Towards the scientific integration of futures research and cognitive neuroscience

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The Challenge of Scientific Integration

◆ The scientific "self-understanding" of the futures research have improved since the1990. The contribution of Wendell Bell (1997).

◆ Available are now also rather good explicit and practical quality criteria for futures research: Standards of German Netzwerk Zukunftsforschung (NZF) Gerhold et al. 2015, Futures map and its validity criteria, Kuusi et al. (2015 a, b)

◆ However,the position of the futures research as the scientific approach among other sciences is still very unclear.

Why to integrate the scientific approaches of cognitive neuroscience and futures research?

- ◆ Provides the link between natural sciences and futures research.
- ◆ Like futures research, cognitive neuroscience has to take into account the mental sense-making beside "hard facts" of natural sciences.
- ◆ Helps to meet the challenge of artificial intelligence
- ◆ The sense-making is based on various learned systems of signs (semiotics e.g. de Saussure 1916, Peirce 1934), in the case of human beings first of all natural languages.

Deep learning algorithms of intelligent machines

- ◆ Machines learn like children to identify shapes and give linguistic interpretation to them
- ◆ Communication with human beings or other intelligent machines using (linguistic) concepts;
- ◆ Efficient sense making of non-linguistic signs e.g. emotional signs of the human face
- ◆ Highly efficient use of verbal and non-verbal information of the internet (the Big Data).

Future-Oriented Mental Time Travel (FMTT) as the recent theme of cognitive neuroscience

- ◆ "Seeing the future, theoretical perspectives on Future-Oriented Mental Time Travel" (Michaelian et al 2016)
- ◆ Twenty articles of the book nicely collect both recent empirical discoveries and theoretical discussion concerning FMTT
- ◆ According to editorial article "Research on FMTT has exploded over past decade, with over a hundred articles published in just the last five years".
- ◆

## Four basic concepts of the FMTT
(Szpunar et al. 2014, 2016)

- ◆ *simulation* :construction of a detailed mental representation of the future;
- ◆ *prediction* : estimation of the likelihood of, and/or one's reaction to, a particular future outcome;
- ◆ *intention* : the mental act of setting a goal;
- ◆ *planning* the identification and organization of steps toward achieving a goal state

Corresponding concepts in the Futures Map frame (Kuusi, Cuhls and Steinmüller 2015 a,b)

- ◆ Simulation: the construction of a picture of future or simply a future and the construction of paths of futures (scenarios)
- ◆ Prediction: is also related to scenarios because it does not make sense to give likelihood to a picture of future without some ideas how the picture will realize step by step.

Szpunar et al. do not see all aspects of "intention" and "planning"

- ◆ In the Futures Map frame, a counterpart of intention is vision. However, it defines just a picture of future or the direction towards which a user or a customer of the futures map likes to go. The good futures map describes many possible paths.
- ◆ The Futures Map frame makes the distinction between the planning and mapping horizons. The definition given by Szpunar et al. (2014, 2016) for planning is suitable to describe just choices inside the planning horizon.

Preferred futures

Vision

Acceptable

Now

Trend

Time

Planning horizon

Mapping horizon
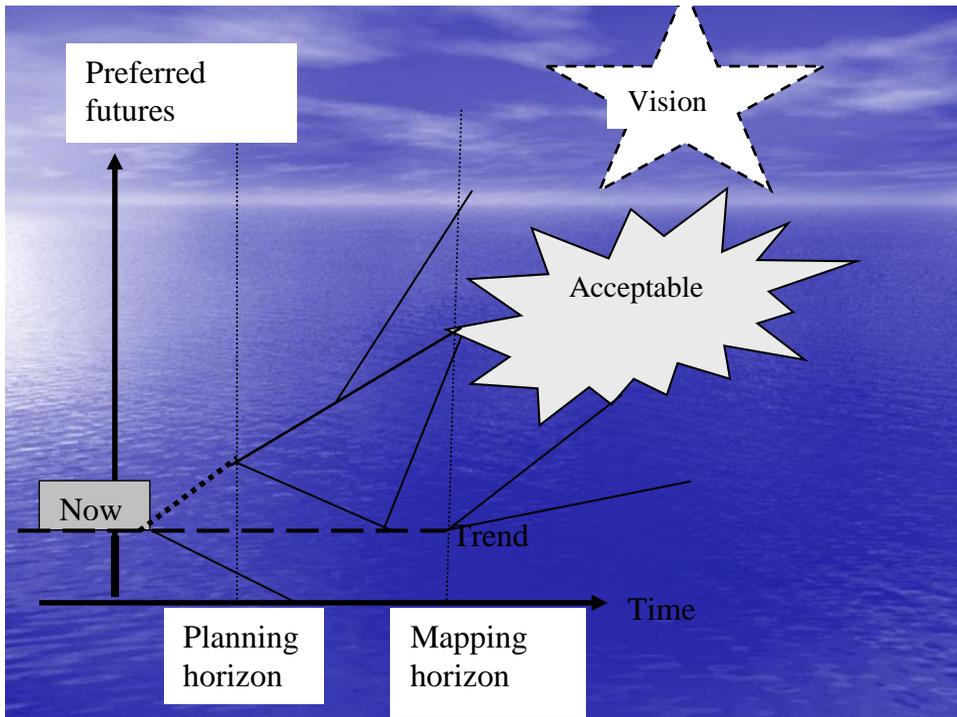
The FMTT discusses the future oriented thinking and choices of single human beings or single animals

- ◆ Instead of a single human being, the users or the customers of the Futures Maps are actors
- ◆ Concerning complex and wicked problems discussed in the field of futures research, relevant actors are various kinds of private or public organizations or groups of people, sometimes even the whole humankind.
- ◆ A group of very relevant future actors will be intelligent machines.

In the FMTT, Default mode network is active in the brain

- *Lateral temporal cortex:* the primary auditory cortex
- *Hippocampus*: dorsal serves for spatial memory, verbal memory, and learning of conceptual information; ventral functions in fear conditioning and affective processes
- *Dorsal medial prefrontal cortex (DMPFC):action based learning (e.g. social interactions between characters), planning and decision making*

Default mode network
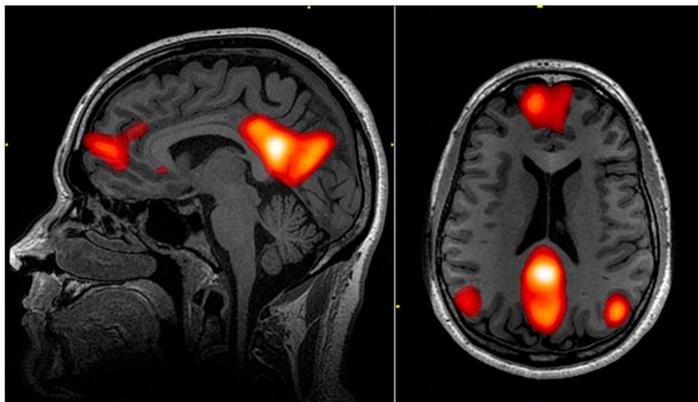
Elven Tulving (1972): Declarative memory

- Episodic memory consists of "temporally dated episodes or events, and the temporal-spatial relations" between these events
- Semantic memory was conceptualized as knowledge experienced as independent from the original source of acquisition, learned "invariances"
- Neuroimaging studies and brain damages have convincingly shown that episodic memories and semantic memories are located in separate areas of the brain.

Theories concerning the connections between episodic and semantic memories in the FMTT

- "scaffold hypothesis" : semantic memory provides an "empty scaffold" or frame that episodic memory fills with futures relevant personal content (e.g.Tulving 1995)
- most neuroscientists agree that some kind of "scaffold hypothesis" is valid, but there is little consensus about the process or the processes that combine past memories to futures oriented choices of people.
- The key role of the emotions

How emotions connect the PMTT and the FMTT?

- ◆ Both human beings and advanced animals seem to have similar emotions related to (un)pleasures of homeostatic needs (e.g. hunger), seeking, fear, rage, lust, care, grief and play (Panksepp and Biven 2012)
- ◆ A hypothesis is that the emotion of (expected) regret connects   the PMTT and the FMTT(Hoerl and McCormack 2016)
- ◆ The more covering hypothesis needs at least the distinction between expected regret and disappointment that Hoerl et al. (2016) do not mention.

The integration of the conceptual frames of cognitive neuroscience and futures research based on the General Frame of Consistence

In summary, key concepts of the GFC are:
- *not-learning being, (not genuine) learning being and genuine learning being (actor)*
- *criteria of sameness, falsification of sameness (learning) based on the general principle of consistence*
- *behavioral language and sense-making language*
- *reaction, action, plan, prediction, anticipation*
- *perceived interest, genuine interest, essence of being,*
- *capacity limits, capability limits and*
- *the invariance principle.*