

Cognitive Psychology and Cognitive Neuroscience/Motivation and Emotion

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Introduction

Happiness, sadness, anger, surprise, disgust and fear. All these words describe some kind of abstract inner states in humans, in some cases difficult to control. We usually call them feelings or emotions. But what is the reason that we are able to "feel"? Where do emotions come from and how are they caused? And are emotions and feelings the same thing? Or are we supposed to differentiate?

These are all questions that cognitive psychology deals with in emotion research. Emotion research in the cognitive science is not much older than twenty years. The reason for this lies perhaps in the fact that much of the cognitive psychology tradition was based on computer-inspired information-processing models of cognition.

This chapter gives an overview about the topic for a better understanding of motivation and emotions. It provides information about theories concerning the cause of motivation and emotions in the human brain, their processes, their role in the human body and the connection between the two topics. We will try to show the actual state of research, some examples of psychologist experiments, and different points of view in the issue of emotions. In the end we will briefly outline some disorders to emphasize the importance of emotions for the social interaction.

Motivation

About Drives and Motives

Motivation is an extended notion, which refers to the starting, controlling and upholding of corporal and psychic activities. It is declared by inner processes and variables which are used to explain behavioral changes. Motivations are commonly separated into two types:

1. Drives: describe acts of motivation like thirst or hunger that have primarily biological purposes.
2. Motives: are driven by primarily social and psychological mechanisms.

Motivation is an interceding variable, which means that it is a variable that is not directly observable. Therefore, in order to study motivation, one must approach it through variables which are measurable and observable:

- Observable terms of variation (independent variables^[1])
- Indicators of behavior (dependent variables^[2]) e.g.: rate of learning, level of activity, ...

There are two major methodologies used to manipulate drives and motives in experiments:

Stimulation: Initiating motives by aversive attractions like shocks, loud noise, heat or coldness. On the other side attractions can activate drives which lead positive affective states, e.g. sexual drives.

Deprivation: means that you prohibit the access to elementary aspects of biological or psychological health, like nutrition or social contacts. As a result it leads it to motives or drives which are not common for this species under normal conditions.

A theory of motivations was conceived by Abraham Maslow in 1970 (Maslow's hierarchy of needs). He considered two kinds of motivation:

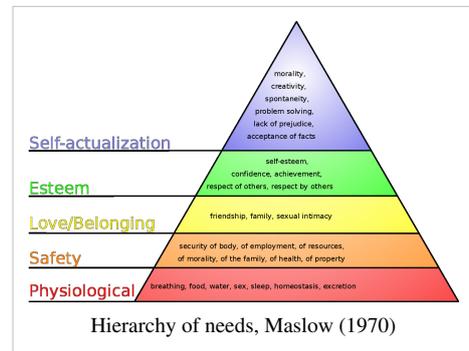
1. *Defected motivation:* brings humans to reconsider their psychical and physical balance.
 2. *Adolescence motivation:* gets people to pass old events and states of their personal development.
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Maslow argues that everyone has a hierarchy of needs (see picture).

Regarding to this, our innate needs could be ordered in a hierarchy, starting at the “basic” ones and heading towards higher developed aspects of humanity. The hypothesis is that the human is ruled by lower needs as long as they are not satisfied. If they are satisfied in an adequate manner he deals with higher needs. (compare to chapter attention)

Nevertheless all through out history you can find examples of people who willingly practiced deprivation like hunger strike, isolation or celibacy. These people may be the exceptions to this hypothesis, but they may also have some other, more pressing motives or drives which induce them to behave in this way.

It seems that individuals are able to resist certain motives via personal cognitive states. The ability of cognitive reasoning and willing is a typical feature of being human and can be the reason for many psychological diseases which indicates that humans are not always capable to handle all rising mental states. Humans are able to manipulate their motives without knowing the real emotional and psychological causes. This introduces the problem that the entity of consciousness, unconsciousness and what ever else could be taken into account is pretty unknown. Neuroscience cannot yet provide a concrete explanation for the neurological substructures of motives, but there has been considerable progress in understanding the neurological procedures of drives.



The Neurological Regulation of Drives

The Role of the Hypothalamus

The purpose of drives is correcting disturbances of homeostasis which is controlled by the hypothalamus. Deviations from the optimal range of a regulated parameter like temperature are detected by neurons concentrated in the periventricular zone of the hypothalamus. These neurons then produce an integrated response to bring the parameter back to its optimal value. This response generally consists of

1. *Humoral response*
2. *Visceromotor response*
3. *Somatic motor response*

When you are depleted of energy, dehydrated or freezing, the appropriate humoral and visceromotor responses are activated automatically^[3], e.g.: body fat reserves are mobilized, urine production is inhibited, you shiver, blood is shunted away from the body surface, ... But it is much faster and more effective to correct these disturbances by eating, drinking water or actively seeking or generating warmth by moving. These are examples of drives generated by the somatic motor system, and they are incited to emerge by the activity of the lateral hypothalamus.

For illustration we will make a brief overview on the neural basis of the regulation of feeding behavior, which is divided into the long-term and the short-term regulation of feeding behavior.

The long-term regulation of feeding behavior prevents energy shortfalls and concerns the regulation of body fat and feeding. In the 1940s the “dual center” model was popular, which divided the hypothalamus in a “hunger center” (lateral hypothalamus) and a “satiety center” (ventromedial hypothalamus). This theory developed from the facts that bilateral lesions of the lateral hypothalamus causes anorexia, a severely diminished appetite for food (lateral hypothalamic syndrome) and on the other side bilateral lesions of the ventromedial hypothalamus causes overeating and obesity (ventromedial hypothalamic syndrome). Anyway, it has been proved that this “dual model” is overly simplistic. The reason why hypothalamic lesions affect body fat and feeding behavior has in fact much to do with leptin signaling. Adipocytes (fat cells) release the hormone leptin, which regulates body mass by acting directly on neurons of the arcuate nucleus^[4] of the hypothalamus that decreases appetite and increase energy expenditure. A fall

in leptin levels stimulates another type of arcuate nucleus neurons^[5] and neurons in the lateral hypothalamus^[6], which activate the parasympathetic division of the ANS, and stimulate feeding behavior. The short-term regulation of feeding behavior deals with appetite and satiety. Until 1999 scientists believed that hunger was merely the absence of satiety. This changed with the discovery of a peptide called ghrelin, which is highly concentrated in the stomach and is released into the bloodstream when the stomach is empty. In the arcuate nucleus it activates neurons^[7], that strongly stimulate appetite and food consumption. The meal finally ends by the concerted actions of several satiety signals, like gastric distension and the release of insulin^[8]. But it seems that animals not only eat because they want food to satisfy their hunger. They also eat because they like food in a merely hedonistic sense. Research on humans and animals suggests that “liking” and “wanting” are mediated by separate circuits in the brain.

The Role of Dopamine in Motivation

In the early 1950s, Peter Milner and James Olds conducted an experiment in which a rat had an electrode implanted in its brain, so the brain could be locally stimulated at any time. The rat was seated in a box, which contained a lever for food and water and a lever that would deliver a brief stimulus to the brain when stepped on. At the beginning the rat wandered about the box and stepped on the levers by accident, but before long it was pressing the lever for the brief stimulus repeatedly. This behavior is called electrical self-stimulation. Sometimes the rats would become so involved in pressing the lever that they would forget about food and water, stopping only after collapsing from exhaustion. Electrical self-stimulation apparently provided a reward that reinforced the habit to press the lever. Researchers were able to identify the most effective sites for self-stimulation in the different regions of the brain: the mesocorticolimbic dopamine system. Drugs that block dopamine receptors reduced the self-stimulation behavior of the rat. In the same way this drugs greatly reduced the pressing of a lever for receiving of food even if the rat was hungry. These experiments suggested a mechanism by which natural rewards (food, water, sex) reinforce particular behavior. Dopamine plays an important role in addiction of drugs like heroin, nicotine and cocaine. Thus these drugs either stimulate dopamine release (heroin, nicotine) or enhance dopamine actions (cocaine) in the nucleus accumbens. Chronic stimulation of this pathway causes a down-regulated of the dopamine “reward” system. This adaption leads to the phenomenon of drug tolerance. Indeed, drug discontinuation in addicted animals is accompanied by a marked decrease in dopamine release and function in the nucleus accumbens, leading to the symptom of craving for the discontinued drug. The exact role of dopamine in motivating behavior continues to be debated. However, much evidence suggests that animals are motivated to perform behaviors that stimulate dopamine release in the nucleus accumbens and related structures

Emotions

Basics

In contrast to previous research, modern brain based neuroscience has taken a more serviceable approach to the field of Emotions, because emotions definitely are brain related processes which deserve scientific study, whatever their purpose may be.

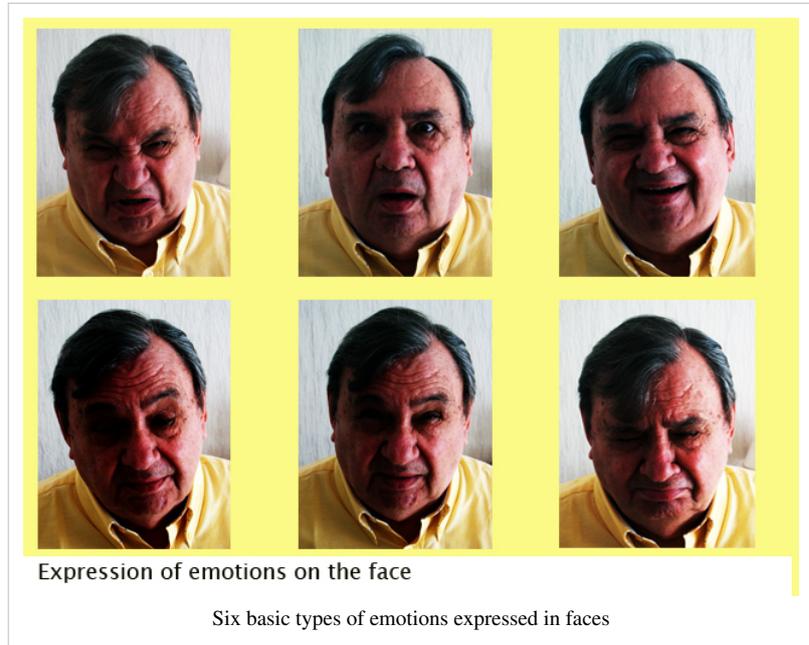
One interpretation regards emotions as „action schemes“, which especially lead to a certain behaviour which is essential for survival. It is important to distinguish between conscious aspects of emotion like subjective - often bodily - feelings, as well as unconscious aspects like the detection of a threat. This will be discussed later on in conjunction with awareness of emotion. It is also important to differentiate between a mood and an emotion. A mood refers to a situation where an emotion occurs frequently or continuously. As an example: Fear is an emotion, anxiety is a mood.

The first question which arises is how to categorise emotions. They could be treated as a single entity, but perhaps it could even make more sense to distinguish between them, which leads to the question if some emotions like happiness or anger are more basic than other types like jealousy or love and if emotions are dependent on culture

and/or language.

One of the most influential ethnographic studies by Ekman and Friesen, which is based on the comparison of facial expressions of emotions in different cultures, concluded that there are six basic types of emotions expressed in faces - namely sadness, happiness, disgust, surprise, anger and fear, independent from culture and language. An alternative approach is to differentiate between emotions not by categorising but rather by measuring the intensity of an emotion by imposing different dimensions, e.g. their valence and their arousal. If this theory would be true then one might expect to find different brain regions which selectively process positive or negative emotions.

Complex emotions like jealousy, love and pride are different from basic emotions as they comprehend awareness of oneself in relation to other people and one's attitude towards other people. Hence they come along with a more complex attributional process which is required to appreciate thoughts and beliefs of other people. Complex emotions are more likely to be dependent on cultural influences than basic types of emotions. If you think of Knut who is feeling embarrassment, you have to consider what kind of action he committed in which situation and how this action raised the disapproval of other people.



Awareness and Emotion

Awareness is closely connected with changes in the environment or in the psycho-physiological state. Why recognise changes rather than stable states? An answer could be that changes are an important indicator of our situation. They show that our situation is unstable. Paying attention or focusing on that might increase the chance to survive. A change bears more information than repetitive events. This appears more exciting. Repetition reduces excitement. If we think that we got the most important information from a situation or an event, we become unaware of such an event or certain facts.

Current research in this field suggests that changes are needed to emerge emotions, so we can say that it is strongly attention dependent. The event has to draw our attention. No recognition, no emotions. But do we have always an emotional evaluation, when we are aware of certain events? How has the change to be relevant for our recognition? Emotional changes are highly personally significant, saying that it needs a relation to our personal self.

Significance presupposes order and relations. Relations are to meaning as colours are to vision: a necessary condition, but not its whole content. One determines the significance and the scope of a change by f.e. event's impact (event's strength), reality, relevance and factors related to the background circumstances of the subject. We feel no emotion in response to change which we perceive as unimportant or unrelated. Roughly one can say that emotions express our attitude toward unstable significant objects which are somehow related to us.

This is also always connected with the fact that we have a greater response to novel experience. Something that is unexpected or unseen yet. When children get new toys, they are very excited at first, but after a while one can perceive, or simply remember the own childhood, that they show less interest in that toy. That shows, that emotional response declines during time. This aspect is called the process of adaptation. The threshold of awareness keeps

rising if stimulus level is constant. Hence, awareness decreases. The organism withdraws its consciousness from more and more events. The person has the pip, it has enough. The opposite effect is also possible. It is known as the process of facilitation. In this case the threshold of awareness diminishes.

Consciousness is focusing on increasing number of events. This happens if new stimuli are encountered. The process of adaptation might prevent us from endlessly repetitive actions. A human would not be able to learn something new, if got caught in an infinite loop. The emotional environment contains not only what is, and what will be, experienced but also all that could be, or that one desires to be, experienced; for the emotional system, all such possibilities are posited as simultaneously there and are compared with each other.

Whereas intellectual thinking expresses a detached and objective manner of comparison, the emotional comparison is done from a personal and interested perspective; intellectual thinking may be characterised as an attempt to overcome the personal emotional perspective. It is quite difficult to give an external description of something that is related to an intrinsic, personal perspective. But it is possible. In the following the most popular theories will be shown, and an rough overview about the neural substrates of emotions.

The Neural Correlate of Emotion

Papez Circuit

James W. Papez was the investigator of the Papez Circuit theory (1937). He was the first who tried to explain emotions in a neurofunctional way. Papez discovered the circuit after injecting the rabing-virus into a cat's hippocampus and observed its effects on the brain. The Papez circuit is chiefly involved in the cortical control of emotion. The corpus mamillare (part of the hypothalamus) plays a central role. The Papez Circuit involves several regions in the brain with the following course:

- The hippocampus projects to fornix and via this to corpus mamillare
- from here neurons project via the fasciculus mamillothalamicus to nucleus anterior of the thalamus and then to the gyrus cinguli
- due to the connection of gyrus cinguli and hippocampus the circuit is closed.

1949 Paul MacLean extended this theory by hypothesizing that regions like the amygdala and the orbitofrontal cortex work together with the circuit and form an emotional brain. However, the theory of the Papez circuit could no longer hold because some regions of the circuit can no longer be related to functions they were ascribed primarily and secondly current state of research concludes that each basic emotion has its own circuit. Furthermore, the assumption that the limbic system is solely responsible for these functions is out-dated. Other cortical and non-cortical structures of the brain have an enormous bearing on the limbic system. So the emergence of emotion is always an interaction of many parts of the brain.

Amygdala and Fear

The Amygdala (lat. Almond), latinic-anatomic Corpus amygdaloideum, is located in the left and right temporal lobe. It belongs to the limbic system and is essentially involved in the emergence of fear. Besides, the amygdala plays a decisive role in the emotional evaluation and recognition of situations as well as in the analysis of potential threat. It handles external stimuli and induces vegetative reactions. These may help prepare the body for fight and flight by increasing heart and breathing-rate. The small mass of grey matter is also responsible for learning on the basis of reward or punishment. If the two parts of the amygdala are destroyed the person loses its sensation of fear and anger. Experiments with patients whose amygdala is damaged show the following: The participants were impaired to a lesser degree with recognizing facial anger and disgust. They could not match pictures of the same person when the expressions were different. Beyond Winston, O'Doherty and Dolan report that the amygdala activation was independent of whether or not subjects engaged in incidental viewing or explicit emotion judgements. However, other regions (including the ventromedial frontal lobes) were activated only when making explicit judgements about

the emotion. This was interpreted as reinstatement of the „feeling“ of the emotion. Further studies show that there is a slow route to the amygdala via the primary visual cortex and a fast subcortical route from the thalamus to the amygdala. The amygdala is activated by unconscious fearful expressions in healthy participants and also „blindsight“ patients with damage to primary visual cortex. The fast route is imprecise and induces fast unconscious reactions towards a threat before you consciously notice and may properly react via the slow route. This was shown by experiments with persons who have a snake phobia (ophidiophobics) or a spider phobia (arachnophobics). When they get to see a snake, the former showed a bodily reaction, before they reported seeing the snake. A similar reaction was not observable in the case of a spiderphobia. By experiments with spiders the results were the other way round.

Recognition of Other Emotional Categories

Another basic emotional category which is largely independent of other emotions is disgust. It literally means „bad taste“ and is evolutionary related to contamination through ingestion. Patients with the Huntington's disease have problems with recognizing disgust. The insula, a small region of cortex buried beneath the temporal lobes, plays an important role for facial expressions of disgust. Furthermore, the half of the patients with a damaged amygdala have problems with facial expressions of sadness. The damage of the ventral regions of the basal ganglia causes the deficit in the selective perception of anger and this brain area could be responsible for the perception of aggression. Happiness cannot be selectively impaired because it consists of a more distributed network.

Functional Theories

In order to explain human emotions, that means to discover how they arise and investigate how they are represented in the brain, researchers worked out several theories. In the following the most important views will be discussed

James – Lange Theory

The James – Lange theory of emotion states that the self – perception of bodily changes produces emotional experience. For example you are happy because you are laughing or you feel sad because you are crying. Alternatively, when a person sees a spider he or she might experience fear. One problem according to this theory is that it is not clear what kind of processing leads to the changes in the bodily state and whether this process can be seen as a part of the emotion itself. However, people paralyzed from the neck down, who have little awareness of sensory input are still able to experience emotions. Also, research by Schacter and Singer has shown, that changes in bodily state are not enough to produce emotions. Because of that, an extension of this theory was necessary.

Two Factor Theory

The two factor theory views emotion as a compound of the two factors: physiological arousal and cognition. Schacter and Singer (1962) did well known studies in this field of research. They injected participants with adrenaline (called epinephrine in the USA). This is a drug that causes a number of effects like increased blood flow to the muscles and increased heart rate. The result was that the existence of the drug in the body did not lead to experiences of emotion. Just with the presence of a cognitive setting, like an angry man in the room, participants did self – report an emotion. Contrary to the James – Lange theory this study suggests that bodily changes can just support conscious emotional experiences but do not create emotions. Therefore, the interpretation of a certain emotion depends on the physiological state in correlation to the subjects circumstances.

Somatic Marker Hypothesis

This current theory of emotions (from A. Damasio) emphasizes the role of bodily states and implies that „somatic marker“ signals have influence on behaviour, like particularly reasoning and decision-making. Somatic markers are the connections between previous situations, which are stored in the cortex, and the bodily feeling of such situations (e.g. stored in the amygdala). From this it follows, that the somatic markers are very useful during the decision process, because they can give you immediate response on the grounds of previous acquired knowledge, whether the

one or the other option “feels” better. People who are cheating and murdering without feeling anything miss somatic markers which would prevent them from doing this.

In order to investigate this hypothesis a gambling task was necessary. There have been four decks of cards (A, B, C, D) on the table and the participants had to take always one in turn. On the other side of the card was either a monetary penalty or gain. The players have been told that they must play so that they win the most. Playing from decks A and B leads to a loss of money whereas choosing decks C and D leads to gain. Persons without a brain lesion learned to avoid deck A and B but players with such damage did not.

Reading Minds

Empathy is the ability that people have in order to appreciate others' emotions and their point of view. Simulation theory states that the same neural and cognitive resources are used by perceiving the emotional expressions of others and by producing actions and this expressions in oneself. If you are watching a movie where a person touches another one the same neural mechanism in the somatosensory cortex is activated as when you yourself get physically touched. Further studies investigated pain empathy for pain. That means, if you are watching that someone feels pain than two regions in your brain are overlapping. The first region is responsible for expecting another person's pain and the other brain area for experience this ache one self.

Mood and Memory

While we store a memory, we not only record all sensory data, we also store our mood and emotional state. Our current mood thus will affect the memories that are most effortlessly available to us, such that when we are in a good mood we recollect good memories (and vice versa). While the nature of memory is associative this also means that we tend to store happy memories in a linked set. There are two different ways we remember past events:

Mood-congruence

Memory occurs where current mood helps recall of mood-congruent material, e.g. characters in stories that feel like the reader feels while reading, regardless of our mood at the time the material was stored. Thus when we are happy, we are more likely to remember happy events. Also remembering all of the negative events of our past lives when depressed is an example of mood congruence. That means that you can rather remember a funeral where you were happy in a happy mood while you remember a party where you were sad in a sad mood, although a funeral is sad and a party is happy.

Mood-dependency

Memory occurs where the congruence of current mood with the mood at the time of memory storage helps recall of that memory. When we are happy, we are more likely to remember other times when we were happy. So, If you want to remember something, get into the mood you were in when you experienced it. You can easily try this yourself. You just have to bring into a certain mood by listening to the saddest/happiest music you know. Now you learn a list of words. Then you try to recall the list in the other/the same mood. You will see that you remember the list better when you are in the same mood as you were while learning it.

Disorders

Without balanced emotions, one's ability to interact in a social network will be affected in some manner (e.g. reading minds). In this part of the chapter some grave disorders will be presented- these are: depression, autism and antisocial behaviour disorders as psychopathy and sociopathy. It is important to mention that those disorders will mainly be considered in regard to their impact on social competence. To get a full account of the characteristics of each of the disorders, we recommend reading the particular articles provided by wikipedia.

Depression

Depression is a disorder that leads to an emotional disfunction characterized by a state of intensive sadness, melancholia and despair. The disorder affects social and everyday live. There are many different forms of depression that differ in strength and duration. People affected by depression suffer from anxiety, distorted thinking, dramatic mood changes and many other symptoms. They feel sad, and everything seems to be bleak. This leads to an extremely negative view of themselves and their current and future situation. These factors can lead to a loss of a normal social live that might affect the depressed person even further. Suffering from depression and losing your social network can thereby lead to a vicious circle.

Autism

Autism is an innate disorder with individual forms distributed on a broad spectrum. This means that symptoms can range from minor behavioral problems to major mental deficits, but it there is always some impairment of social competence. The American Psychiatric Association characterizes autism as "the presence of markedly abnormal or impaired development in social interaction and communication and a markedly restricted repertoire of activities and interests" (1994, diagnostic and statistical manual; DSM-IV). The deficits in social competence are sometimes divided into the so-called "triad of impairments", including:

- (1)Social interaction This includes difficulties with social relationships, for example appearing distanced and indifferent to other people.
- (2)Social communication Autists have problems with verbal and non-verbal communication, for example, they do not fully understand the meaning of common gestures, facial expressions or the voice tones. They often show reduced or even no eye-contact as well, avoid body contact like shaking hands and have difficulties to understand metaphores and "to read between the lines".
- (3)Social imagination Autists lack social imagination manifesting in difficulties in the development of interpersonal play and imagination, for example having a limited range of imaginative activities, possibly copied and pursued rigidly and repetitively.

All forms of autism can already be recognized during childhood and therefore disturb the proper socialization of the afflicted child. Often autistic children are less interested in playing with other children but for example love to arrange their toys with outmost care. Unable to interpret emotional expressions and social rules autists are prone to show inappropriate behaviour towards the people surrounding them. Autists may not obviously be impaired therefore other people misunderstand their actions as provocation.

Still there are other features of autism- autists often show stereotyped behaviour and feel quite uncomfortable when things change in the routines and environment they are used to. Very rarely, a person with autism may have a remarkable talent, such as memorizing a whole city panorama including, for example, the exact number of windows in each of the buildings.

There are several theories trying to explain autism or features of autism. In an experiment conducted by Baron-Cohen and colleagues (1995) cartoons were presented to normal and autistic children showing a smiley in the centre of each picture and four different sweets in each corner (see picture below). The smiley, named Charlie, was gazing at one of the sweets. The children were asked question as: "Which chocolate does Charlie want?"

Normal children could easily infer Charlie's desires from Charlie's gaze direction whereas autistic children would not guess the answer.

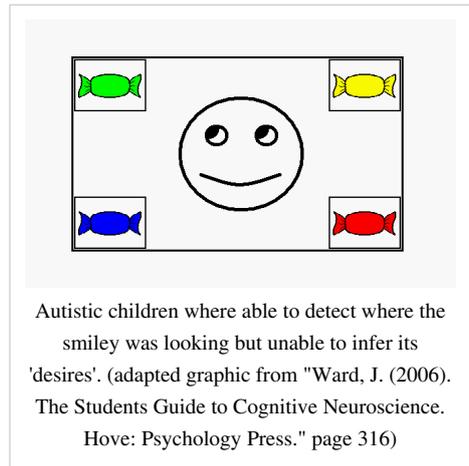
Additional evidence from other experiments suggest that autistic are unable to use eye gaze information to interpret people's desires and predict their behaviour which would be crucial for social interaction. Another proposal to explain autistic characteristics suggests that autists lack representations of other people's mental states (mindblindness-proposed by Baron-Cohen, 1995b).

Psychopathy and Sociopathy

Psychopathy and sociopathy are nowadays subsumed under the notion of antisocial behaviour disorders but experts are still quite discordant whether both are really separated disturbances or rather forms of other personal disorders e.g. autism. Psychopaths and sociopaths often get into conflict with their social environment because they repeatedly violate social and moral rules. Acquired sociopathy manifests in the inability to form lasting relationships, irresponsible behaviour as well as getting angry quite fast and exceptional strong egocentric thinking. While acquired sociopathy might be characterised by impulsive antisocial behaviour often having no personal advantage, developmental psychopathy manifests in goal directed and self-initiated aggression. Acquired sociopathy is caused by brain injury especially found in the orbitofrontal lobe (frontal lobe) and is thought to be a failure to use emotional cues and the loss of social knowledge. Therefore sociopaths are unable to control and plan their behaviour in a socially adequate manner. In contrast to sociopaths psychopaths are not getting angry because of minor reasons but they act aggressively without understandable reasons at all which might be due to their inability to understand and distinguish between moral rules (concerning the welfare of others) and conventions (consensus rules of society). Furthermore it even happens that they feel no guilt or empathy for their victims. Psychopathy is probably caused by a failure to process distress cues of others, meaning that they are unable to understand sad and fearful expressions and consequently suppress their aggression (Blair 1995). It is important to mention that they are nevertheless able to detect stimuli being threatening for themselves.

Summary

We hope that this chapter gave you an overview and answered the question we posed at the beginning. As one can see this young field of cognitive is wide and not yet completely researched. Many different theories were proposed to explain emotions and motivation like the James-Lange Theory which claims that bodily changes lead to emotional experiences. This theory led to the Two-Factor-Theory which in contrast says that bodily changes only support emotional experiences. Whereas the newest theory (Somatic marker) states that somatic markers support decision making. While analyzing emotions one has to distinguish between conscious emotions, like a feeling, and unconscious aspects, like the detection of threat. Presently researchers distinguish six basic emotions that are independent from cultural aspects. In comparison to this basic emotions other emotions also comprehend social awareness. So, emotions are not only important for our survival but for our social live, too. Reading faces helps us to communicate and interpret behaviour of other people. Many disorders impair this ability leaving the afflicted person with an inability to integrate himself into the social community. Another important part in understanding emotions is awareness; we only pay attention on new things in order to avoid getting unimportant information. Moods also affect our memory - we can remember things better if we are in the same mood as in the situation before and if the things we want to remember are connoted in the same way as our current mood. We also outlined the topic of motivation which is crucial to initiate and uphold our mental and corporal activities. Motivation consists of two parts: drives (biological needs) and motives (primarily social and psychological mechanisms). One important theory is the Maslow Hierarchy of Needs; it states that higher motivations are only aspired if lower needs are satisfied. As this



chapter only dealt with mood and memory, the next chapter deals with memory and language. So you have to go on reading if you think this was already interesting.

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- [1] Independent variables are the circumstance of major interest in an experiment. The Participant does only react on them, but cannot actively change them. They are independent of his behaviour.
- [2] The measured behaviour is called the dependent variable.
- [3] At the humoral response hypothalamic neurons stimulate or inhibit the release of pituitary hormones into the bloodstream and at the visceromotor response neurons in the hypothalamus adjust the balance of sympathetic and parasympathetic outputs of the autonomic nervous system (ANS).
- [4] α MSH neurons and CART neurons of the arcuate nucleus. α MSH(alpha-melanocyte-stimulating hormone) and CART(cocaine- and amphetamine-regulated transcript) are anorectic peptides, which activate the pituitary hormones TSH(thyroid-stimulating hormone) and ACTH(adrenocorticotropic hormone), that have the effect of raising the metabolic rate of cells throughout the body.
- [5] NPY neurons and AgRP neurons. NPY(neuropeptide Y) and AgRP(agouti-related peptide) are orexigenic peptides, which inhibit the secretion of TSH and ACTH.
- [6] MCH(melanin-concentrating hormone) neurons, which have extremely widespread connections in the brain, including direct monosynaptic innervation of most of the cerebral cortex, that is involved in organizing and initiating goal-directed behaviors, such as raiding the refrigerator.
- [7] The NPY- and AgRP neurons.
- [8] The pancreatic hormone insulin, released by β cells of the pancreas, acts directly on the arcuate and ventromedial nuclei of the hypothalamus. It appears that it operates in much the same way as leptin to regulate feeding behavior, with the difference that its primary stimulus for releasing is increased blood glucose level.

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links

- Dana Foundation and the Dana Alliance: The Site for Brain News (<http://www.dana.org/braincenter.cfm>)
- Brain Facts: PDF (<http://www.sfn.org/index.cfm?pagename=brainfacts>)

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