

Chapter 2

Considerations Based on Behavioral Psychology and Cognitive Science

Abstract Subconscious processes, which are based on experience and which can be trained, control our behavior and follow an “internal reasoning”. They are shaped—among other things—by linguistic constructs. These subconscious processes form the “fast and intuitive thinking”. The benefits of this efficiency are associated with hazards such as prejudices, bias etc. Intuition is an essential resource of our cognitive system and can be influenced. The subconscious mind acts as an associative machine which works on the basis of pattern recognition. So we form our reality in a three-step process consisting of suppression, distortion and generalization. Associations and analogies are essential characteristics of intelligence. These aspects from behavioral psychology and cognitive science at the personal level can be used to support good decision-making and—in the context of the respective organization—they also can be used in the light of the metaphor of shaping “the subconscious mind of organizations” in order to cope with change, uncertainties and disruption.

Keywords Intelligence • Intuition • Motivation • Perception • Cognition • Pattern recognition • Decision making

When we want to contemplate the subconscious mind of organizations it is important and permitted to consider the subconscious mind of the involved actors of an organization first—of managers, of employees, of stakeholders, of the humans in their relevance for decision making mechanisms. Here we meet cognitive sciences and behavioral psychology. As we will see later, the extensive consideration of these issues is valuable while applying this on organizations and their subconscious mind and conscious mind in an analogy.

2.1 “Mind” and “Self”

The psychologists and neuroscientists, such as Antonio Damasio in his book “Self Comes to Mind” (2012) talk about the awareness and the large area of the unconscious. According to the above definitions, it is permissible—even in terms of behavioral psychology in the social and economic context—to define the realm of the unconscious, which is close to consciousness, as the subconscious mind. In the behavioral and psychological considerations in social and economic context it’s all about the particular interaction and mutual influence of the conscious and the subconscious.

In the mainly English literature from this area we also repeatedly encounter two concepts which I initially want to explain: “mind” and “self”.

“Mind”—sometimes synonymously described as “spirit” or “soul”—can be seen as a collection of cognitive abilities, skills, processes and properties that influence and allow consciousness, perception, understanding, thinking, judging and memory—applicable to people (the human mind, the human soul) and other forms of life. The “conscious mind” or “consciousness”—awareness—and the “subconscious mind”—the subconscious—are instances of this term. Psychology considers and treats all of the conscious and unconscious processes and actions. The subconscious also includes elements of the unconscious, such as values, beliefs, patterns, and a specific personal (subjective) map of reality—a model of reality.

“Self”—the self is a diversely used term with respect to psychological, sociological, philosophical and theological meanings—the sensation of being a unified, consistent, sentient, thinking and acting being in introspective sense. The self serves the reflection, reinforcing and emphasizing of the concept of “Me” (see Bracken 1996). C.G. Jung refers to the symbols of the self as a comprehensive expression of the totality of the psyche.

The cognitive scientist Damasio (2012) described the development of consciousness from evolution: Consider the awareness of animals as the processing of the images of the environment, which is carried out based on certain internal images. The self thus focuses the process of consciousness in dangerous situations. The dualism body-mind in such situations is also discussed in philosophy—philosophy discusses that specifically as “mind-body problem”.

“Mind” and “self” can—in analogy—also be applied to organizations concerning the formal as well as informal rules and the corporate culture on the one hand and the reflective, reinforcing and emphasizing processes focusing on the organization’s mission and business on the other hand—with the potential to foster entrepreneurship. The concepts of organizational behavior form a prominent research area in the US but are less prominent in the german speaking countries and mainly deal with the way employees are and can be influenced. It also deals with the influence and interrelationships of leadership, strategy, vision and mission etc. challenging how the mind, the behaviour and the performance of humans in an organization can be influenced.

2.2 Processes of Consciousness

When—in the course of evolution—the processes of consciousness have become more complex due to the benefits in evolutionary competition, functions such as memory, reasoning and language developed. It was possible to survey the near future, to delay reactions and responses—automatically proposed by the subconscious—in order to prevent or to enable delayed reaction and to allow not only an immediate reward and punishment, but the estimate of future benefits and drawbacks. This was also the beginning of the development of a socio-cultural homeostasis (“equilibrium”) and therefore of civilization, culture, art, science and research up to the contemporary social and technological achievements (see Damasio 2012). Applied on organizations it is interesting to evaluate the controlling processes on the respective level of an organization from this point of view: What has to perform in the realm of the conscious mind of an organization and what can be left to the subconscious mind?

2.3 Learning and How to Build a Mind

As learning is a key feature in Artificial Intelligence (AI) and as learning has an eminent role in forming one’s subconscious mind—and presumably also the subconscious mind of organizations—, it seems appropriate to look at this issue more closely from the viewpoint of cognitive sciences:

How do intelligent minds learn? Consider a child navigating through its day, bombarded by a kaleidoscope of experiences. How does its mind discover what’s normal and begin building a model of the world? How does it recognize unusual events and incorporate them into its worldview? How does it understand new concepts, often from just a single example? How does its mind emerge?

These are the same questions machine learning scientists ask as they are moving closer to AI that matches or even beats human performance. Much of AI’s recent victories are rooted in network architectures inspired by multi-layered processing in the human brain (Fan 2016).

Kumaran et al.—as scientists from Google DeepMind and Stanford University—published an update on what is the actual theory of how humans and other intelligent animals learn. Following this review paper in *Trends in Cognitive Sciences* (Kumaran et al. 2016) the Complementary Learning Systems (CLS) theory (McClelland et al. 1995) states that the brain relies on two systems that allow it to rapidly soak in new information, while maintaining a structured model of the world that’s resilient to noise. Applied to organizations this concerns the ever challenging question of what is really relevant for my organizations and what can be neglected as “noise”.

Given the discrepancy found when studying patients with damage to their hippocampus, it can be reasoned that new learning and old knowledge likely rely on two separate learning systems with the hippocampus being the site of new learning,

and the cortex—the outermost layer of the brain—as the seat of remote memories. According to CLS, the cortex is the memory warehouse of the brain. Rather than storing single experiences or fragmented knowledge, it serves as a well-organized scaffold that gradually accumulates general concepts about the world—it is learning.

Experiments with multi-layer neural nets, the precursors to today's powerful deep neural networks, proved that: Experiments with artificial learning systems showed that they gradually learned to extract structure from the training data by adjusting connection weights—the computer equivalent to neural connections in the brain. Thus the layered structure of the networks allows them to gradually distill individual experiences (or examples) into high-level concepts.

Similar to deep neural nets, the cortex is made up of multiple layers of neurons interconnected with each other, with several input and output layers. It readily receives data from other brain regions through input layers and distills them into databases (“prior knowledge”) to draw upon when needed. “According to the theory, such networks underlie acquired cognitive abilities of all types in domains as diverse as perception, language, semantic knowledge representation and skilled action,” the authors wrote.

Perhaps unsurprisingly, the cortex is often touted as the basis of human intelligence. Yet this system isn't without fault. For one, it's painfully slow. Since a single experience is considered a single “sample” in statistics, the cortex aggregates experience over years in order to build an accurate model of the world. Information stored in the cortex is relatively faithful and stable. It's a blessing and a curse—we need time to learn. Related to Artificial Intelligence networks that means that jamming new knowledge into a multi-layer network, without regard for existing connections, results in intolerable changes to the network. The consequences are so dire that scientists call the phenomenon is “catastrophic interference” (Fan 2016).

Thankfully, we have a second learning system that complements the cortex. Unlike the slow-learning cortex, the hippocampus concerns itself with breaking news. Not only does it encode a specific event, it also registers the context in which the event occurred. This lets us easily distinguish between similar events that happened at different times.

Following Kumaran et al. the reason that the hippocampus can encode and delineate detailed memories—even when they're remarkably similar—is due to its peculiar connection pattern. When information flows into the structure, it activates a different neural activity pattern for each experience in the downstream pathway. Different network pattern; different memory.

In a way, the hippocampus learning system is the antithesis of its cortical counterpart: it's fast, very specific and tailored to each individual experience. Yet the two are inextricably linked: new experiences, temporarily stored in the hippocampus, are gradually integrated into the cortical knowledge scaffold so that new learning becomes part of the “database”.

But how does that work? Scientists don't yet have all the answers, but the process seems to happen during rest, including sleep, the type of electrical activity that propagates to the cortex is called short wave ripples (SWR) (McClelland et al.

1995). When examined closely, the ripples were actually “replays” of the same neural pattern that the animal had generated during learning, but sped up to a factor of about 20. Picture fast-forwarding through a recording—that’s essentially what the hippocampus does during downtime. This speeding up process compresses peaks of neural activity into tighter time windows, which in turn boosts plasticity between the hippocampus and the cortex.

Following Kumaran et al. in this way, changes in the hippocampal network can correspondingly tweak neural connections in the cortex. Unlike catastrophic interference, SWR represent a much gentler way to integrate new information into the cortical database. Replay also has some other perks. You may remember that the cortex requires a lot of training data to build its concepts. Since a single event is often replayed many times during a sleep episode, SWRs offer a deluge of training data to the cortex.

SWR also offers a way for the brain to “hack reality” in a way that benefits the person. The hippocampus doesn’t faithfully replay all recent activation patterns. Instead, it picks rewarding events and selectively replays them to the cortex. This means that rare but meaningful events might be given privileged status, allowing them to preferentially reshape cortical learning.

“These ideas and this view on memory systems are being optimized to the goals of an organism rather than simply mirroring the structure of the environment,” the authors explained in the paper (Kumaran et al. 2016). This reweighting process is particularly important in enriching the memories of biological agents, something important to consider for Artificial Intelligence too.

The two-system set-up is nature’s solution to efficient learning. “By initially storing information about the new experience in the hippocampus, we make it available for immediate use and we also keep it around so that it can be replayed back to the cortex, interleaving it with ongoing experience and stored information from other relevant experiences,” says Stanford psychologist Dr. James McClelland. CLS has been instrumental in recent breakthroughs in machine learning (Kumaran et al. 2016).

I am convinced that these ideas and concepts might be considered when thinking about and designing and shaping the “subconscious mind” of organizations as well e.g. by emulating a “two-system set-up” by providing enough time and resources to make simulations of alternative decisions to be taken or to implement e-learning and micro-learning—possibly blended with simulations.

But let us first get an idea of how Artificial Intelligence is using these concepts “written by nature” [according to Fan (2016)]: Convolutional neural networks (CNN), for example, are a type of deep network modeled after the slow-learning neocortical system. Similar to its biological muse, CNNs also gradually learn through repeated, interleaved exposure to a large amount of training data. The system has been particularly successful in achieving state-of-the-art performance in challenging object-recognition tasks. Other aspects of CLS theory, such as hippocampal replay, has also been successfully implemented in systems such as DeepMind’s Deep Q-Network.

“As in the theory, these neural networks exploit a memory buffer akin to the hippocampus that stores recent episodes of game play and replays them in interleaved fashion. This greatly amplifies the use of actual game play experience and avoids the tendency for a particular local run of experience to dominate learning in the system,” explains Kumaran. “We believe that the updated CLS theory will likely continue to provide a framework for future research, for both neuroscience and the quest for artificial general intelligence”, he says.

To use this knowledge about learning, memory and experience for metaphoric views and source of analogy for considerations in management, leadership and everyday decision making seems highly relevant for individuals as well as for organizations as socio-technical systems.

So let us follow these ideas of 2 systems collaborating, of blending of memory and experience, of fast and slow and of building concepts as part of our minds later when we discuss what has to be considered when forming and shaping the subconscious mind of an organization (Chap. 5) and in particular when thinking about hybrid intelligencies (Chap. 6).

2.4 Decision-Making and Learning Processes

With progressive evolution of organisms, the subconscious decision-making processes could be continually managed and controlled in a better way and in particular the decision-making processes of humans improved through learning. There are two types of control: the conscious control and the unconscious control, which is partly developed under conscious control. In human childhood and adolescence there is a lot of time available to condition the subconscious processes in accordance with the conscious objectives and cultural conventions. Parts of conscious control are—figuratively speaking—outsourced to a “Subconscious Server”, and the control is taken over by the consciousness in “special” situations as Suhler and Churchland (2009) have convincingly shown.

Subconscious processes are thus becoming a suitable ability to control behavior and allow the consciousness more time and more resources for further and challenging tasks such as analysis, deliberation and decision-making. The consideration and decision-making however often are subject to numerous “biases”, “priming” and “framing”—biologically determined or culturally acquired prejudices, imprints and frames. The conscious control of awareness can reduce these negative effects, but requires attention and thus cognitive resources. Ap Dijksterhuis, a Dutch psychologist has demonstrated in an experiment with purchasing decisions for normal consumer goods on the one hand and major buying decisions (house, car) on the other hand that also unconscious processes are subject to “internal reasoning” and can lead to good results if the subconscious mind is well prepared by past experiences and training. There are not always exact considerations of possible advantages and disadvantages necessary (see Dijksterhuis 2006). This experiment demonstrates how powerful the right combination of subconscious and consciousness can be. The

decision is made consciously and efficiently at a reasonable cost, which takes place in the subconscious as some sort of “due diligence”.

Applied on organizations this emphasizes the importance of self-control and self-motivation of the people responsible of the teams and the organizational units. Thus to set the right goals, to establish good processes, an agile organizational structure and the appropriate incentives are key challenges to shape the subconscious mind for your organization.

If we practice something enough, we store skills, knowledge and expertise in the subconscious and are mostly unaware of the technical execution steps. I remind you of driving a car, as described in the preface, or the elite among musicians who—consciously focus on the expression and thus setting themselves apart from their competitors—with a good part of technical perfection “outsourced” to the subconscious. In a metaphoric view these considerations are also highly relevant for organizations as socio-technical systems.

2.5 The “Extended Mind Thesis”

Let us now “extend” the view: The “extended mind thesis” (EMT) suggests that some objects in the environment of a person are used by its consciousness in a way, that these objects can be considered as an extension of consciousness itself. The thesis goes back to Andy Clark and David Chalmers from (1998).

They have argued, that the assumption that our consciousness is “limited by cranial bones” is an arbitrary one. The separation between mind, body and environment is questioned. Because external objects and sources play an important role in cognitive processes, mind and environment, they are seen as coupled systems. It is seen as a key differentiator to traditional processes of interaction with the environment, when external objects are used in cognitive processes as part of an extended cognitive system. Thereby they pursue the same objective as the internal cognitive process. The critics argued, among other things, that this approach would lead to an exuberant, “inflated” concept of knowledge, because for example, a calculator would be seen as such an extension of the cognitive system.

As a result of scientific debate, a moderate revision of the “extended mind theory” developed, which relativizes the assertion of equivalence and complementarity of internal and external elements of cognitive systems and operations. The “extended mind thesis” has thus been granted an explanatory character and value in the consideration of cognitive processes instead of being regarded as part of the nature of mind and knowledge.

This discussion refers to the skills and cognitive processes of people. But it also shows that—in extension and in analogy to this modified concept of the “extended mind thesis”—the metaphoric approach of this book applying the analogy between the consciousness and the subconscious of human and the “conscious and subconscious mind of organizations” is a valid and consistent approach.

Organizations designed and developed by humans can be seen as part of the evolutionary process of mankind. The cognitive processes as there are perception, recognition, decision etc. are being changed by new technologies like augmented reality, visual analytics, decision support etc. The “cognitive” processes of organizations and organizational units as group of individuals collaborating in an organizational setting are even more undergoing massive change with the availability and the immersion of those new technologies. That can be considered as part of the “evolutional process” of our organizations we work and live in and of society as a whole. We also see this tremendous extension of our organizations’ “conscious and subconscious mind” in the increasing connectedness concerning cross enterprise business processes enabled by these ever more sophisticated and highly automated tools. More and more is bound to be part of the subconscious mind, which consequentially has to be shaped very carefully in order to prevent unintended effects.

The value of this approach should be reflected on the one hand in the design of this subconscious mind of organizations and on the other hand in the approach of “Rethinking organizations”. This will be detailed in Chap. 6 referring to so called “hybrid intelligence” as a concept for close collaboration between humans and machines.

2.6 Language and (Artificial) Intelligence

Language is one of the essential means of expression of our mental processes. On the other hand language and linguistic constructs characterize our thinking and are therefore part of our consciousness, but also of our subconscious.

Language and its representation in computer science also significantly shapes the development of information and communication technologies. Noam Chomsky was in this respect one of the pioneers of linguistics. Minsky (1988)—by the Society of Minds Theory—very early built the bridge towards the concepts of Artificial Intelligence. See the following two citations from Marvin Minsky in “The society of mind”: “Minds are simply what brains do” and “When intelligent machines are constructed, we should not be surprised to find them as confused and as stubborn as men in their convictions about mind-matter, free will, and the like” (Minsky 1988).

Alan Turing very early (about 1950) defined the Turing test as a benchmark for the assessment of whether or not Artificial Intelligence had been achieved. That too is an issue close to the Linguistics: A computer and a human interact under observation by a third party in the role of observer. The observer has to determine by questions, who is the man and who is the computer. If the observer is not able to reliably determine who the computer is, the Turing test (see Turing 1950) is considered satisfactorily passed. In science and near popular scientific use it is permissible to consider systems such as Apple’s Siri or IBM’s Watson and similar advanced developments to be “Artificial Intelligence”.

Aside from this technical importance of language as part of actual and future Artificial Intelligence, language and terminology are a decisive part in professional collaboration in and across organizations as basis for mutual understanding—thus also forming and shaping the subconscious mind of organizations. So the question in this book is how to shape this and how man and machine (AI) can collaborate in “hybrid intelligencies” with the human staying in the “driver’s seat”.

2.7 “System 1” and “System 2”—Thinking Fast and Slow

Kahneman (2011), the Nobel Laureate in Economics has outlined the basic principles of decision-making with a focus on the economic sector in his book “Thinking Fast and Slow”. He introduces the subconscious and consciousness in terms of the behavioral psychology to the decision-making processes in the economic sector by structuring System 1 (Thinking fast) and System 2 (Thinking slow).

System 1 as the fast system represents much of what we summarize under the term intuition. It is *inter alia* characterized by the following characteristics:

- Operates automatically and quickly
- Requires little or no effort
- Has no conscious, self-chosen management and control
- Develops surprisingly complex patterns of ideas
- Its instinctive skills we have in common with some of the wildlife
- Activities are exercised faster and run automatically
- Knowledge is in memory and is used without deliberate influence and without difficulty (the “preconscious”)
- Is subject to biases and influences
- Cannot be “turned off”
- Is subject to cognitive illusions.

System 2 as the slow, consciously working and thereby effort- and attention-requiring system is characterized by the following characteristics:

- Normally operates in a comfortable “standby mode”
- System 1 continuously generates suggestions to System 2, this forms then opinions etc.
- Is activated when an event is detected, the mental models are violated, which in turn are maintained and developed by System 1
- Assigns attention to difficult and laborious mental activities
- Is often perceived as subjective experience of reasoning, choice and focus
- Formulates thoughts
- Has the ability to change the way System 1 works
- The capacity of attention is limited
- Is responsible for self-control—but with limited capacity

- Has the final say in the decision
- It is easier to see the mistakes of others than your own
- Everything that consumes capacity of this “memory” reduces our ability to think.

So the benefits and risks of intuition as an essential element of the decision making become clear. Applying this concept to organizations in an analogy leads us to a better understanding of the way organizations work and to numerous ideas how to shape the subconscious mind of organizations facing the new emerging technologies especially in the border region of the conscious and the subconscious of your organization.

2.8 Decision Making—Cognitive Typologies

The self as a parent concept of psychological description of an individual is structured by Kahneman (2011) in two types: the “remembering self” and the “experiencing self”. The experiencing self “leads the life” and would, for example, try to prevent pain or at least keep the phase of pain sensation as short as possible. The remembering self would choose which were the positive and less negative connotations in the memory. In remembrance of the duration of a painful phase for the intensive though short moment of achievement for example, the painful phase gets easily “forgotten”. People identify more with the remembering self and try to establish “their story”.

So Kahneman derives two typologies in the decision-making process: the fictitious “Econ” as living in the theory of rational decision, as the Chicago School of Economics with Milton Friedman and the laissez-faire approach under the postulate of freedom of choice (“free to choose”) has characterized it. On the other hand, he characterizes the human, living in the real world as the “Human”, which can not be rational, which is repeatedly exposed to the traps of intuition. The “Human” can be greatly influenced by the presentation of decision documents and products. In these different typologies the dilemma of behavioral economics becomes clear, namely that the “Humans”—especially customers and consumers—need protection against the exploitation of their weaknesses (especially System 1). The behavioral economics does not believe the total rationality and puts questions whether to establish protection mechanisms, such as “Unsafe text” in small print or opt-out rules rather than opt-in rules (for example, Electronic Health Record in Austria, Obama Care, etc.).

Apart from these general considerations and systematization and structuring on the path to good decisions numerous dangers are lurking (Kahneman 2011):

- In general the law of least effort applies even when the resources of the brain are—whatever is possible—delegated to System 1
- The attention represents a limited resource and cognitive ease is preferred

- Intuition is an essential resource of our cognitive system and can be influenced
- The subconscious mind acts as an associative engine that operates on the basis of pattern recognition
- Cognitive relaxation promotes creativity, whereas blocks of the mental resources during cognitive stress impede good decision
- Confidence, Overconfidence, trust and “priming” and a misleading frame in the decision making (“framing”) are common causes of errors even made under conscious control (System 2). That can be avoided by self-critically switching to System 2 and—at best—by modifying System 1 and therefore establishing a learning process.

I am sure some of these points trigger association with an organization you know—not only with single persons and their behavior.

As far as single persons are concerned, this raises the question of how far this thinking and decision-making processes can be approximately made aware by measurement and feedback and can be made conscious and improvable. One way is to offer so-called “Eye Tracking Glasses”. These are new methods for measuring eye movements, for example, when looking at a shelf in the supermarket. A monitor displays in real time whether objects are seen and whether they are also perceived. Mental processes such as concentration and stress can be tracked over time. In test patterns and with test video the ability to focus on surprising details is tested. At the same time the users of such tools learn that “to see” is not equal as “to perceive”. In the scenario of an accident you probably hear the phrase “I looked, but I did not see”. It is an expression, that though he sees traffic signals, he has not realized that link just as being relevant for behavior. In this case he was distracted and not focused. Also the human aging process can alter perception and attention.

The analysis of facts and data is characterized by the ability to create statistics and graphs and interpret them. The creation of representations and statistics is also often a given opportunity to manipulate something in your own sense. Often subtle methods are used, which are not obvious, clumsy attempts to manipulate. Here a great deal of attention should be applied. The analysis is, as Kahneman says, not trivial, but an error-prone activity, since many potential pitfalls of System 1 are threatening the analysis. Often biases and prejudices, imprints (“priming”), contextual references (“framing”) etc. influence analysis unconsciously. The saying “do not trust statistics that you did not create yourself” has a core of truth.

A lately arising new term in this context is “Neuro Business” (see Brown 2013). While we have learned to behave logical and rational in our daily professional decision making in our organization, we should also be aware of how much the human irrational momentum controls us in professional decisions. We have something like an “action mindware”, which is marked by our life experience and shapes our motivation in the decision situation. Accordingly, our perception filters are set. Behind the constellations of our value systems are the personal attitudes and the beliefs of the people involved (here not the faith in the religious sense is meant). Ultimately, it is—still largely until today—always the humans who make the decisions.

Most of these patterns of behavior are also applicable on organizations where humans are embedded in a set of structural, organizational and technological settings like Artificial Intelligence etc. thus forming a “subconscious mind of organizations” which interacts with the conscious activities performed by the organization or organizational units. You easily can imagine, that it is possible to design and influence the subconscious mind of the organizational units or organizations as a whole.

2.9 Coping with Uncertainty

This book is mainly about decision making. We try to predict the future as best as possible and new technologies support this with tremendous progress e.g. by enabling algorithms that support simulation, prediction, machine learning etc. Digital analysis is capable of making things and connections visible which otherwise would remain invisible. Control of processes, individuals, organizations etc. resides in knowing what is likely to happen in the future. Personalisation has become the new normality—both are about control. Taming of chance by combined probability theory with big data has progressed, but the individual remains a random variable. “Predictive analysis und performativity of big data have become possible because we succeeded linking the individual with the aggregate level” Eva Nowotny says in her book “The Cunning of uncertainty” (Nowotny 2015)

Risk management proliferated by transforming the unknown into something known by converting danger into a risk that could be calculated and hence contained. Risk is conceived as evaluation of a potential loss. It has become mandatory to anticipate, assess and wherever possible integrate risk management in the development of technology. Risk has become a known unknown, which one would like to know.

Regulatory systems everywhere increasingly rely upon the control of control—self-checking, self-reporting arrangements in line with performance objectives, measurement and monitoring. Based on the feedback their performance objectives are iteratively adjusted anew—they follow the logic of performativity: a model validating itself in the sense of making itself successful. The borderline to the phenomenon of the self-fulfilling prophecy is a slim one.

“The real problem is that technological risk often ignores social risk” Nowotny says. “Data are the thin description of the self; the perception, self-awareness, self-confidence and doubts are encoded in the thick description of the self”. In the past identities were formed and transformed through bureaucratic processes like in communism. Now there are different political processes on their way like autocratic regimes that try to control everything by using technology, that promised endless diversity and freedom a few years ago. Think of the “arab spring”. Today we know that facebook, Google etc. can also be used—with their underlying and self-optimizing algorithms—to create and control perception as well as cognition of information consumers of the relevant target groups by encapsulating them in a

“filter bubble” or “echoe chamber”, where peer groups or political parties (esp. populist parties) can establish some sort of “social bubbles” that seem to be sustainable in the sense of their creators. These are simply using the inherent mechanisms of social media and exploiting the low skill level of the users concerning how to critically deal with information overflow and evaluate the origin, the aim and the quality of the given—or even pushed—information.

“In the end only uncertainty can explain profits and losses”, Nowotny remarks. The complexity of the system is the real power base of uncertainty. On the other hand human behavior especially of individuals often escapes predictability.

The onset of extreme events escapes prediction as well—special mechanisms of self-organization can be phase transitions, bifurcations, catastrophes or tipping points. So an individual person as well as organizations tend to be open to decisions following gut-feelings and momentous intuition. That’s where the subconscious of the individual as well as the subconscious mind of organizations comes into play. Trying to perceive an organization in its specific environment and its internal and external connectedness in this way will help to manage complexity and handle uncertainty—hopefully resulting in a resilient organization.

Another question is: How relevant is the past for the future? The non-deterministic answer hopefully is: The unexpected is lurking behind the next corner and the odds for tomorrow lie in the future that is radically open—and thus uncertain.

“Complex systems cannot be left to themselves, they require a new kind of ethos arising from a sense of responsibility for being part of the whole”, Nowotny says (Nowotny 2015).

Finally mechanisms must be in place that permit errors and allow performance to fluctuate, so that resources can be managed with a sufficient degree of freedom—more you can read in the chapter about how to form the subconscious mind of an organization.

So in the end uncertainty is an important quality of our civilisation we hopefully will never escape. The taming of chance will thus hopefully never succeed. Going back to a main source of uncertainty—to the individual person and its subconscious as a foundation for the metaphoric view on the subconscious mind of organizations—this leads us to decisive elements of the human psyche: Motivation and Intuition.

2.10 Motivation

“Neuro Business” tries—under the “umbrella” of the keyword neuroscience—to put in the center the role which rewards and punishments play in influencing the subconscious mind of the people involved and the role that motivation plays in this context. The correct approach is that it can be assumed that the brain and especially our subconscious in its “programming” does not distinguish between business and personal decisions. This should also be aware in all decisions concerning staff selection. Nobody has the same “mindware” as his colleague. Everyone forms his

reality accordingly (see Brown 2013). From the wide variety of possible realities we choose our reality based on what is familiar to us and familiar to what seems convenient and easy to us and what we expect. We form our reality in a three-step process of displacement, distortion and generalization.

Sprenger (2013) examines motivation fundamentally and dispels many myths—especially the value of the extrinsic motivation. He contradicts the widespread credo that the motivation of the employees is an important task of the manager. Motivation actually has a high impact on the success. Motivation of people depends to a high degree on communication. The extrinsic motivation through incentives and—“false”, in the context of motivation often “seductive”—communication cannot and must not replace or even try to replace the intrinsic motivation. Sprenger makes the point by saying: “Instead of moving people in an endless loop of incentives to the desired behavior, he should be better taken seriously; to perceive him in his being as he is and to communicate your expectations on him”. “Do not seduce—challenge him” should be the motto. The will to perform is given to all humans. Recognition for performance in family and social—and therefore also organizational—environments are key motivators. The dimensions of performance are the willingness to perform, the ability to perform, competence and the opportunity to perform. Motivation for performance is the responsibility of the employee and not of the manager of the employee. The ability to perform can be raised by education, training and the granting of opportunities to gather experience, partially promoted by executives. The recruitment of personnel has a major impact here. It is key to offer opportunities to perform and that means also to urge performance and agree upon that. Goal setting and the associated process of consensus building are essential and not so much the goals themselves. They are a basis for ensuring that the willingness, the ability and the opportunity to perform are given and that the decisive motivation—self-motivation—arises. Missing opportunity to perform over a prolonged period also destroys the motivation and self-motivation. Performance is not something absolute, but more a matter of expectation.

How these aspects of leadership, like motivation in an organization with its methods, traditions and “culture” are dealt with, and how they are in interaction with the purpose, the vision and the objectives of the organization, forms an essential part of the subconscious mind of organizations. That will be worked on in detail in this book in Chap. 5 where the “shaping” of the subconscious mind of organizations is elaborated.

2.11 Intuition

Few terms in psychology, cognitive science, and also in the considerations for decision making in general and decision-making under stress in particular is so close to the subconscious mind and is so closely associated with the subconscious mind, as “intuition”. This term and this phenomenon “intuition” is also highly relevant in an analogy as the “subconscious mind of organizations”. From a special

behavioral psychology perspective, it was also considered in the reflections on “Thinking Fast and Slow” according to Kahneman (2011) in describing System 1 and System 2.

In the psychology of Carl Gustav Jung intuition is a basic psychological function that allows a perception of future developments with all its options and potential. It is mostly perceived as instinctive detecting or as emotional idea or hunch. The concrete intuition mediates perceptions that affect the reality of things. However, the abstract intuition mediates perceptions in idealized contexts. With Jung’s intuitive type of character, a fusion with the collective unconscious often emerges (see Jung 1995).

Understood as basic human skill, intuition is the key ability to process information and to respond appropriately to great complexity of the information that has to be processed. This very often leads to correct or good results. There are two different levels of intuition when decisions are taken: The decision based on emotion and feeling and the decision based on an intuitive mind (incubation). The information is processed unconsciously and awareness is “turned on” when the subconscious encounters a solution. Intuition does not necessarily mean an immediate solution; often it helps to sleep a night on it.

Kirsten Volz from the Max Planck Institute for Cognitive Sciences in Leipzig examined intuition using an MRI device (magnetic resonance imaging) (see Spiegel 2007). In Volz experiment she projected incomplete images of everyday objects—each for 400 ms—on the glasses which her 15 probands in the MRI tube were wearing. In some pictures the outlines of the objects were filtered out, so that the objects looked like processed with an ink eraser. When the probands recognized an object, they reported with the touch on a button. From this, the medial orbitofrontal cortex was revealed as “something of a connection device that reviewed the incoming information to see if the brain knows something like this.” This region of the brain was more active the less of the original drawing could be seen, because it meant more work for the orbitofrontal cortex. When this region signaled, that there really was an object, another brain structure has been activated—the gyrus fusiform —, which is responsible for object recognition. Only then the probands pressed the button. This division of labor between unconscious and “consciousness” of future activity accelerates the decision because the “gyrus fusiform” thus has access to the “tacit” knowledge, “sunken” in the orbitofrontal cortex.

This fast, pattern-recognizing and constructing brain activity becomes more important the more complex the environment and the more disjointed the information. Without their hidden “tacit” knowledge humans would be hopelessly overwhelmed.

“The mind, that people are using to make wise decisions supposedly is limited, accounting for only a small part of our actual knowledge,” says the American intuition researcher Milton Fisher. “Nevertheless, when we have an intuition this is the retrieval of information that we have perceived and stored sometime through the five senses” (Spiegel 2007).

As about 40 sensations simultaneously reach the brain, the constant input is therefore diverted to another memory: the subconscious. “And sometimes from this

wealth of knowledge a small scrap of it penetrates the consciousness.” “Then we have an intuition”, the psychologist Fisher says (Spiegel 2007).

“The intelligence of the unconscious is to resort in any situation to the appropriate rule of thumb”, the psychologist Gigerenzer (2007), director at the Max Planck Institute for Human Development in Berlin says. Commonly, especially during difficult decisions, people seem to trust their analytical mind much more than their gut feeling. “Most of us accept that it is unrealistic to assume that you have unlimited knowledge and unlimited time to choose one from many options. On the other hand, we are confident that we would make better decisions without these restrictions and with more logic” Gigerenzer says. “Good intuition ignores information,” says Gigerenzer. “Who wants to be intuitive, should allow himself no opportunity to reflect on his actions”. Often the opportunity is missing anyway—such as when emergency physicians must care for accident victims and every minute counts (see Gigerenzer 2007).

But on the serious side of life “newbies in a field rather should deliberate and analyze all the possible consequences of their actions thoroughly”, recommends sports psychologist Markus Raab of Flensburg University. “Only those who have already gathered experience in a field should rely often on their intuition.” “A theory training, in which the players are challenged with many alternatives, does not work”, Raab concludes from his experiments. His advice to athletes is: “Collect as much experience as possible” (see Spiegel 2007). From my experience the same applies on professional business and organizational context.

How can we provide information with context to the actual situation of decision—for a single person to decide or for a group or organizational unit to decide? Which conditions should be provided to achieve best possible results with reasonable effort? This will be further elaborated in the chapter on the design of the subconscious mind of organizations.

The problem with the unconscious is that depending on personal experience, the rules of thumb of intuition can also include prejudices. An intuitive guidance of whether our perception is distorted or not, does not exist. That’s the point, when intuition can become a pitfall. And that is the reason why people fall particularly easily into this trap, when it comes to themselves and it is not “only” an external affair.

The German chess grandmaster Stefan Kindermann has his experience in the use of intuition in chess. For decisions in complex situations in organizations he created a 7 step decision model—“The Royal Path”—where he covers the range from providing clarity concerning the environment of the decision situation to the generation of creative ideas as well as to forward thinking followed by backwards reflection guided by the key values of the organization (see Kindermann and von Weizsäcker 2010, it will be described in more detail in a later chapter). Hofstadter et al. declared in the book “Die Analogie—das Herz des Denkens” (Hofstadter et al. 2014) (engl. “Analogy—the core of cognition”) associations and analogies as an essential feature of intelligence: “Every concept in our thinking owes its existence to a long series of analogies, that have unconsciously emerged over the years, and they have already contributed to the origination of the concept. The analogies have

enriched each concept in our thinking throughout its existence. In addition, at every moment of our lives we get our ideas of provoking analogies, that the brain—by trying to tap into using the old and the new and unknown acquaintances—incessantly produces”. Analogies are from this perspective also foundation and building blocks for intuition.

Intelligence is the ability to rapidly detect deep analogies and the ability to put our finger on the essence of a situation within a short time. For example, first mathematicians let themselves guide from vague intuitions and insights before. Afterwards they justify their actions and fill the gaps among others with logic (see Hofstadter et al. 2014).

How can we support opportunities for fruitful intuition in the setup of our organizations and the infrastructure of our organizations as building blocks of their subconscious mind? Is it only a matter of the experience and the quality of the individual person involved? Or is it the set of conditions the organization provides?

2.12 Is There a Subconscious Mind of Organizations?

In the light of new technologies our perception and our perception filters are in the process of change from an individual’s point of view as well as from an organization’s point of view. They thus shape the subconscious mind of an organization in this ever-accelerating business environment we are in.

This subconscious mind of organizations is more than the (conscious and subconscious) behavior of the interconnected individuals of an organization. The infrastructure of the organization—constituted in formal and informal rules, the communication channels and networks, the information systems, etc.—get a new and more powerful meaning. All the more important it is therefore to condition the subconscious decision processes and to build, form and shape this subconscious mind of an organization proactively.

How these aspects from behavioral psychology and cognitive science can be used at the personal level for good decision-making and how the context of the organization—also in the light of an analogy to the subconscious mind of organizations—can be affected positively, is elaborated in the model of the subconscious mind of organizations (Chap. 4), and particularly in the design, building, forming and shaping of the subconscious mind (Chap. 5) before concluding in the considerations of organizations emerging as “Hybrid Intelligences” from the Digital Transformation (Chap. 6).

Beforehand I will describe components of the infrastructure of organizations, including the relevant new technologies in their impact on the design of the subconscious mind of organizations and particularly the relevant information and communication technologies. Dear reader if you are already familiar with these technologies you can go through the following chapter more quickly.

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Digital Transformation Shaping the Subconscious Minds
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Leodolter, W.

2017, XXI, 254 p. 20 illus., 5 illus. in color., Hardcover

ISBN: 978-3-319-53617-0