An animated animal?

1. Introduction

Blueish concentric circles are outlined against the uniform bright sky. One area in the centre of the circle is clearly brighter. It must be just before dark, because the area is right in front. A strong sweet smell becomes noticeable. It is the main point of orientation, because the surrounding area is rather vague and only visible in blurred contours. There is a black leaf with a dark purple track. The sweet smell is now becoming very strong. A buzz, becoming louder and louder, is recognized by the hollows of the knees and breaks the silence. Danger? Better step unto the leaf. The soles of the feet are perceiving a sweet taste. The eyes are now seeing the purple track well-defined. The antennae are directed at the source of the smell: the nectar. Now put out the long tongue and suck it up. That is what honeybees do.

Every living being is equipped with the instruments that enable it to function as well as possible in its environment. It is the result of the selective effect of evolution. Besides, in a honeybee (weight 0,1 grams) (Gould and Grant Gould, 1988) all the specific instruments are made to be carried along and interpreted easily. For instance, a honeybee has facet eyes, with which it can distinguish the colour spectrum from yellow to ultraviolet. So it sees the colour red as black. The eyes are highly myopic. In fact, to see at greater distance, the bee would need a pair of glasses with dioptre strength of minus 13, but within one to two centimetres its sight is fairly good. That is enough, though. It can perceive polarised ultraviolet light, so that the position of the sun can be determined, even on a cloudy day. Sound can only be heard in a few frequency bands. One of which is the (high) buzzing of bee wings. The 'ear' is situated on the joint of one of the legs. The smell is well developed. Contrary to humans, bees are able to distinguish appr. 700 different flower scents and they can also smell water, oxygen and dead bees. With the soles of their feet they can taste to a certain extent. For orientation and navigation bees will use the magnetic field of the earth. Nobody would doubt the fact that the world view world view of a bee differs dramatically from ours.

The description of the human world view by a bee, would also reflect great astonishment, about the limitations as well as the extras. It is just very self-evident to consider one's own world view as the world view. What our senses report may contribute to our view of the world, whether or not due to our (emotional) reaction to it. Except that our senses cannot tell us all about the world - there are no eyes in the back of our head - it is uncertain that what they tell us is always correct.

In fact there is more. Not only do bees and humans have a different world view, they also react differently. It is not that the organizational problems are so different Bees also have to eat, drink and rest. They have to raise their young, that have to be cared for during one third of their whole life. An elaborate division of tasks is required to fulfill all tasks that are necessary for the

survival of the colony. They have to communicate to make their needs known and to share out the tasks. In a colony they need to distinguish foreign bees from bees of their own colony and react differently to foreigners. The seasons should be approached properly with balanced behaviour, they have to build a home and know how to hibernate. They should be able to orientate themselves outside the hive and remember their way home somehow or other. If necessary they will attack enemies and defend themselves. In short, the problems that have to be solved for a communal life are very much the same. Evolution, however, did its job also here. In our opinion, a greater part of a bee's behaviour is controlled by genetically determined instincts and pheromones (aromatic substances stimulating the instincts). In humans, conversively, behaviour is determined by free will, anyway that is what most people think, but is it? That's what this plea is all about.

Differences and similarities have been observed between bees and humans. Few people however will consider that bees have a conscience or emotions. If they should have them one way or another, we would certainly not be able to recognize them. We are unable to surpass our own perception that far. On the ground of further analogies we can speculate how far comparing would get us, but there is not much point if we don't have a clear image of what exactly is going on. What has evolution done to us? It seems highly unlikely that we came into this world as a blank. What did our genes do to us? What is it that we are experiencing? Do these experiences have a function in our existence? What does our 'reality' looks like? These are all questions that belong to the field of psychology. It would surpass the intention of this argument to try and answer every question. Here we will confine ourselves to three areas that are important for the remainder of this argument.

First we will draw an image of our world view and the possible origin of our motives. What of it is conscious and what is subconscious? In what way do we react to it? Then we will make an excursion outside to the possible evolutionary origin of some developments in our brain structure and the results thereof. In conclusion some aspects of conscience, including thinking and will, will be discussed in so far as they are of importance for this argument.

2. Our world view

As long ago as two hundred years, it was Immanuel Kant who realised that our world view might be deceiving us. In his book Kritik der reinen Vernunft, that he published in 1781, he indicates how - in his opinion - reality and human insight are related. Without congenital templates of perception (apriori's), with which we can have a go at reality, we will not succeed to get some grip on reality (see 1 Kant on perception). In contrast to Locke and Hume, who believed that the human mind starts as a blank that will be covered by its environment, Kant thought that there are congenital structures, determining what we perceive and how we perceive it. Afterwards it became clearly obvious, that, as Kant assumed, time and space are playing an important part here. The structuring goes unconsciously, but often we are aware of the result because we have to do something about it.

The subconscious part not only means structuring, but also an attempt to identify. We will compare the structured part with what is known about it in our memory and what it means to us. Here a second principle comes into action, namely the (emotional) relevance for our existence of what we perceive.

Kant on perception in ***"Kritik der reinen Vernunft"***,1781.

Kant argues that there is a reality that is independent of us, the cause of numerous perceptions that our sense organs receive. That is, however, the only thing we can say about this reality. The perceptions, per se indefinable, without structure or meaning (Kant mentioned a 'stirring' of perceptions"), are processed by us, the observers. And that in two levels, in two processes that we are able to distinguish, but that we, in fact, cannot separate. First of all there is the process of perception itself. According to Kant our perception is formed by space and time. We can only perceive in space and time. The difficulties we run into if we interpret space and time as being absolutes, Kant is trying to solve by claiming that they do not exist actually, nor are characteristic of objects, but that they are forms of our perception. Space and time are not derived from the reality on the outside, but are supplied by ourselves. We use them to organise and structure the sensations our senses receive. Space and time are necessary apriori's, subjective frames of perception. Subjective not in the sense of 'different per individual', but conditions for all perceiving subjects to perceive anything whatever. Space and time are the first moulds we use to give shape to the chaos of 'information'... The thus structured data are then organised into a thought process. We cannot perceive without thinking; and we are thinking by way of apriori forms of thinking. This made Kant to claim that the order in world or nature is not naturally; but that the order is brought about by our own mind...We do not know what reality really looks like, because our perception, our knowledge of reality, is an image of reality constituted by ourselves. We only know that there is a reality that one way or another provides us with an abundance of information (perceptions). Thus a duplication of reality has occurred: reality as it is, but cannot be recognised by us (according to Kant: 'Ding-an-sich'), and the reality as we see it, and talk about with each other. This is the empirical reality as we experience it, commonplace or scientific, but transformed by our consciousness. The structure, with which we cover reality-an-sich, is a human structure, typical for our knowledge. We cannot remove those glasses. Nevertheless this reality may be called objective, because every human being shares it.

1:Kant on perception.

In his book Kritik der reinen Vernunft Kant mainly concentrated on reason and consciousness. He was concerned about the meaning of things. However, perceiving reality also has another side and that is the (emotional) relevance it has for us. In fact, every perception, every experience, consists of two parts; one is its objective or common significance and the other is its subjective or individual significance. The objective or common significance will not go beyond recording, while the subjective or individual significance tells us what to do with it, whether we have to respond to it and if so, how we should respond to it. That is the (emotional) relevance is has for us. Psychology concentrates on the latter and because of that psychology is not experienced as an exact science, because an exact science is mainly concerned with structuring the (objective)

significance of perception and events. For individual (emotional) relevance there is often no room.

3. Qualia.

It is not impossible to explain to a colour-blind person what 'red' is. Amongst other things it is the colour grey he sees when red light, better still, electromagnetic waves with a certain frequency, are striking his retina. These waves have specific, measurable characteristics distinguishing them from other waves, so that they can be identified and reproduced. They are able to transfer a certain energy etcetera. One can also explain that many people experience the colour red as being 'warm' and have certain feelings when they see a red sky at night. And that being 'red with anger' indicates the vehemence of the anger. This could also indicate that the redness of red is more than the physical explanation and also answers to its emotional value for the individual human being. We fail to grasp why this emotional value of red is warm or vehement. It seems to be the result of an often subconscious process. The how of red is obviously completed with the why of red. Only when the colour blind person would really be able to see red after an operation, he could also really experience this connection emotionally(Dennett 1991). It appears to be nearly impossible to explain to somebody else what we feel when in serious pain. In our vocabulary we only have general labels for it. Someone else can interpret those labels fairly reasonable and - at best - will complete it with his own experiences. There is however no guarantee that it matches my sensation of pain. Sometimes artists are able to transfer feelings by using the more - often subconscious - (emotional) relevance of words and their underlying concepts, instead of using the conscious (objective) significance. However, in that case, we still don't know whether it is our own interpretation of the sensation concerned, that the artist has expressed so aptly or whether it is really his sensation. In psychology these intangible, individual sensations are called qualia, the redness of red, the 'painness' of pain. Qualia are the specific feelings that are consistent with the (emotional) relevance. The following experiment also proves that qualia and (objective) significance are different aspects of a (word) concept.

Gazzaniga and LeDoux (LeDoux 1996) are describing a patient P.S. with surgically separated hemispheres (split-brain) to restrict the attacks of a certain type of epilepsy to one hemisphere in order to increase the chance of survival. Thus the hemispheres cannot communicate anymore and are operating practically independently? The functions of the two hemispheres, however, are not similar. By splitting the brain, certain functions become inaccessible for the other half of the brain. Generally speaking we can only read words by way of our left hemisphere, but this patient was able to read through both hemispheres. Though he could only speak through his left hemisphere and tell what happened there, so he could not tell what happened in the right hemisphere. When he was given (emotional) stimuli to the left hemisphere P.S. could tell what the stimulus was and how it felt; whether it was good or bad, for instance mother - good and devil - bad. When these stimuli were given to the right hemisphere, the left hemisphere could not tell what it was, but the left hemisphere

could tell whether it was good or bad. One way or the other the (emotional) relevance had leaked to the left side, while the actual (objective) significance of the stimulus remained unknown. In all probability, the stimulus bifurcates through two paths in the right hemisphere; one to the (objective) significance and the other to the (emotional) relevance of the stimulus. The latter could still reach the left hemisphere. Apparently the (objective) significance and the (emotional) relevance are processed along different ways, although they are both part of a stimulus. The fact that different aspects of a phenomenon are processed separately is not uncommon. Visual images appear to be examined for colour, form, movement and location in order to be integrated again afterwards.

4. Functional systems.

An aspect that often is under-exposed is the multiplicity of brain functions. For good reason the Dutch language uses the word *'hersenen*', a plurale tantum which puts it way ahead of most other languages as regards clarity. Our brain consists of a wide range of functional systems, that indeed have a number of functional characteristics in common, but that are clearly different in their effect. (See also: 2 Functional systems.) Every single functional system is the current final product of an evolutionary development. One may think of primary needs like hunger, thirst, sex, sleep, but also of functional systems for pain, balance, fear (escaping danger) etcetera, and even of socially orientated functional systems including empathy and care, shame, guilt, jealousy, etcetera. New functional systems will develop because existing functional systems are also being used for other purposes, whereupon evolution provides the new target with an adaptation of its own. In creating functional systems, evolution obviously often takes existing methods as a starting point. There is less need for mutation compared to totally new developments, which results in a pretence of similarity. Every functional system contains memory in some form. However, the memory for the functional system for fear and that for the functional system for hunger are not accessible to each other, because they are recorded on different locations with their own symbols that are specific for their own functional system. In fact it is plain nonsense to talk about 'one's memory' without mentioning what functional system it belongs to. One may have a good memory for figures and a bad memory for music. In general every

Functional systems.

In general, functional systems have a so-called homeostatic function, i.e. that they record deviations of a rule, laid down in some type of memory, and then try to restore the point of departure again. They consist of two separate parts, namely a perception part and an action part that both may undergo a development and may be adapted as required. Here, many functional systems are using the central nervous system that may take over some control and memory functions. There are also, however, functional systems that are working roundabout the nervous system. Our immune system, where a certain type of leucocytes is the seat of the memory, is a good example. Various metabolic systems are also working as autonomous functional systems.

2: Functional systems.

functional system has its own specific memory that is optimized for it. This was also argued already by Schacter (Sherry and Schacter 1987).

It is a pitfall to generalize the similar characteristics of different functional systems and consider them to be one and the same independent quality.

Therefore, it is better to think in terms of separate functional systems when studying the human characteristics rather than in terms of their similar characteristics. Anyway, this doesn't mean that the functional systems will not show similar patterns, as indicated in section 7. Functional systems diagram.

Many of the various functional systems are operating side by side. One may be afraid and keep one's balance. This shows that the functional systems are nearly independent. They may operate automatically and subconsciously, as far as they do not need each other and their implementation does not raise questions. Most symptoms of fear, including growing rigid, increased heart rate, and transpiration, appear before we become aware of the cause of our fear. The evolution created functional systems that, if necessary, become effective very fast. Other functional systems are subconsciously at the beginning, but become conscious very soon, because choices have to be made, e.g. the systems controlling hunger and sleep. A sequence of necessary actions has to be determined. This is not necessary with subconsciously working functional systems. Some functional systems are triggered by external stimuli, others by internal stimuli or by both. Our control over the triggers is much less than we think.

In addition, different functional systems often have their own specific symptoms of disease. In general these can only be remedied by intervening in the system itself, and not by taking general measures. One of the features of alternative medicine is that it applies methods that are successful in specific functional systems, also in other systems, even when there isn't any justification to do so. The equivalent qualities of different functional systems are put in the same category. Thus, if anorexia is a disease of the hunger system, therapies for psychological trauma often will be less successful. Because little is known about the hunger system, sometimes alternative methods are reverted to. Maybe we should pay more attention to the signals of the hunger system from the brainstem, to the effect of addiction, or the effect of the hormone leptine, rather than to traumas of the mind. The study into its background isn't yet finished off.

5. Functional systems and evolution.

The fact that relatively independent functional systems are existing side by side is a logical result of the principles of evolution. The present species owe their origin to the capacity of their ancestors for genetic adaptation and development. The capacity of genes to mutate and change the genotype of an organism without endangering its viability, must have had a selective advantage. The

problem is however, that most mutations are damaging. (Gerhart and Kirschner 1997) described how this damage may be reduced. By splitting the whole in different, relatively independent systems, by superfluity of characteristics, weak mutal links and robustness of the basic systems, the damaging nature of a mutation may be limited. As a result, it can live on until in a new mutation of it has changed the damaging nature into an advantage. These characteristics all mean that evolution can only try innovations succesfully if many consistuent parts and connections are not essential for the continued existence of the organism. It is much more probable that a structure, consisting of separated functional systems, will meet this condition, than in case of a fully integrated system. And so, we are able to function rather well when certain functional systems, for instance hearing, fear system or care instinct, are not functioning too well. Thus the evolutionary pressure will stimulate the development of parallel ways, superfluous mechanisms and specialised circuits and inhibit the development of one integrated and optimized, but vulnerable system.

6. Regulation of our body temperature as an example of a functional system.

What are the characteristics of functional systems and how do they work? The working of the fear system has been discussed in detail by LeDoux (LeDoux 1996), who explained the physical parts of the scheme and showed that it is working as an independent system. In addition (Panksepp 1998) has described a range of other known functional systems extensively. There are however a lot more that have not been examined physiologically. Nevertheless it is possible to give a coordinating outline representing the effect of it. As an example we will pass one functional system under review in order to check what form the different elements can assume. For this we will choose the regulation of body temperature because it has sufficient recognisable elements and the system is fairly well known.

Our body has a network to perceive temperatures. (1.) Heat receptors are recording temperatures in the skin or the central nervous system and report them through the nervous tracts to our brain, many animals have two different systems -one for perception of heat and one for perception of coldness.

In mammals who are trying to maintain a constant body temperature for an optimal working physical system, the recorded temperature is compared with a calibration point in the hypothalamus (2.) Some species have two calibration points, one for normal functioning and one for energy saving (hibernation). (2.1.) When the temperature threatens to fall below or rise above the calibration point, we will sense it because we are freezing or we are feeling hot, two distinct non-verbal signals. (3.) For instance, when the (conscious) evaluation of the signal tells us that we are too close to the fire, we move and subsequently neglect the non-verbal signal (1.A and 5.A) If not, the sensation will finally divert us from the things we are occupied with, and we are almost forced to do something about it (4.) In the meantime our thermoregulation has already gone into action (5.) When the

temperature of our skin becomes too low, our hair will be standing up straight for better isolation; we will get goose flesh. Also the capillaries will narrow, so that the blood flow to the skin is reduced adn we will loose less warmth. Finally we will begin to shiver. All kinds of muscles will come into action, resulting in the development of heat. When the temperature becomes too high, the capillaries will dilate to increase the blood flow to the skin, on the assumption that this will bring about a drop in temperature. Our sweat glands will start to secrete fluid which will evaporate and thus remove heat. These reactions occur subconsciously. They are controlled by our thermoregulation system. It is unknown where these reactions are stored (5.1) They cannot be evoked voluntary.

It is possible however, to anticipate warmth or coldness in thought, for instance when we intend to enter a freezer room or a boiler house. Through our conscious adaptive responses we are able to take action (5.A), but we cannot evoke the subconscious reactions (5.1).

When warmth or coldness has sufficiently attracted our attention (4.) we can also take other actions. We can influence them, for instance, by changing our clothing, by stepping in the shadow or in the sun, by moving or sit still, by eating or going to bed. We have acquired every single one of these actions (5.A) and we stored them in our declarative and procedural memory. The result of all of those actions, subconsciously or consciously, may cause the temperature to return within its limits. The non-verbal voice stops talking to us and we feel comfortable again. It is now time to de-activate (7).

The calibration point, however, is less stable then it seems to be. Not only it is varying during 24 uur along with our 'circadian clock', but it also shifts when infections occur. We will get a fever. This increased temperature apparently helps to fight bacteria and virusses. Fever will often start with shivering, as if we are cold. This may also happen because the calibration point has been adjusted upwards. The fever stops when the infection is suppressed. How do we observe all of this? These reactions must have been stored in a type of memory (2.1.).

Amidst all functional systems the thermoregulation has an important place. In young people it is however more effective than in elderly people. Maybe the later acquired conscious reactions have to compensate for the low automatic reactions.

7. Outline of functional systems.

Functional systems are performing a function. In evolution, functional systems have developped into effective standardised responses to occurring challenges. They may be relatively simple, for instance growing rigid with fear of more complex like maintaining one's balance. Most functional systems have similar elements, albeit that their working is completely adapted to the demands of the functional system. It appears to be possible to distinguish two different process parts in every functional system. It should not be surprising that there are two process parts to be

distinguished. In a reflex arc (the most primitive functional system we know) we may also recognise a sensory part for perception and a motor part for implementation. Without pretending to be exhaustive, the following scheme may represent a picture of the most important characteristics, though not all of them are to be found in every functional system:

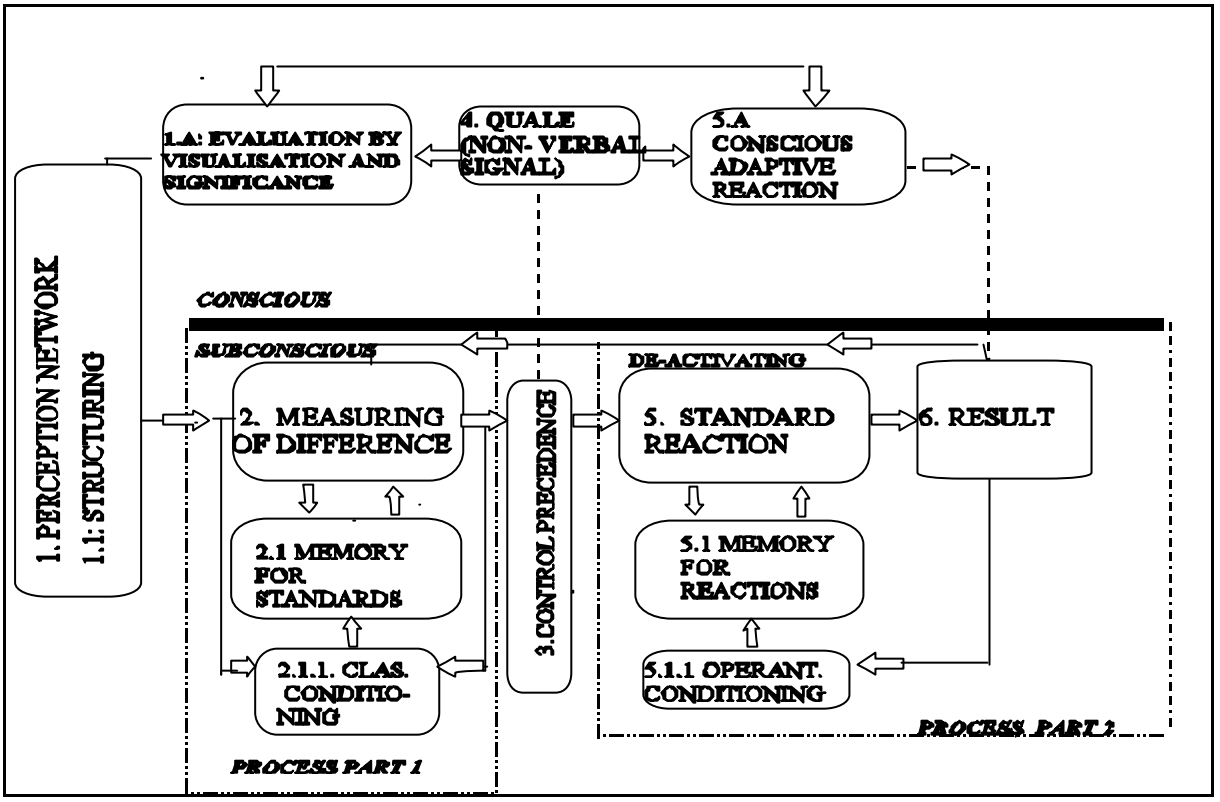


Fig 1: Diagram of functional systems.

Process-part 1:

1. Perception network. Basically working subconsciously.

1.1 A possible structuring part, that may elucidate (objective) significance and clarification of the sensations through visualisation and realization, but may also subconsciously start an action.

2. Reference criterion or calibration point.

2.1. Memory (possibly collection) for criteria.

2.1.1 Extension and / or adaptation of criteria by among other things (traditional) conditioning.

3. Determining preference of control; if necessary through consciousness and/or

attention, caused by non-verbal indication in which the working memory is involved.

4. Perception of possible difference through non-verbal indication.

Process part 2:

5. Reaction through specific subconscious (5) and/or conscious (5a) network.

5.1. Memory for (collection of) subconscious reactions.

5.1.1. Extension and/or adaptation for reaction network by learning (operant conditioning).

5.1.2. Eventually first 'making a dry run' of the reaction.

6. Non-verbal indication (separate signal 'all clear' or simple loss of 'alarm signal') and perception of the results.

7. Result and reduced effect by de-activation of attention.

8. Possibly re-adjusting importance by reorientation among other functional systems.

Functional systems often enable us to become aware of the (intermediate) results. Pain, hunger, fatigue, fear, sleep, desire, shame etcetera are different signals that are well comprehensible. As it were, these sensations are 'words' of a non-verbal language. In the first place these signals serve to ask for priority for the concerning functional system to be able to choose between respective alternatives. Because, as we shall see, consciousness always goes through the working memory (see section 10. Some aspects of consciousness) and only one subject can be dealt with at once, a choice has to be made. The strongest signal will win, and mutual coordination will be possible.

Qualia are the 'non-verbal words' of different functional systems, that use other symbols than language, to indicate the (emotional) relevance of an event or perception for that system to ourselves and possibly to others, and ask for priority for questions and provide motivation for action.

To begin with, qualia are being associated with feelings including fear, pleasure or distress, delight or disgust, but they also are part of common things like eating and drinking (good or nasty), art (poor or nice), sex (desirable or repulsive) etcetera. Though qualia have a strong personal experience, that is difficult to transfer to others, this does not mean that they don't have a general import that is suitable for selection in the evolutionary process. They are closely involved in processes to survive, fear to cope with danger, hunger and thirst to stay alive, lust to reproduce, care for the young to guarantee continued life etcetera. As such, they attribute in various, often autonomous processes, that have developped a structure of their own, to the evolutionary process. (See also 3. Functional system and emotion.) Qualia are the link between the subconscious process part 1 of a functional system and

the process part 2. The process part 2 causes the response.

The (emotional) relevance puts us on the track of readiness to take action and the direction of action that are included in process part 2.

It is remarkable that process part 1 is running subconsciously up to the non-verbal signal. Because the working memory can only receive one subject at once, only one function could otherwise be active at a certain moment. While the first part is running subconsciously, it is possible to have more functions being observant at the same time. When a functional system is asking for priority in control because a reaction is needed, there are in principle two possibilities. At first, from a viewpoint of evolution, there is the old subconscious reaction with standard solutions. Process part 2 will then come into action until its result de-activates the stimuli of process part 1. In addition it is possible, when the situation has become conscious as a result of a (non-verbal) signal, to take action (at the same time) in an adaptive manner as a response to the signal from process part 1. The consciousness belonging to the functional system, tells us what choices we can make. We can also (for instance partly due to operant conditioning) build up a complementary response system with matching memory system. It is impossible for a matching memory system to develop before the end of process part 1.

Functional system and emotion.

We recognise functional systems through their non-verbal signals. From every systeem we only perceive the part that goes into action in order to restore the starting point. We have nothing to say about the part that establishes that the starting point has been disturbed. For us, the non-verbal signal is the beginning of an emotion, of which we are not always conscious. It may operate under the skin, that is, start the action for restoration. Sometimes, the changes that are the result of the action, are the first to tell us that something is going on. Sometimes we indicate the non-verbal signal, sometimes the outcome of the action. In both cases we come up against a functional system. Hunger and thirst are non-verbal signals, shivering and seasickness belong to the reaction part of the functional systems for thermoregulation, respectively balance system. Laughting and crying seem to be independent expressions, but are in fact part of a functional system. What was it that made us cry or laugh? '(Emotional) relevance' means the part of a functional system that starts with a non-verbal signal, qualia means the non-verbal signal itself.

3: Functional system and emotion.

A funny image forces itself upon us. In the same way the sound spectrum in a modern speaker is presented in a diagram by a number of vertical columns varying in height, depending on the intensity per area of sound, the activity and effect of the various functional systems at any moment could also be depicted. Regarding the melody of life, it could result in a dynamic view of the impulses that drive us. In our dreams this image manifests itself most clearly. As will appear lateron, the vigorous acting qualia tend to take priority of control and to shove aside less strong impulses. (As an illustration see 4. Politics.) They will give our basic consciousness, that at first danced along vaguely and uncontrolled with the columns, a clear direction and intensity. It is as though this focussing converts our consciousness from being vague and unaimed to goal-oriented and intensive. The pittfall is contained in the expectation that consciousness and will are above the functional systems and are extraneous to it. It is

as if a little green man is sitting in our brain and receiving all the information, while taking directive decisions on the ground of it. Then who is controlling this little green man? An even smaller little green man? This dichotomy between controlling instrument and functional systems is not tenable.

Consciousness and will are rather to be considered as originating from and belong to the various functional systems and not as being central autonomous controlling units. As goes for memory, also consciousness and will may take various forms.

A functional system is steering us into a certain direction. In this image the triptych 'id, ego and superego', the ego playing the leading part as pivot of human being, disappears and is replaced by a collection of functional systems, driven by a momentaneous internal need and/or external urgency through a non-verbal language and possibly corrected by the (objective) significance of experiences and perceptions on the basis of which we are able to prevent further action.

Politics.

The dutch socialist politician Ed van Thijn once described politics as follows: on Monday the government starts with all sorts of good intentions, after consultation by telephone on Sunday evening. On Tuesdaymorning suddenly and out of nothingness a message from the media emerges drawing public attention, because it differs from what people had hoped for, believed or thought. Government and members of parliament are aware of the newsworthiness and excitedly start to make comments. A political row is born. It demands enormous attention. The parties, operating as a coalition, start to operate separately. It takes until Friday before the message has lost its newsworthiness and peace has been restored. In the government's consultation on Friday, the message is consolidated and eliminated. Government will resume its good intentions. On Sunday evening the governments plans are again taking definite form by telephone etcetera. The coordination between the various functional systems in the brain highly resembles this political procedure, though probably it is the other way around. The political process reflects the way our brain is coordinating. In fact it is a miracle that this country is governed at all, albeit slowly and with many compromises. The same goes for our life.

4: Politics

The concept that functional systems are chiefly bound to physical processes, might settle in. (Frijda 1988) however, described a number of relational action tendencies, each of which may be seen as process part 2 of a functional system, having a relational and psychological approach (see Table 5. General outline of well-known non-verbal signals (emotions).

The number of functional systems that have not yet been described, will no doubt be much more, the more so because a number may disappear from observation because of their automatic character. It is also likely that in mammals many functional systems have developped in a similar way, because many of the functions require similar solutions.

Relational action tendency. forms of activation and inhibition

Action tendency	**End situation**	**Function**	**Emotion**
1. Approach	Entrance	Creating target-activy allowing situation	Desire
2. Avoidance	inaccessibility	Protection	Fear
3. Nearness	Contact, interaction, activity	Allowing target confidence	Pleasure
4. Attention (opening)	Identification	Orientation	Interest
5. Rejection (closing)	Removing object	Protection	Disgust
6. No attention	No information or contact	Selection	Indifference
7. Agonistic	Removing obstacles	Recovering control	Anger
8. Interruption	Re-orientation	Re-orientation	Terror, surprise
9. Domination	Maintenance of control	General control	Arrogance
10 Submission	Diverting stress	Secundary control	Submissiveness, resignation
11 De-activation		(Recovering?)	Sorrow
12 Bound activation	End situation of action tendency	Reaching target	Effort
13 Excitement		Willingness	Excitement
14 Free activation		General willingness	Delight
15 Inactivity		Recovering	Contentment
16 Inhibition	No response	Caution	Fear
17 Surrender	Activation decreasing?	Activation decrease or social cohesion?	(Laughing, crying)

5. General outline of well-known non-verbal signals (emotions)

8. Non-verbal langage.

(Damasio 1994) studied patients with brain damage who had lost the normal emotional reactions and became emotionally indifferent. They could still think rationally on the basis of the (objective) significance of facts and events, but making decisions or choices appeared to be utterly difficult. The feeling that they were going in the right direction was missing completely. Though (emotional) relevance and (objective) significance are separated, the study showed that (objective) significance cannot work without (emotional) relevance. After all, the (emotional) relevance puts us in the track of readiness to take action and the direction of action included in process part 2. Is it true that (emotional) relevance can do without (objective) significance, phonological and/or spacial information? Actually these are referring to reality in and around us. They indicate where the (emotional) relevance should be effective and which concept it belongs to. Without this indication there is a risk that the (emotional) relevance will keep droning because there is no adequate action to take. Finally, as a result of a disorder in the internal system of the body (e.g. hyperglycemia, hypotension or hypertension, and such) a mood may develop, a droning non-verbal signal, that remains until balance is restored. This may take a rather long time because the disorder may be caused by a defect in the system and will not always be cured spontaneously. Without clear external reason we may feel inert or on the contrary active, depressed and such. The process part 2 of the homeostatic system doesn't work at all or very slow. The balance has been disturbed for quite a while.

When we speak, the (objective) significance as well as the (emotional) relevance are transferred by words and the their intonation. Which of the two is received best, depends on the listener. The tone often seems to be much more important than we think.The (objective) significance may remain an overal view, while its (emotional) relevance transfers the message. In virtually all social communication it is a matter of (emotional) relevance rather than of (objective) significance.

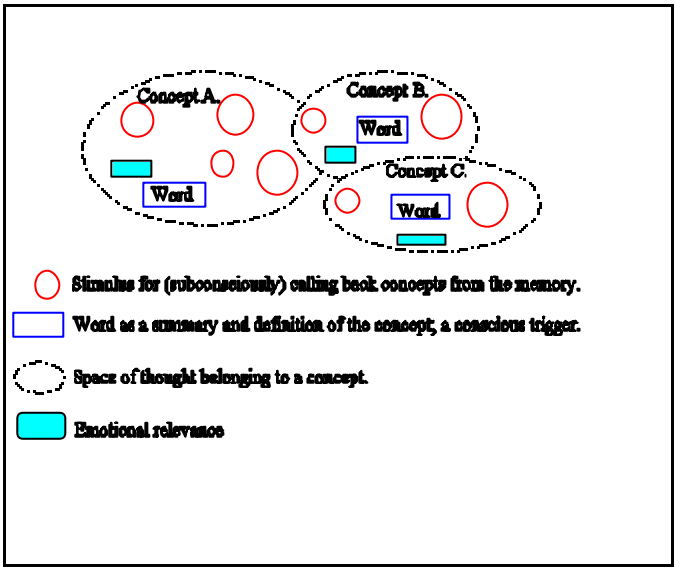
9. Evolution and brain structure.

A second important basic principle on which this argument is grounded, is the way in which the evolutionary development of the brain took place. Though absolute evidence is missing, there are sufficient indications to be taken seriously, the more so because it enables us to give practicable explanations for some important aspects of human functioning by means of this theory.

During the mitoses, the copying of chromosomes, the carriers of the genes, may cause various errors to creep in, as a result of which the genetic code is changed. One error may be that a gen in a chromosome is duplicated. The old gen stays unharmed and in use. The number of genes is thus extended. The other gen may not be used or get a function of its own, possibly after various mutations. Gen copies may also spread among other chromosomes, where they may undertake new functions.

One of the consequences of this gen duplication may be that a brain area with a certain function may also be duplicated. This has occurred regularly. In addition to the primary motor area, a number of other areas is formed with additional and also new functions. Thus it became possible to simulate actions and to foresee the consequences before actually carry them out. It may not end with one duplication (sometimes partial), but it may occur more often and the effect may depart further and futher from the original.

Duplication of the brain sections for observation and action, could enable us to experience that observation and action in the duplicated section of the brain once again. A sort of retrospective simulation we can evoke ourselves. Reality may be reproduced symbolically. These symbolic experiences are more or less solidified fragments of reality combined with our imagination. They are the concepts that consistute the basic elements of our thinking. From childhood we have been making concepts (see Fig. 2 Concepts) of events and perceptions. They are clusters of experiences that belong together in our mind. Besides, they may be really existing data as well as imaginary associations. A coffee cup doesn't merely remind us of the design of the cup, but also how it feels when we hold it, how the coffee tastes, and remotely of the circumstances in which we drink coffee. (Objective) significance and (emotional) relevance are part of each concept. Sensory perceptions of parts of concepts may revoke the whole concept. This process goes subconsciously. It is possible though, that if the revoked concept and the perception are incompatible, the consciousness comes into action to solve the problem. Gradually we discover the limits of the areas of different concepts, we began to summarize in one (symbolic) word. According to Patricia S. Churchland language helps to categorise the world and brings the complexity of our conceptual structures back into a manageable form. The possibility to capture so many notions in one word per concept, makes it conceivable to summarize more and more and to think and communicate and in a more and more abstract level. The cognitive economy of language. Words are symbols with a certain significance.



Figuur 2: Concept.

From childhood, man is linking (emotional) relevance and (objective) significance with each other by means of concepts. This could be the cause for our need to explain phenomena.

(Objective) significance and (emotional) relevance need each other to function well. Most of the time the links are sensible, but unfortunately not always. In that case neuroses may occur. Our whole life we are trying to remove wrong links from concepts, that combine (objective) significance and (emotional) relevance. The teddy bear, that gave us a feeling of safety and that could listen, gradually becomes, if everything goes right, a doll of rough fabric with one glass eye that could do with a bath. Sometimes it doesn't work and it is kept for our own children in the hope that they will take over the old concept , but usually they do not want a filthy object like that.

Because of their associative richness, concepts may have large overlaps with other concepts. Therefor it is possible and easy to pass from one concept to another in one's mind. This is how daydreaming occurs and, as an extra-ordinary form thereof, thinking.

10. Thinking.

In principle functional systems have a homeostatic function, i.e. that they are out to restore the initial situation. For sensory perceptions this is impossible because there is no initial situation. Here an other, further evaluated mechanism could be effective, that is recognition, returning to what is familiar. Propably evolution has adapted the pattern of the functional systems of the senses and provided process part 1 with a learning memory (our declarative memory) and dissociated it from process part 2. This may be the result of duplication of certain brain areas that got a function of their own. We will see an image that we recognise, dependent on what has been stored in our memory. The image is created after process part 1 has been completed. What we see is the non-verbal signal of the visual functional system. The link with process part 2 is much less firm because there is no universal answer to a sensory signal. The answer should remain open and is dependent on the situation. A suitable process part 2 may be selected from the existing arsenal by way of the (objective) significance of the image and the related (emotional) relevance. This, however, is not necessary. It is possible that no further reaction follows because, after recognition, the link with an (emotional) relevance proves to be too weak to get priority. The corresponding consciousness only emits a weak signal requiring steering priority. It may easily be pushed aside by other processes requiring steering priority.

Sometimes we can nominate the image in a process part 2 by way of our language system, store it in our declarative memory for (future) reference, neglect it or react to it otherwise. Unknown sensory signals may be added through the learning process (Fig. 1. 2.1.1) to a corresponding memory so we can recognise them in future. It may whether or not be linked to an (emotional) relevance. If there is no explicit process part 2, the (emotional) relevance plays no part in the process. As it is, (emotional) relevance, evoked by the non-verbal signal, manifests itself through a process part 2 included in the non-verbal signal. Thus we are left with the (objective) significance, that is neutral in itself. In its turn this (objective) significance may work as a new (sensory) signal and

start process part 1 once more. That is the process of thinking.

Partly on the basis of above theories, we could create the following image of the mental process. From childhood we have created concepts of events and perceptions. Sensory impressions from parts of concepts may recall the whole concept, but it is a subconscious process. It may be possible that if the recalled concept and the perception do not correspond, the consciousness will come into action to solve the problem. Gradually we will discover the limits of the area of the various concepts, that we began to summarize in one word.

Thinking is an iterative process. Almost always, before each action there is a simulation, in order to try and prevent that the action will have harmful consequences. In thinking this process also occurs. A combination of (parts of) concepts is tried out, and subsequently tested to a range of other, mostly associative obtained data, to see whether a discrepancy may be found. If so, the combination is adapted and checked anew, until the discrepancy has disappeared. The solution manifests itself in an action or a word. The difference between thinking and (day)dreaming is to be found in the checking. In (day)dreaming the concept parts keep linking up into a chain without intervention. In that case the concepts will not solidify into words. Thinking takes place in words or actual images.

What is the origin of thought? We will return to process part 1 of the functional systems. Assuming that in evolution ongoing developments are building on existing systems, we also should be able to deduce 'thinking' from the existing functional systems. There are however two comments to give. In the first place it is possible that only a part is adopted and it is also possible that due to earlier changes, a completely new possibility emerges, that would have been impossible in any other form. These so-called emergent processes will make an evolutionary leap possible.

In thinking the leap is made possible by the so-called episodic and declarative memory that may easily be extended and changed by learning, contrary to the memory for (conditioned) reflexes. Whereas in the (emotional) functional system the memory of process part 1 is fairly stable and difficult to change, in thinking on the contray it is very easy because there the (evolutionary new) episodic and declarative memory is used. As it were, every change creates a new functional system (See Fig. 3). This feed-back to process part 1 now is the new effect of process part 2 , that removes the difference that is observed between perception and memory. In stead of starting its own programme to restore the balance, process part 2 changes the standard of process part 1 with the result that it stops giving signals of difference. Thus the concept conforms to reality. The stimulus that is compared with the concept, is always more limited than the concept. It is a subset thereof. Thus there will always be a difference and a signal that requires steering priority and in most cases evokes consciousness. Thinking is largely a conscious process that basically takes more time than other functional systems. In our perception it even seems dominant!

Although a tendency may arise to associate intelligence with the degree in which simulation of and thereby control on associations may occur, making it possible to correct and focus concepts, this process does not explain anything about the accuracy of the result. Incorrect or inconsistent factions in concepts cannot be ruled out. It is however one of the prerequisites for intelligence, but there are also other conditions to be met.

The more a concept is consistent with the processes that actually are taking place, the better it may serve to predict the result of those processes and thereby provide the possibility to check them. Not all processes are governed by the same laws. Indeed it makes a difference whether the processes are physical or psychological. The first can be checked for accuracy through verifiable facts because the (emotional) relevance should hardly play a part here, whereas the latter are highly dependent on (emotional) relevances with intense individual variations.

In thinking the concepts are cleared out and made consistent as far as possible. This doesn't mean that the (emotional) relevances are no part of it anymore. On the contrary, to understand other people the (emotional) relevances should be assessed well.

11. Some aspects of consciousness

A third basic principle consists of the location and the function of our consciousness. To us, our consciousness constitutes the most important element of our existence. Without consciousness we would vegetate like a plant and it is not at all surprising that this vegetal state is so frightening that many people think that in this condition life is not worth living. Consciousness enables us to choose and develop alternatives that correspond best with our wishes and desires. Consciousness enables us to experience our emotions and turns social contacts into a source of rich adventures. Thinking is impossible without consciousness. 'Cogito ergo sum' Descartes said, indicating the essence of his existence. The demand for explanations about the whys and wherefors of consciousness, giving cause to many theories, has increased significantly. Though generally accepted explanations for the phenomenon consciousness have not been found, it is obvious that many subconscious processes are preceding. Consciousness often is the end point of subconscious processes. We hear words, music or slogans, not different sound frequencies, though that is what our ears register. We also see (generally recognizable) images and not a large number of (coloured) spots, coming from the cones and rods in our retina. We do not perceive as if our body contains an instrument that reflects what happens around us. We use the information and structurize it. This structurizing process withdraws from our consciousness. When we make a certain gesture with our hand, we are aware of the result, but we fail to grasp how we achieved it. We are kept in the dark about what muscles we have activated and when, and with what force and for how long. Talking will not allow introspection either. As it were, the words emerge spontaneously in the right grammatical context. Without these subconscious processes, consciousness would not occur. Many people are of the opinion, therefor,

that consciousness is one of the later evolutionary developments, that is mainly manifest in humans. After all, in terms of evolution, humans are latecomers.

As consciousness nearly always follows subconscious processes, understanding of those subconscious processes will tell us a great deal about the nature, the potentials and the restrictions of our consciousness. In the meantime clever investigations allowed an increasing impression to develop. The purpose of this argument is to provide more information on the subject.

Consciousness is a hybrid concept. The consciousness manifests by responding to the environment, through attention, will, thought, daydreaming and the like. In one respect it is a basic quality, related to the physical condition of the nervous system at a certain moment. The point is that we are in contact with the environment, others or ourselves. On the other hand, it first shows its cultural dominant tones with which it operates in our society. Here the question is how we are in contact with the environment, others and ourselves. There are a number of expressions were the meaning of the word consciousness has a different accent everytime. He regained consciousness again: he reacted to his environment again. It slowly got through to his consciousness: his attention was focussed. He did that in all consciousness: he did it knowingly. His deepest consciousness was shocked: his conscience was affected. In the first place it is a relational phenomenon here and therefor it has cultural aspects, which means that the communication mode is subject to value judgements. Consciousness always means that there is an interaction between (emotional) relevance and (objective) significance, appreciating and recognising, consciousness and perception. Consciousness has many faces (Block 1995). Our attention is focussed on the physical condition and its function. Generally speaking we are conscious when we are awake. It is, however, difficult to realise how long we are virtually absent during the day, i.e. not interacting with ourselves or others. Indeed, we are awake and need few stimuli to be on the ball, but nevertheless we seem to be in a kind of 'stand-by' position, a basic condition that may be considered a core consciousness.

(Baars 1988) (global workspace), (Edelman 1989) (primary consciousness) and (Damasio 1999) (core consiousness), all made propositions on the existence of a kind of basic consciousness. It appears to be a productive idea. Suppose consciousness is possible without notion of space and time (that means, without using the Emanuel Kant's 'patterns' and therefor not getting around to giving (objective) significance). Let's call it core consciousness; it concerns being aware of here and now. There is no past or future, no elsewhere, only here and now. As it were, we just woke up. The light has switched on. Appropriate words here are observant and alert. It is not dependent of (declarative) memory, working memory, language or reason. It may not be exclusevily human, in fact it could be present in the bees featuring in the introduction. In addition, the contents are changing continuously. There is a constant changing flow of subdued perceptions and experiences passing by. It seems as if an ever changing group of neurons is active that must be intrinsically instable to let this core consciousness ripple by and enable it to develop into full consciousness.

12. Consciousness as part of a proces.

Full consciousness is part of a process. It fulfills a specific task, which enables us to choose from alternatives. In different processes consciousness may offer different choices. It seems logical to assume from now on that these states of consciousness do not have the same foundation. There is a multitude of forms of consciousness, just like there may be different memory systems in different processes. When we are paralyzed with fear, the corresponding consciousness leaves us to choose between flying, fighting, hiding or surrender.

Every state of consciousness has its own corresponding options.

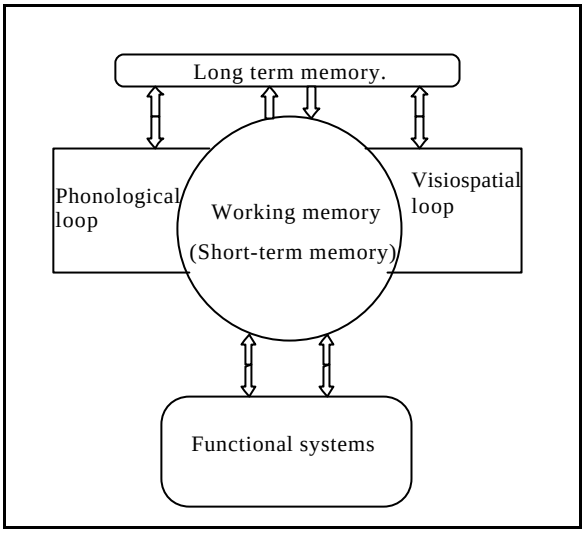
Assuming that there are different forms of consciousness, each having its own functional system and abandoning the illusion of unity, it is possible to attribute a common function to what we experience in some forms of consciousness, that is taking steering priority for a certain functional system and making choices. In studying memory it took a long time to realise that there are many types of memory, that often are mutually noncommunicable and have their own functions and rules of play. Just like that, it will take a long time before it will be accepted that there are different sources and types of consciousness. Also the question whether or not consciousness exists in animals, is seen in a different light when we realize that this question has to be replaced by the question what types of consciousness are present in animals.

Because we experience a conscious state as being continuous, we hardly are aware of the fact that the nature of consciousness changes all the time. This nature is corresponding with an (emotional) relevance and/or an (objective) significance and may be mutually different. As a result, it may have a typical own part to play in the outcome of the demand for steering priority. In general, pain will get steering priority before sleep or hunger. Also, in case there are gaps between consecutive states of consciousness, this will not be noticed by definition, because we are not aware of it.! Sometimes we miss a lot, but when asked we fill the gaps as if we have been conscious continuously. Consciousness may be identified in different manners, dependent on the non-verbal signal that has caused it or the (objective) significance we attach to our perception of it. Qualia and (objective) significance, through corresponding (emotional) relevance, both are a source of consciousness. Consciousness enables us to consider corresponding alternatives before reacting.

(Baddeley and Hitch 1974) argued that consciousness manifests by way of the so-called working memory. If consciousness does not become manifest in one way or another through the working memory, it will not be recognised as such. It may fulfill its task, that is demanding priority and choose from available alternatives, but sometimes it operates so fast, that is has disappeared before we noticed it. In that case the process runs (seemingly) subconsciously. People who for any reason only have a (short-term) working memory and no longer create a declarative memory (e.g. because having had a stroke) will hardly be aware of consciousness, but they will still be able to

choose their reactions. To a considerable extent, the retrospective as well as the prospective aspects will give us the feeling of consciousness (Baddeley 2003).

In Baddeley's model of the working memory (see Fig. 4. Diagram working memory) the hypothesis is that a system with limited capacity, that can temporary store and process information, may support a 'thought'-process by realizing a link between perception, long-term memory and action. The non-verbal words of the functional systems are using it. Statistic analyses lend further support to a concept consisting of a central executive organ and in addition separate storing systems for phonological and visuospatial information that may process different categories of information (Engle, Kane et al. 1999) (Miyake 2000) (Kane and Engle 2002). Therefor, it seems reasonable to consider states of consciousness using them, as separate categories.



Figuur 3: Diagram working memory

Possibly there are three main groups of states of consciousness to be distinguished:

Consciousness as non-verbal word in functional systems.

Consciousness regarding phonological concepts (including words).

Consciousness on the ground of visiospatial information.

A model of the phonological loop consists of a short-term memory in which sounds and specifically phonemes can be kept several seconds, before they fade away along with a process of repetition for the articulation of the phonemes that is analogous to soundless speaking and therefor are renewed again and again and may be remembered longer. When the number of unities (six to nine) repeated increases, there will be a moment when the first is lost before it can be repeated. Due to the repeating process the possibility to communicate with the long-term memory increases. Apparently the phonological loop has made it possible to acquire language. The capacity of the phonological loop is a good prediction for learning a (second) language in young people and the elderly (Baddeley, Gathercole et al. 1998).

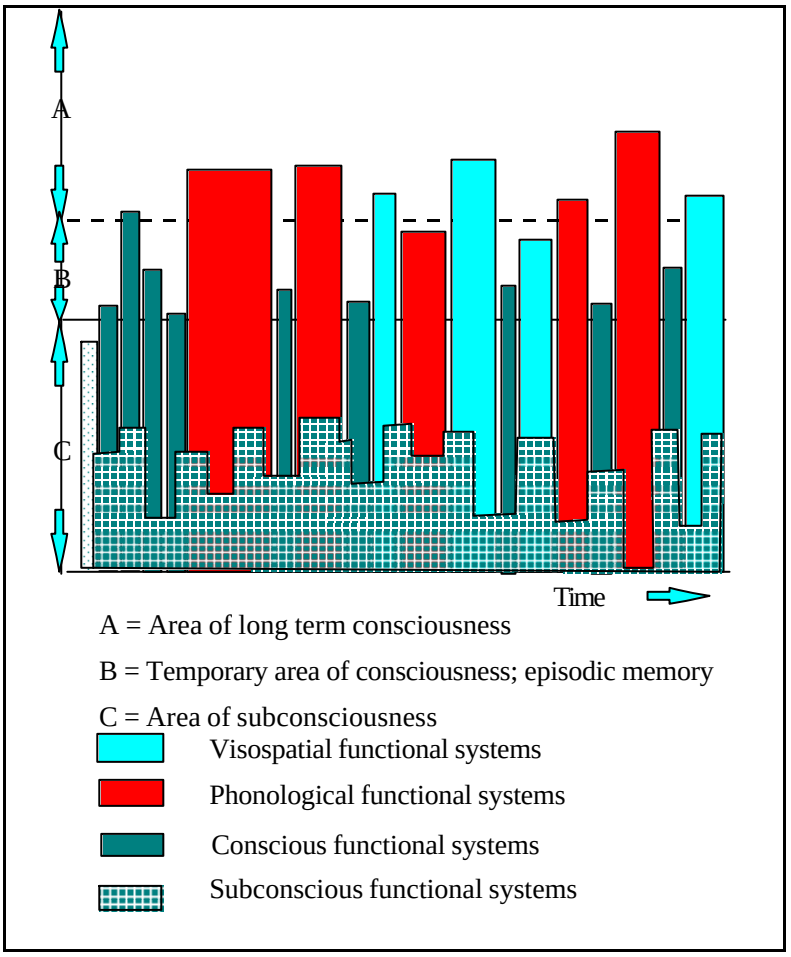
Just like the phonological loop, the visiospatial working memory is limited in capacity. Three or four objects is a general rule. Again repetition is the way to remember them for a longer perod of time. Due to the restriction to a few objects, however, something will be lost earlier. This results in an insensibility to changes, in which objects may change in colour, move or disappear without

people noticing. In general the visual world is a stable frame that makes repetition less important. Storage in the long-term memory is dependent of the link with determining characteristics of the objects, demanding time and attention. The function of the visiospatial system is different from that of the phonological system. The capacity to remember and manipulate visiospatial representations is a criterion for non-verbal intelligence that predicts success in areas such as visual arts and technology (Purcell en Gero 1998), (Verstijnen, van Leeuwen et al. 1998). In animals the visiospatial loop may increase the hunting (or flying) skills.

Because of the iterative aspect of these loops, the inherent state of consciousness generally could be much longer than the state of consciousness inherent to a functional system. In our perception, consciousness will mainly be related to these processes.

A process getting steering priority can evoke the matching consciousness. When different processes require steering priority at the same time, only one of them can get it. This steering priority may be interrupted when another process with a higher priority suddenly announces itself. As soon as this new process is completed, the steering priotity can return to the process that was interrupted. When the interruption is short, we will hardly notice anything, because the working memory will resume the thread through the states of consciousness that still are present in the loop.

Consciousness is intermittant in nature. It may be interrupted by periods without consciousness because no steering priority is required. In addition there are periods during which consciousness is transitory because it does not reach the long-term memory. What we experience afterwards as a conscious state, is just a limited and selective part of the time in which we are awake. We will experience this period as if it were continuous. It seems as if our thinking process passes continuously, as if we don't miss



Figuur 4: States of consciousness in time.

anything of what is happening around us, but we are much less in control of our environment than we think and we are predominantly geared to be reactive. (See Fig. 5 States of consciousness in time).

What we call consciousness appears to be a sequence of separate conscious states that each belong to a functional system, an audiological or visiospatial concept. This flow may be discontinuous without us noticing.

13. Coordination of functional systems

A system like fear, hunger or desire, that cannot go on without conscious action on our part, calls for attention. As a result the possibility for other functional systems to get to our consciousness is reduced. As it were, our conscious coordination says: "one thing at a time". At the same time it reduces the possibility for functional systems to happen simultaneously. It is the coordination between those functional systems that makes our brain such a specific organ.

The fact is that the possibilities for processing the simultaneous flows of information are limited because of the available processing capacity. When, in additon, these flows of information are using each others results, as for instance in visual and motor processes, the whole process becomes very complex and restriction will be necessary. To carry this through, a mechanism for selective attention has probably developped. Without this selectivity, organisms would be equipped poorly. The moment attention is directed to one source in order to discover a specific object, the processing of other sources is clearly reduced. Also, more senses are being involved, all of them demanding steering priority for practical reasons. Therefor attention will prolong the time during which the steering priority for one type of consciousness is continued without it being shoved aside by a new type.

An important observation is appropiate here. Because our consciousness cannot cope with more than one thing at a time, we have not been able to realize that many (subconscious) processes are running simultaneously. Only by way of a detour (by observing it in others) we learned to accept that there other processes may take place parallel to our consciousness. Until recently our consciousness, lacking foresight, felt to be its own master, thinking that everything that happens, always happens through our consciousness. It drove autonomy so far that the notion of free will has developped. The fact, however, that our actions are the result of cooperation and confrontation of many functional systems, conscious and subconscious, puts it in a different light. A sum total of actions and inhibitions (there are inhibiting functional systems, like for instance fear, guilt and shame) will determine the subsequent course of events. Maybe we expect too much from this coordination and maybe it is less perfect than we want to believe.

The (emotional) relevance of an event and its (objective) significance don't necessarily have a

(hereditary) fixed connection. The situation on the moment of the occurence generally is determining for the connection. It apparently is difficult, though, to make any changes afterwards. Therefor the 'second voice' of (emotional) relevance (some sort of intuition) isn't always right, but it may be completed with another colouring. The process is only partly subject to our will (our vetosystem), that mainly works in the conscious area. It's nature is more that of operant conditioning. In any case that generally is a useful method to try and change it. Phobia's are good examples of links between (objective) significance and (emotional) relevance to the same phenomenon, for example a square. For one thing the square as an open space, and on the other hand as the frightening unprotectedness. Frequently it is obvious that old-fashioned psychotherapy has little effect, while generally operant conditioning is effective in short time to (temporary) reduce fear.

Grammar

The grammar of language has probably been modelled on the grammar for movements. It will be obvious that in performi ng movements, a strict direction is necessary. Not only special care has to be paid to the coordination of the different commands, but also a strict order must be observed as untimely movements may turn out to be disastrous for the locomotor apparatus. This strict direction requires a sort of movement grammar that indicates what is permitted or what is not. This grammar, that is working fully subconscious, is gradually expanded by practising and thus the movements will pass off easier. It seems probable that every individual is able to make his own adaptations and additions to this movement grammar and that only the basic rules for a grammar to be established, are in common. Regarding movements, the necessary grammar is stored in the procedural memory that is present in the basal ganglia and the cerebellum and that is not accessible to the declarative memory. The same may be true for the rules of the grammar for language. stored in the procedural memory that is present in the basal ganglia and the cerebellum and that is not accessible to the declarative memory. The same may be true for the rules of the grammar for language.

5: Grammar

14. Final conclusions

(Objective) significance and (emotional) relevance, functional systems, evolutionary brain development and consciousness are the subjects that have been reviewed in the preceding pages. They have been selected because they serve as a basis for the model of our functioning. (Characteristic) (objective) significance and (emotional) relevance are the twins that cannot do without each other and that themselves embody the action and the subject of this action. The functional systems appear to be the basic processors of these perceptions and actions. They work simultaneously and relatively independent of each other. We are much more subject to their whims than we realize. Regarded from an evolutionary point of view, they seem to be a logical development from reflex paths and they serve to maintain the homeostatic condition of our organism, physically as well as mentally. Consciousness and will, just like memory, don't seem to be independent variables, but originating from and belonging to the individual functional systems. Most of these systems are already present in other mammals, albeit that they may be less far developped.

Basically, man appears to resemble other mammals to a great deal. The differences are in the

continued extension of the brain by more elaborate duplication of certain brain sections that already have a specific function. As a result, parallel paths may develop in the processing of information, making it possible to generate additons and extensions to this information. Talking and thinking in words and images became possible because graduallly integration of a lot of information from the secundary (and higher) brain areas, took place. Symbols may be created in the duplication of the brain areas for observation and action. In turn they can lead to concepts and words, that may be stored in the declarative memory, which for its part may be a further evolution of the episodic memory. By means of a grammar words may be made into meaningful sentences (see Fig. 6 Grammar). With that, the development of a phonological branch to the working memory was of decisive importance. Words are characterized by specific phonemes, that can be built by a crucial positioning of the larynx and tuned motor skills. These motor skills are located in a specific part of the brain (Broca's area) that probably has developped by duplication from the existing motor parts. In addition there was a development in another part of the brain (Wernicke' area) to understand phonemes and interpret words. Regarding its position in the cortex, this may have developped from a duplication of sensory parts of the brain. Though many animals are also able to make meaningful sounds, words or speech are out of the question. The absence of, for instance, an usable larynx and possibly a phonological loop to the working memory, is likely to be also one of the causes.

The visospatial loop of the working memory seems to be an earlier development, because spatial perception has been demonstrated in many mammals and the capacity to use visiospatial information adequately indicates that this is not an instinctive behaviour. Frequently choices are made that require consciousness, for instance in hunting and flying.

Speech and language may be seen as an evolutiary leap that has paved new ways for further development and as a result has separated man amidst other mammals. Consequently the difference with other mammals was highlighted so much that the similarities faded into the background. The prolonged duration of the state of consciousness and the iterative character of thinking, are the reasons why this condition gives a much more intense perception than the generally short-term consciousness that occurs in the basic functional systems. Often, we even don't notice the latter condition. Consequently, we highly underestimate its occurence. In addition, the prolonged states of consciousness often are interrupted by short-term ones, without us noticing. These are changing the context of the process that as a result may take another direction. The effect of the (basic) functional systems is such, that the control on, for instance, our thinking process is highly subject to chance; external and internal effects that we cannot control. The fact that also many 'animal' processes constitute the basic types of human functioning, is often neglected. Maybe we could typify a human being as an animated animal?

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