tool-box, but have to be tailored along the way and stem from multiple disciplines (Gibbons et al. 1994, Bruce et al. 2004). This yields some difficulties: in combining findings across the disciplinary divide, any transdisciplinary research is facing the dangers of (i) making categorical mistakes, (ii) leaping into the naturalist fallacy, and (iii) fostering theoretical eclecticism. Now, the author of this paper isn't at all sure if there really is something like a naturalist fallacy, despite in its most trivial sense: "should" doesn't follow from "is" without any additional bridging principles. Anyway, in order to provide a methodological framework to avoid all these pitfalls, some reminiscence is paid to Stafford Beer (Beer 1984). The problem solution is being described with the help of a key concept that is being dealt with in different natural as well as social science disciplines. Along these two different strands, cross-disciplinary syntheses are drawn which abstract from any single discipline. Further, from these two abstract syntheses, another, this time transdisciplinary, synthesis can be deduced, bridging the gap between the natural and the social sciences with neither categorical nor naturalist mistakes. The problem solution now shows its structural i.e. context-free and isomorphic form and can be used on all sorts of similar problem situations (classes), of which organisational learning is the one exploited in this paper.

Transdisciplinary synthesis of memory[1]

Why memory? As Luis Buñuel so wonderfully put, without memory there is nothing, at least nothing to think of and remember. Memory controls the system's reality from which it looks towards the future (Luhmann 1997). It is necessary and sufficient for any system's self-referentiality and thus its self-reproduction: without memory no difference between self and not-self, between now, earlier or later. This truth holds for a great range of systems: biological and psychological as well as social. Furthermore, memory is a well researched field in the natural as well as the social sciences, so that the necessary first abstractions can be achieved. Before providing those, one general finding across all fields emphasises that memory is not a thing, not a fixed ontological entity, no "bucket" things can be put into. What makes up a memory is the function of remembering. Memory always is a memory in action, a doing rather than a being.

In the social sciences, memory can be regarded as the structure of social life. It is permanently instantiated in specific social interactions and routines and thus reproduced (Giddens 1984). In these interactions, memory manifests itself as communicative memory as opposed to cultural memory, which has greater endurance but less flexibility. It is within social (face-to-face) interactions where memory, both long-term and shorter term, comes alive and where changes occur. They are the constitutional point of a collective memory, which in turn guides and controls these interactions (Welzer 2002,

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[1] This is a very brief version of a more in-depth part of the author's doctoral thesis, to be published in fall 2006.

Assmann 2002). Cultural memory thus makes up the external structures of actors, their interaction context, whereas communicative memory determines their internal structures, reflecting on the other. The cultural (collective) part of social memory can be comprised of symbolic codes (language) and material artefacts (text, built infrastructure, natural infrastructure etc.; Donald 1999). These few sentences hopefully make it clear that memory, in a social science context, is only meaningful when thought of as permanently instantiated. Considering Luhmann along with Giddens, an individual memory is unthinkable without reference to a societal memory: psychological and social systems depend completely on each other, they are indissolubly coupled to each other (Luhmann 1996). Here, the stitch between both social theories can be made: within structure lies the memory of a system. Structure at the same time is the medium and outcome of action; it is instantiated in action (it is "done"). Through this process of instantiation, internal (individual) memory is externalised in a symbolic code and thus becomes (social) communication. The externalisation process, the code used, and the artefacts referred to turn that communication into the living example of social (collective) memory. In order to change memory in this perspective, the reference points themselves have to be changed. These are:

- ❑ *virtual structures* in the Giddens' sense, like interpretative (mental models, cognitive maps) and normative (belief systems, traditions, Weltanschauung) rules, allocative (capital: money, machines, tools, infrastructure) and authoritative (organisation, authority) resources.

- ❑ *material artefacts*, providing something to "put hands on", like texts, bodies, tools, urban and traffic infrastructure, money, sculptures, paintings, landscapes and so forth.

- ❑ *relational acts*, positioning and aligning material artefacts with virtual structure.

- ❑ *communication* in Luhmann's sense, as the basal operation of social systems which can be influenced by people through text (verbal resp. written language) and made resonant towards beliefs, worldviews, agendas or visionary concepts like sustainable development.

Through communicated relational acts, changing and newly relating artefacts and structure, a social memory is constructed just as it is aiding the construction of individual memory. Changes occurring here are the outcomes of learning processes.

In the natural sciences, a process view on memory also dominates: remembering produces memory and only within that recursive construction loop it makes sense to speak of a mind or a self. In a way, the self is not only the result of that construction process, it is that process, it "*is the waves and the current, the vortices, the flying spray*" (Beer 1981: 51). Learning and the changing of memory, then, imply a change in focus towards the reorganisation of cognitive structures in co-adaptive system-environment interactions. Learning in this regard is re-relationing of structures (here: neural patterns), through interactions of cognitive elements (here: neurons resp. neural networks), producing an emergent order, meta-signatures within cognitive structures and neural patterns. This meta-signatures are providing the "glue" that coordinates neural activities, grouping neurons together into networks and thus enable self-organisation through what is called "downward causation" (Singer 2003: 43). Nevertheless, when talking about self-organisation and emergence, this does not mean, that the brain is "just" a bunch of structures for whatever those may be. It is a functionally differentiated network of memory systems and their differentiation is guided by re-relationing activities, thus creating these memory systems. The "first wave" of orderings that appear in the human brain set up what is termed

semantic memory: a context-free, abstract, de-indexed knowledge about the world and the place of the memory-bearing system in it (Markowitsch 2002). Here the first abstractions, the first denominations appear (be it in language or other). The world can start to make sense. Through execution of these first abstractions within cognitive acts, a web of knowledge is created, enriched by feelings (which then can also be coded in abstract terms) and thus becoming the episodic memory of the memory-bearing system: it acquires a history and therefore an identity (Markowitsch and Welzer 2005). This identity then can be reproduced in self-referential actions, whereas the act of reproduction is creating a consensual space, wherein the world, the system and system-world interactions cannot only happen but be understood (Maturana 2000: 205, Varela 1990: 96).

For a transdisciplinary synthesis, three isomorphic aspects of memory are identified: memory ontogenesis, memory autopoiesis, and memory change.

Memory ontogenesis

The development of memory follows three distinct steps: (i) production of a symbolic (representational) code, (ii) repeated interactions recurring on that code, (iii) emergence of meta-signatures which "cause downwards" and control (and foster) the development of further signatures and memory patterns. The symbolic code can be produced spontaneously or deliberately, what matters here are direct and localised interactions providing for so-called proprioceptiv feedback – the temporal and spatial proximity of interactions and their results (contingency relation; Markowitsch and Welzer 2005: 168). From such stabilised interactions, new general types of interactions (interaction schemes, scripts or rules) emerge "out of themselves" and become action-guiding. These generalised or abstracted types make up the condensed structure of the now forming memory-bearing system, a first semantic memory containing abstracted, generalised and de-indexed knowledge. Within this memory structure, the potential for self-referentiality is embedded and needs one further step of memory formation: the ability to refer evaluated cognitions onto itself, thus establishing this self as a distinct ontological entity apart from its environment. Evaluation needs emotional markers in addition to the cognitive markers (or filters) already in place (Damasio 1999). This new memory structure can be called episodic memory, enabling conscious remembering of the system's own past. Only from here onwards it is possible to self-organisationally fit in new cognitions into the web of the already known. In other words: new knowledge is always known before the background of old knowledge, it is a re-relationing of that knowledge.

Memory autopoiesis

In order to uphold a memory and thus the system's identity, memory has to be permanently instantiated: knowledge has to circulate, it has to be "on the move" and reference back on itself. Within the process of instantiation (actualisation of memory), semantic memory is indexed (contextualised) with the help of episodic memory (web of the already known) and fed back either emotionally marked (evaluated) as a single occurrence or, regularity at hand, as de-indexed semantic knowledge. Here, the relation between memory structure and instantiating interaction is of importance: structures are stabilising factors of memory, while at the same time being instantiated ("made real") by the very interactions they give stability to. To conclude: the identity of the memory-bearing system is produced through actualising interactions, taking reference on virtual structures and material artefacts. At this moment, a brief look at the artefactual side of memory is of interest. There are several distinctions of artefacts, most important of all symbolic and non-symbolic. A symbolic artefact has meaning embed-

ded by someone resp. something: the memory-bearing system. Another distinction is between material and non-material artefacts. A material artefact can be non-symbolic (coloured paper) or symbolic (banknotes). Among symbolic, non-material artefacts there are communicative and institutional artefacts, the former being a "person" within an interaction system of the Luhmann kind, whereas the latter is a fixed role (or scheme, script etc.) as Berger and Luckmann (1966) have pointed out. Figure 1 exhibits this classification. Returning to material artefacts, they are the homestead of virtual structures and thus the referential object of actualising interactions. In the human brain, these material artefacts are biochemical synapse weights between neuron cells, while in the social realm they are texts, built infrastructure, natural infrastructure and so forth. Within the process of actualising interactions, the virtual structures embedded in their material artefacts become real and action-guiding.[2]
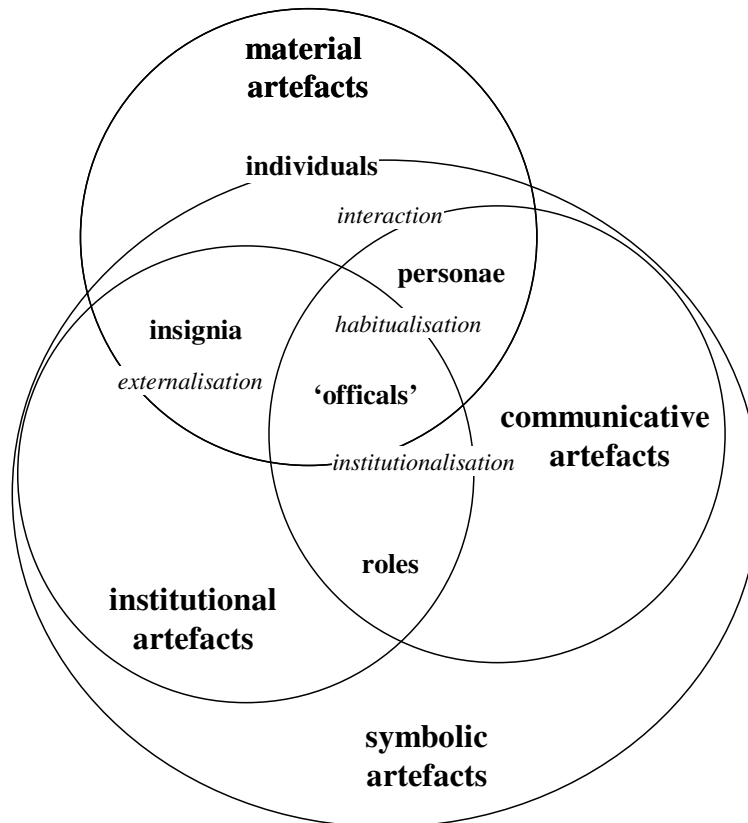

figure 1: classification of artefacts

Memory change

Changes in memory occur regularly. Memory is never objective remembering of a fixed past, but always instantiated within a present context. What remains unchanged is the belief (or assumption) of identity of the memory-bearing system. This is upheld by re-relationing of memory structures and therein embedded knowledge. Newly learned knowledge is thus fit into this web of knowledge, it changes the structure but not the organisation of the whole lot (Maturana 2000). Changes can then

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[2] Note: the distinction between real and virtual is not the same as between real and unreal. What is virtual has a reality of its own and influences the "real reality". One can substitute "real" with "actual" and "virtual" with "potential", then the distinction might become clearer.

only occur within interactions of system elements, whereas the continuity is guaranteed on a systemic level. In order to make a change, the thing to be changed needs to be reference i.e. it needs to become a part of the memory-bearing system: itself and its subject-to-change state have to be marked in a discursive way (in Giddens' sense), made visible on the basis of its own signatures and representations. This is of course nothing else than the already described instantiation of virtual memory structures through memory interaction elements (memory actors). Between those elements, the identity of the memory-bearing system is negotiated under present context influence. What does negotiate mean here? If new variations are the product of interactions, selection criteria are necessary in order to make the change happen. This can be understood as follows: within interactions abstract signatures, scripts, representations and the likes are being marked discursively *different* depending on the interaction element. Given that the memory-bearing system is to be upheld, these different markings (different interpretations) are not allowed to endanger the interactions themselves. Otherwise there's no more actualising interactions, no memory, no system. To avoid this danger, the nature of the externalisation of interactions is of importance. Externalisation means instantiation of structure within a certain symbolic code. All interactions lead to externalisations, be it the externalisation of a societal order (Berger and Luckmann 1966) or the externalisation of an emergent order of neural networks and thus neural patterns (Singer 2003). Externalisations cause downwards and if they thus enable the interactions they sprang from to continue, the externalisations and their interactions are positively selected: something new (and beneficial for the memory-bearing system) has been learned, which can then be condensed to new structures and relations.

The general form of a learning architecture is depicted in figure 2. It consists of three instantiating activities – working memory, cognitive consolidation and learning – as well as two memory filters – cognitive and emotional – and two memory systems – semantic and episodic. These seven elements are isomorphic to all memory-bearing systems, regardless of their class. However, each class might develop additional elements or actualise them differently according to its specific system-environment interaction history.

Working memory

The structural realm in which direct interdependencies between all parts of the learning architecture are organised is termed the working memory. It is the constitutional point, as said before, which actualises resp. instantiates the system's memory and thus its identity. Elements making up this working memory (memory actors) recur on artefacts and their embedded virtual structures in order to do so.

Cognitive consolidation

This is carried it in a non-reflexive manner as regards the working memory i.e. the working memory is not "bothered" with this task. The outcomes of working memory are connected towards the already existing semantic and episodic memory systems, while at the same time providing input for the cognitive filters.

Cognitive and emotional filters

Any input of the memory-bearing system is filtered before it can produce resonance within the working memory and its elements. The cognitive filters check incoming input against the background of semantic and episodic memory, which is provided by processes of cognitive consolidation. Here already "the world" is internalised and remembered according to the memory-bearing system's own

past. Emotional filters are in a way bypassing this process of "fitting in" once reflexively known (rationally learned) knowledge and address what Konrad Lorenz termed "ratiomorphic" cognition (Lorenz 1941). This adds a certain evaluative feel to any cognition; it enables the memory-bearing system to judge in a right/wrong manner as opposed to the true/false manner of the cognitive filters.
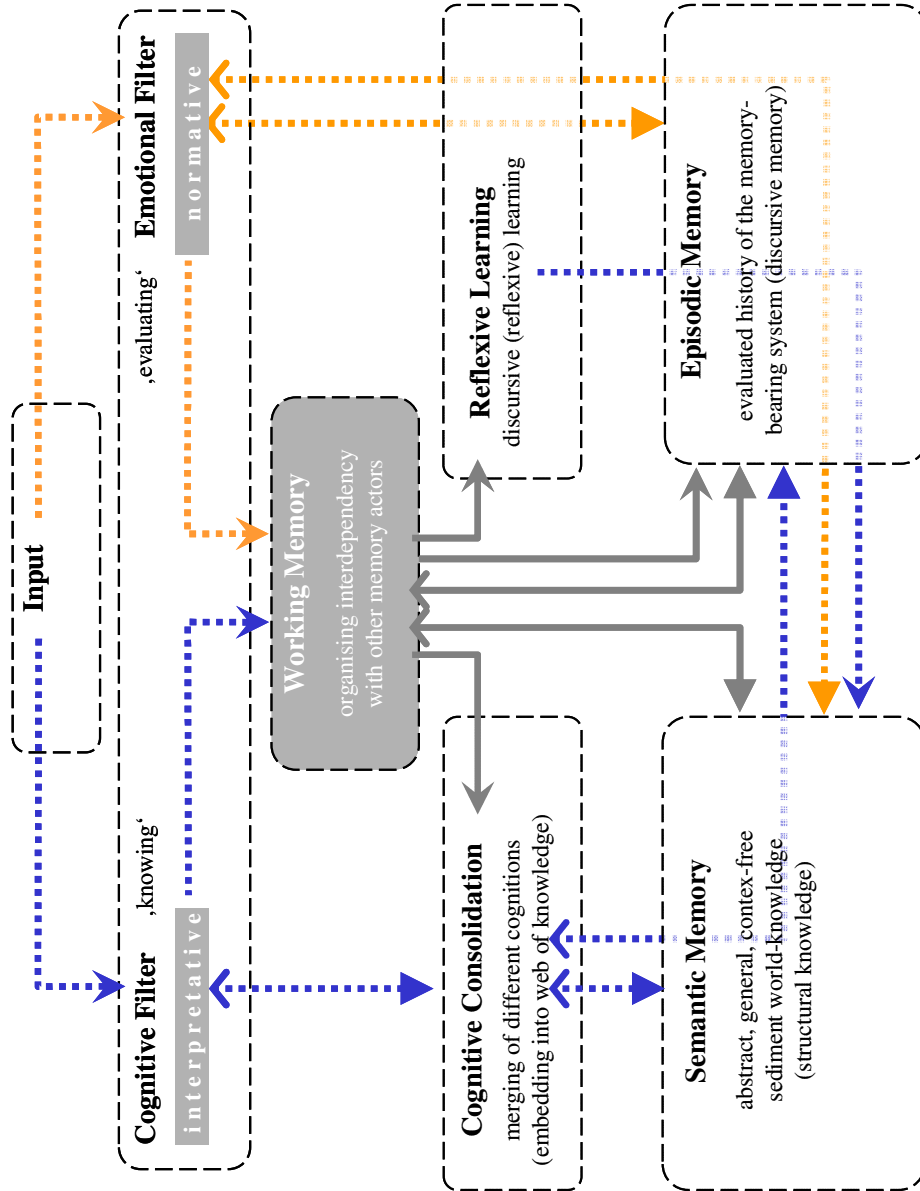
figure 2: general outline of the learning architecture

Semantic and episodic memory

Semantic memory is de-indexed, abstract knowledge of the world. One can think of it as mathematical construction rules, of formulae that do not contain any resemblance to a certain situation (or instantiation). Semantic memory is, to put it in another way, the estimated average of all cognitions from system-world interactions. It is necessary for any system to become aware of itself, but it is not sufficient. For that, an episodic memory is needed that uses emotional markings in order to "write"

the memory-bearing system's history. It does so by using semantic knowledge in actual situations and circumstances, creating its own record. What is now contained within these memory systems? On this level of description, all explanations are abstract, need to be abstract in order to provide enough adaptability for applying the learning architecture to different real-world phenomena. Nevertheless, any memory refers on material artefacts (or structures) of some kind, be it synapse weights in neural networks (memory of the brain) or organigrams in organisations (memory of the firm). The world is, after all, not made up of mysteries but matter-energy relations.

Learning

The learning process within such a learning architecture starts with instantiations or, as it is called here, actualising interactions of memory elements resp. memory actors, using material artefacts and meaning attribution. This now actualised memory, discursively marked, can then feedback on itself, enabling changes not only in memory structures but also in memory elements behaviours and thus the behaviour of the memory-bearing system as a whole. But behaviour here means new instantiations, producing a stream of actualising interactions. Regularities in this stream cause the emergence of new abstract knowledge through habitualising interactions ("downward causation"). Let alone, this wouldn't be sufficient for learning; the production of material artefacts resp. changes in existing material artefacts (attribution) is needed.

Outline of an organisational learning architecture

Applying the isomorphic framework of the learning architecture in an organisational context, some transfer efforts are necessary. The diagrams developed here as well as the outcomes of the initial research agenda, learning processes during regional implementation of sustainable development, will be of assistance for that. Returning to the latter, the learning architecture has been "filled" with regional actors of sustainability, which play different roles. Among these actors, a division is made between primary (implementers), secondary (supporters) and tertiary (stabilisers) actors. Primary actors consist of economic and civil society actors (like NGO e.g.). They are concerned with direct implementation or, in a more organisational term, operations management. Their main activity is interaction, that's instantiating memory, thus realising the potential of the memory-bearing system. Secondary actors stem from the political, scientific, educational and media realm. Their supporting tasks are to initiate, to coach and to cover implementation efforts. Within an organisation, their roles would be played by actors from the strategic management, from knowledge management and corporate communication. Main activity with them is communication, and that is communication in Luhmann's view: social communication (mainly textual, written). Tertiary actors, to a large degree, make up the memory systems and filters, especially episodic memory and emotional filters. These actors are, and this didn't come as such a surprise regarding implementation of sustainability: arts and culture, ethics and belief groups, and the region's natural environment. Whereas arts and (ethical) beliefs respond to the cultural determination of human beings, the natural environment responds to their evolutional disposition and thus acknowledging them as cultural as well as natural "animals" (Siebenhüner 2001). What all these actor groups have in common is, that it is not so much the actors themselves but their artefacts (nature being in fact "just" an artefact in this regard and not an actor at all) that are of relevance to the learning architecture. Furthermore, all of them operate along "sense". Not power, not money, but their ability in providing sense and meaning is what makes them interesting. Arts and culture take up a special position: whereas belief groups and their artefacts aim at conservation and stability, art is there to provide a mirror for society, to provide for self-reflexivity and thus the prerequi-

site for any kind of change. Within the firm, these actors, if they can be called like that, are hard to find. They are more or less located "somewhere" on the normative level and span across organisational boundaries. Figure 3 shows a first outline of an organisational learning architecture, with
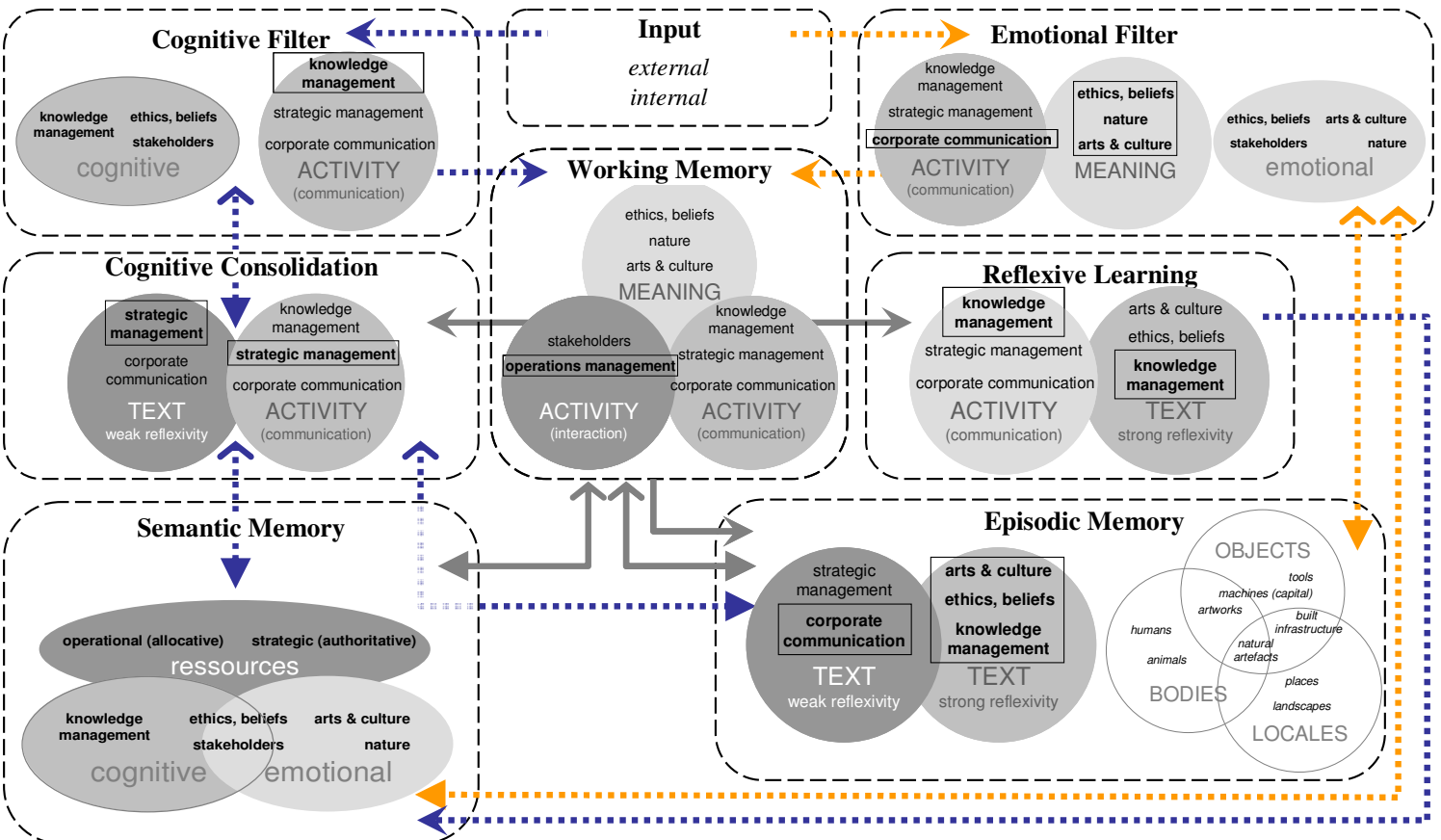
figure 3: outline of an organisational learning architecture3

3 The "boxed" actors can be considered lead actors in their respective contexts.

Cognitive Filter

knowledge management

knowledge management   ethics, beliefs
stakeholders
cognitive

strategic management

corporate communication

ACTIVITY (communication)

Input

external

internal

Emotional Filter

knowledge management
strategic management
corporate communication

ethics, beliefs
nature
arts & culture

ACTIVITY (communication)   MEANING

ethics, beliefs   arts & culture
stakeholders   nature
emotional

Cognitive Consolidation

strategic management

corporate communication

TEXT
weak reflexivity

knowledge management

strategic management

corporate communication

ACTIVITY (communication)

Working Memory

ethics, beliefs
nature
arts & culture
MEANING

stakeholders

operations management

ACTIVITY (interaction)

knowledge management
strategic management
corporate communication

ACTIVITY (communication)

Reflexive Learning

knowledge management

strategic management

corporate communication

ACTIVITY (communication)

arts & culture
ethics, beliefs

knowledge management

TEXT
strong reflexivity

Semantic Memory

operational (allocative)   strategic (authoritative)
ressources

knowledge management   ethics, beliefs   arts & culture
stakeholders   nature
cognitive   emotional

Episodic Memory

strategic management

corporate communication

TEXT
weak reflexivity

arts & culture
ethics, beliefs
knowledge management

TEXT
strong reflexivity

OBJECTS

tools
machines (capital)
artworks
built infrastructure

humans
animals
natural artefacts

BODIES

places
landscapes

LOCALES

organisational and cross-organisational actors placed within different memory systems and filters. Note the distinction between virtual structure as semantic memory and material artefacts making up episodic memory. The former is made up of cognitive (interpretative) and emotional (normative, evaluative) elements as well as allocative (operational; machines, tools etx.) and authoritative (strategic; plans, programms etc.) resources resp. knowledge about this elements resources. Actors draw on that structure, instantiating it in interaction. At the same time, structure is not hanging in a vacuum; it is represented in material artefacts which make up episodic memory. Among them are different types of text (as regards their effects on actors' reflexivity), which play a dominant part in organisational life, and additionally the more and more tangible objects, bodies and locales: objects are tools or machines, but also works of art; within bodies one finds human bodies (people) and animals, but also certain sculptural elements of art; the locales are places and landscapes, artefacts of the natural environment. All of those artefacts have attributed meaning, even texts, which at first glance to have an observer-independent meaning of their own

Now, the whole processing within the learning architecture is thought to ensure organisational stability in the face of environmental turbulence, while at the same time enabling the organisation to change itself without sacrificing that stability. As Weick (1985) put it, that is the hardest task for any management of organisations. The learning process within this architecture then follows these steps:

1. Through interactions of primary and secondary actors, organisational memory is instantiated and "sensualised" by means of certain material artefacts:

❏ Texts enabling strong reflexivity, especially from the firm's knowledge management systems and actors, from arts and culture, and texts concerning corporate ethics and beliefs.

❏ Tangible objects like corporate buildings and factories (design, layout, building materials etc.), tools and machines, but also artworks and natural artefacts.

❏ Bodies, mainly humans (with intentionality) who are conducting placing activities (Löw 2001) in order to create

❏ Places, though this can also be achieved by artworks (arrangements, inclusion, exclusion etc.) as well as natural and cultural landscapes.

2. Such instantiated memory (actual memory, memory in action) recurs back on itself, making its underlying cognitive and emotional or, as Giddens would call them, interpretative and normative rules fluid and subject to change. Interpretations and norms are interdependent: interpretations are always "done" in front of the already known, while norms determine what is known, but at the same time change with newly acquired knowledge, thus changing the virtual structure of the memory-bearing system.

3. Changes in virtual structure mean a change in semantic memory within the learning architecture and this change feeds back to the interaction processes of actors, who constantly draw on their abstract world knowledge. This is the already mentioned stream of actualising interactions (2 >> 3 >> 2 >> 3 >> …).

4. In order to stabilise organisational learning, in addition to this stream of interactions the episodic memory of the firm has to be changed, thus marking these changes within the organisation. This is done by producing artefacts and attributing meaning to them:

❏ Again, texts enabling strong reflexivity

❑ Texts with weak reflexivity, not containing something new but focussing on distributing the already known, thus strengthening its visibility (corporate newsletters, corporate intranet).

❑ Objects, bodies and locales

5. Just like primary actors draw on semantic memory, they also draw on episodic memory, referring to and working with its artefacts. The job of episodic memory here is to ensure stability of organisational learning processes and thus achieving Weick's difficult task of both organisational stability and flexibility.

6. In the end, all outcomes of such learning processes are input to cognitive consolidation efforts, a task for the firm's strategic management, but also for corporate communication, distributing the newly found knowledge into the organisational arteries and ensuring consistency with the organisation's past, present and future activities.

Conclusions: towards a memory of the firm

With the transdisciplinary synthesis of a learning architecture, a "recipe" for a memory of complex (social) systems is available. Out of its initial research field, implementation of regional sustainable development, fertile transfers into the organisational realm are possible. The shortcomings of existing organisational learning theories, which generally lack a structural foundation, can be overcome. The footsteps followed here are those of Stafford Beer, which's work is responsible for the first ideas of looking for isomorphic structures in different scientific areas that could provide a solution for a systems' problem. For further steps towards a memory of the firm, the theoretical as well as practical "connectability" of the learning architecture has to be explored. An already large and still growing body of work is done in applying structuration theory to organisational theory (Duschek, Ortmann and Sydow 2001, Windeler 2001). Here, the learning architecture could add some grounding as regard the "vagueness" of structuration theory (what Stones (2005) calls "ontology-in-general"). Another interesting connection is with the literature concerning systems and cybernetic theories for organisations, especially the viable system model of Beer himself. Here, the learning architecture can either be "filled" with systems one to five, proving its heuristic value in asking questions like "what are the emotional filters of a viable system?" or "are there different layers of episodic memory for each sub-system?" and so forth. For practitioners, the learning architecture can aid as a "reflexivity tool": the learning architecture, in the view exhibited in this paper, is already there, in every organisation, it is just rarely reflexively known. There are always processes going on like cognitive consolidation or learning, every organisation has cognitive and emotional filters and so on. With the learning architecture, as depicted in here, a tool is available that can be laid out over the organisation and help in categorising its memory aspects. The benefit is even increased in the simple fact, that the learning architecture is in fact not a new structure to be introduced. As said before, it is already in place, it just needs to become visible and thus subject to managerial control. The learning architecture, and with this conclusion the paper ends, is pointing in the direction towards a memory of the firm, enabling organisations as well as organisational theory to see "that memory is what makes our lives… Without it, we are nothing."

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