# Philosophy of Mind

# Philosophy of Mind:

## *Contemporary Perspectives*

Edited by

Manuel Curado and Steven S. Gouveia

Cambridge
Scholars
Publishing

Philosophy of Mind: Contemporary Perspectives

Edited by Manuel Curado and Steven S. Gouveia

This book first published 2017

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library



ISBN (10): 1-5275-0000-4
ISBN (13): 978-1-5275-0000-6

# TABLE OF CONTENTS

# CHAPTER THIRTEEN

# SCIENTIFIC DREAMS AND FOCUS FICTIONS ON CONSCIOUSNESS

JUDITE ZAMITH-CRUZ
AND ANDRÉ ZAMITH CARDOSO

Life experience translates into psychological reality through memories, imaginations, visions, smells, touches as sensory perceptions, cognitive and affective processes. In a person's focusing ability, someone does not live the consciousness of someone else. With 3D brain images, functional magnetic resonance imaging (fMRI) has been used to correlate and reconstruct the active parts of the brain with what is being observed by the subject (Naselaris et al., 2009). In human beings as a whole, the complex and the superior are included in the frame of *extended consciousness*, developed by Damásio (1999). If consciousness plays a key role in allowing us to bring information together in novel ways, researchers suggest that consciousness serves other functions too. Edelman et al. (2000), Nir et al. (2010) or Graziano (2013) have expanded the knowledge about the dynamic and correlational mental processes. Nili et al. (2015) questioned our imagination: "How does an information-processing machine produce subjective awareness?" The understanding of consciousness is discussed in five paradigm shifts. Here, a literary and phenomenological view on consciousness is examined, as well as a psychobiological, neurological, emotional, social-neurological perspective. The thoughts on consciousness that stem from science-fiction films and literature are analysed in the context of building an artificial intelligence (AI) machine.

## Introduction

The mind interprets reality through generating mental representations. In this sense, representation has the sense of "product of mental activities

exerted on the real" (Tiberghien et al., 2002), that are neither copies nor intrinsic characteristics of the reality.

Some years ago, Carter (1998) described the cognitive thinking process as a *working place* of consciousness. There, the metaphor of the processing features of consciousness appears as a symbiosis of cortical areas in the frontal lobes with "evaluating tasks", while subcortical areas feed these areas as "underground production chains". This underground subconscious process is the largest producer of emotions, which have an enormous effect on the unconscious experience, densely connected to the grey matter. Consequently, it has not been possible to *see* consciousness by brain imaging techniques; furthermore, we cannot delineate areas of memory, images or thoughts.

There are numerous theories to explain consciousness (Tiberghien et al., 2002): activation (exceeding a certain threshold for a mental process to be conscious), novelty (the requirement of new information to be brought to consciousness), *the tip of iceberg* (the imposition of a set of emergent exchange of unaware experiences to become aware), and *the theatre* (the needed place to collect the information in order to make a person aware). Baars (2002) and Bennett et al. (2007) defend the idea of "information" (novelty), when they think of consciousness as a "series of input and output that form a chain where information moves on". As the stream of consciousness is erratic and fragmentary, Dennett is outside of the theatre metaphor. Rosenthal (2005) suggests a new "quality-space theory", part of the global-workspace theories. Graziano (2013) suggests the question is about social neuroscience and the attention process: "How does an information-processing machine produce subjective awareness?" Does social perception give a person the feature of awareness that can be attributed to someone else?

What is the interest in consciousness and in the knowledge of existence? Consciousness is present in our perception of the world and in the representation of other people. It emerges from the knowledge of feelings and the cognition process. These combined processes are present in self-consciousness, and it is connected with the intuitive sense of experiencing its meaning. This happens either when we connect perceived memories and imaginations and when we are offered the sense of living.

The prefrontal lobes (stress control, dithering and planning tasks) and cortex are essential in conscious acts (Crick and Koch, 1998): it was found that the type of neural mechanisms that underlie the organization of visual perception, and the conscious perception of emotions and focused attention are related to prefrontal cortex activity.

The evolutionary theories suggest that if human ancestors and other hominids (extinct up to one million years ago) evolved, there should be neuroscientific evidence about the adaptive value of consciousness (Rossano, 2003; Striedter, 2005; and Rakic, 2010). It was in the evolution from hominids to human that the frontal lobes increased to approximately 28% of cortical area of the brain (Carter, 1998), and consciousness widened in the *core consciousness*. The brain expanded to incorporate something that may well be only human – the difference between to be (passive *automata*) and to act, the appearance of self-determination (to follow needs, demands and desires). The extinct animals possessed brain regions focused on the neocortex; however these were located in different places as compared to current mammals (Mlodinow, 2012).

Nowadays, images of the brain not only show the mechanisms of aggression and the systems involved in perceptive dysfunctions (Logothetis, 2008), but also mood, guilt and self-esteem (Wagner et al., 2011). The brain forms images of the body and external objects, creating a second order representation. This is not an abstraction with regard to self-consciousness. In brain mapping, the representation of the self-body is activated in the hypothalamus and cingulate cortex (Damásio et al., 1996). Several brain regions are assigned to the conscience task of making the body aware. Simultaneously, consciousness is also controlling awareness of the rational process under way. An area that appears to control consciousness is the ventromedial cortex (Drevets et al., 1997), also associated with depressive states. A disruption in activity in this area makes us perceive a lack of meaning in life or fall into manic states. This is a productive emotional centre, with several circuits of cognition and emotion. Those regions are extremely dense, and unite the conscious and unconscious mind. Unconscious processes gather different "results", which are unknown, however consciousness recreates these "products" (Tiberghien et al., 2002). *Freewill* depends on the selective function of consciousness, we can select from random elements which one is "interesting" to think about. Freewill is associated with the orbitofrontal cortex (conduit adapter to fluctuations in social and emotional context), below the ventromedial cortex. These were linked to reward and to hedonic experiences by fMRI (Kringelbach, 2005). In these cases the function of the brain is to recreate, construct and modify the experience, rather than receiving it. In harmony with the shared experience, when someone is asked where they feel their focus is, they usually point to the region just above the nose (Carter, 1998). Despite not being aware of this or other brain regions, they still point to the prefrontal cortex region.

The state of consciousness that occurs during the *waking life* is also called "waking consciousness". At this point, a number of questions arise: How to escape the approach of that "normal" consciousness, a moral entity or public conscience? How is it possible that most of our illusions occur without unveiling different levels of consciousness?

In this paper, we intend to discuss the interpretations of the conscious mind, and some apparent lack of consciousness: attention deficit hyperactivity disorder, fainting, hysterical paralysis, coma and *blindsight* (Celesia, 2010; Weiskrang, 1986). Additionally, the state of a professional athlete is examined (e.g. tennis, baseball, badminton, cricket, hockey) when they get to instinctively react, for example, to a high-speed approaching ball. The case of a person with altered states of consciousness (ASC) such as sleep deprivation, hallucinogens and mental disorders, usually linked to a deficit in brain states, is discussed in conjunction with a possible brain injury or chemical/biological molecular imbalances. In neuroscience, determination and self-consciousness were studied by interventions conducted in war veterans and other patients (Doidge, 2007; Carey, 2008), who suffered serious injuries in the pre-frontal lobes, with notable personality changes.

## XXI Century Approaches: Theories and Beliefs

In neuroscience and cognitive psychology, there were three questions of initial focus: "How to connect consciously the large number of perceptive and psychical processes in a single coherent whole?" (Crick, 1994; Llinas et. al., 1994; Singer, 1998; von der Marsburg, 2002); "Is consciousness determinant for self-awareness (Keenan et al., 2001), and does it assist emotional control (Silvia, 2002)?" Other influential theory (Baars, 2002) suggests that consciousness brings us "information" by novel ways. In an intuitive view consciousness is only an "internal light bulb illuminating the mind".

Recently experiments were carried out on the introspection on consciousness (Natsoulas, 2001; Varela & Shear, 1999). These resulted in a division between an inherently *easy*, and a *hard* kind of "problem". In order to give meaning to subjective experience, psychiatry uses new labels originally introduced to describe other syndromes (e.g. schizophrenia, among others). These medical terms are currently associated with ASC. The psychology of consciousness uses most of the same labels, such as in psychiatry.

As the concepts are based in beliefs (epistemic attitude about uncertainties), the theories are partly based in beliefs, subject to historic and linguistic turnarounds. Beliefs are metaphorical artefacts, which we need in order to predict the behaviour. They can be found both in superstitions and prejudices. Functionalism unfolds on a belief, for cognitive processes located in the social structure we live in. The beliefs system may (or may not) be contradictory, absurd, or contradicted by scientific evidence. Such an example of belief is when each of us feels more comfortable believing that we are in control of our own lives. According to the attribution theory (Lerner, 1980), humans are led to believe in a *Just World*, where it is possible to predict and guide our pathway. Beliefs are rooted and are extremely difficult to change, as it is difficult to change values, conceptions of self, the notion of reality or power.

Some people do not agree with most of other's beliefs, knowledge, and feelings (in greater extent, people with autistic type of characteristics). Identity and inter-subjectivity in schizophrenia and autism have been studied in clinical psychology for many years.

One thought experiment about autism suggests that a "shared activation mechanism" is needed, at a motor level and at an intentional level, beyond the "theory of mind" (TM) associated with beliefs that fail in autism. In that perspective, a theory is not only a cognitive, intentional and logical process (Tiberghien et al., 2002). Several research groups have suggested that the TM can be observed in the unfocused look (Premack & Woodruff, 1978; Leslie, 1991; Frith, 1989; Lillard & Skibbe, 2004; Welborn & Lieberman, 2015; Baron-Cohen, 1995, 1997, 2011). *Mindblindness* and the absent *mind reading* are characteristic of autism (Baron-Cohen, 1995). Disrupted communication and lack of empathy are used to characterize autism. The subjects did not have "other minds in the brain" (Fletcher, et al., 1995). Some people cannot "get themselves in someone else's head" (TM) and do not believe intuitively that others have a different vision of the world from their own.

Frith and Happé conducted a study with positron emission tomography (PET scans) where they compared people with and without *Asperger* features (Baron-Cohen, 1997). The subjects were asked to infer the other person's mental state during the PET scans. The control group had an active median left prefrontal cortex. For *Asperger syndrome* subject group, a region located immediately below the one that became active for the control group was active instead. With functionalist registration, people who avoid eye contact (Baron-Cohen, 1997) use modes of "processing of information" that are often distorted, such as save and retrieve, combine

and remember, for cognitive operations, generated by simple images, words or geometric figures stimuli.

As functionalism is a top-down view of brain functions, these researchers break down the functions into singular elements. Alternatively, the bottom-up view explains neuronal functions from the simple to the complex (from molecules, cells, brain, individual up to social networks). Therefore, perception of a functional mind features these two interpretations.

We can refer to folk psychology as a bottom-up theory. Folk psychology is an expression used to refer to behavioural reasons (an immediate human resource), as well as reasons for abstract concepts (beliefs and desires). Since those assumptions "originate" states and mental events, they are the "causes" of these behaviours. Folk psychology is ascending – bottom-up (Bruner, 1986, 1990, 1991). It starts from a few stories situated in a timeframe, and finishes in epochal dreams and blurred visions of consciousness. Narratives of knowledge and existence cannot be tested as hypotheses because people are not very predictable, the world is not fully knowable, and phenomena to be experienced in the world appear to be irreplaceable when these appear to be in controllable situations (Zamith-Cruz, 1996).

## The Enlightened Land of *Psychologies*

The acts of reading, speaking, memorizing, thinking or performing an automated task are human attention activators, such as driving a car.

One of the most prolific researchers on attention and consciousness was Francis Crick (1916-2004). He surprised a psychologist with the manifest view of consciousness by a simple mental exercise (Kosslyn & Rosenberg, 2004): "Hold both hands in front of you, but with one closer to you. Now look at the front one; now look at the back one. See how the front seems different when you are focusing on the back one?" The psychologist did not like to hear that consciousness was merely an attention aspect of the brain, to what Crick have responded: "consciousness is enriched by attention, but attention is not the necessary awareness". What Crick and Koch (1985, 1998) exposed were the crucial areas of the frontal lobes to consciousness. According to them, consciousness does not arise from regions of activity that register perceptive information: the primary visual cortex (V1) and the primary auditory cortex (SMA V1). Grazziano (2013) pursues an "attention schema theory", thinking that the specialized machinery of the brain calculates the form of consciousness and gives it to others in a social context. Nowadays, Koch (2009, 2012) suggested the fundamental property of consciousness to be like mass-energy and

electrical charge expressed through local concentrations of "integrated information".

Consciousness can also be observed in mundane human situations. An intuitive situation is attention deficit, lack of concentration, hyperactivity (physical restlessness), uncontrollable impulses and failed integration of stimuli or inputs. However, usually the hyperactive child is a "difficult" one. They have irregular activity in the prefrontal cortex, the anterior cingulate gyrus (i.e. attention focus in the stimulus) and/or the upper auditory cortex (i.e. integrates stimuli from different sources). In attention deficit hyperactivity disorder (ADHD) the brain may not be fully activated. Therefore, while sub-cortical regions are fully functional, the prefrontal brain areas fail to work synchronously (Cowen et al., 2012). In this case, the dominant protagonists of consciousness fail in *sustained attention*.

It is common sense that if someone faints and is not consciously present, the person stays physically immobile; therefore the person loses their consciousness. These regions do not appear activated in PET scans, while the frontal lobes appear activated, in the case of a leg movement. So one can see that having inactive limbs can occur despite the fact that their corresponding brain connections of consciousness are still intact.

The full sense of the "phenomenological flow" sets up another illusion. When someone is in the state of vegetative coma, the person can give us the idea of being aware. When a hand is stung, the spinal cord and the thalamus immediately trigger the fixation of the eyes of someone else by a rapid gesture. Yet it is an automatic reflexive activity. A tennis player can act instinctively, unlike a blind person, he possesses brain activity on the occipital lobes; nonetheless it is not an automatic reaction only. A blind person can move their face rapidly to the attention direction. Thus by extension of meaning given to their conscience, the blind person will also come to interact with their attention seeker (Pegna et al., 2005). In imminent danger, a person even uses a *blindsight* (Celesia, 2010). It is possible that the study of consciousness may unveil more insight in the field of dementia (e.g. Parkinson's and Alzheimer's diseases) and strokes.

## The Literary and Phenomenological Consciousness

In the phenomenological domain, Romanyshyn introduced a metaphorical aspect of experience. This was part of the extension of meaning, and similar to the reflection on experience by the classical philosophers Erasmus of Rotterdam (1469-1536) and Michel de Montaigne (1553-1592).

First, Romanyshyn argued that "from fidelity to the psychological experience, in its own terms, it takes us beyond the alternatives of facts

and of ideas of things and thought, empirical and mental reality; it takes us to a metaphorical reality" (Romanyshyn ,1982; cit. by Becker, 1992). On the one hand, it is thought that experience comprises a kind of awareness. On the other hand, it is in the fictional realm that new theories have emerged beyond the ordinary cognition problems (the *easy problem* of consciousness).

The writer José Rodrigues Miguéis (1959) has fallen at the door of "ethical realism", a new strain of consciousness in the subjective and common sense "reality". He named hunger as the most urgent primary need (Maslow, 1954). It would be the resentment of an internal physical motivation (hunger), when he wrote about his character: "Suddenly I felt the guts rolled me up in hunger. (...) and sometimes there is nothing like such a simple desire to reactivate a man to his consciousness and confidence" (Miguéis, 1959). In Lev Vigotsky's original works of 1938, he mentions that there is a paradoxical demand of consciousness, in the case of hunger, it would cause social and political awareness.. He framed it in an internal model that mirrored his own condition, by saying that "the word is for the conscience as the small world is to the big world".

## The First Scientific Turning Point: Functional Biopsychology

A function is generally opposed to a phenomenon. Alternatively to the phenomenological mind, the functionalist paradigm of experience is focused on the "products" or "results" of thought and it is not directed to the way of how we think during the (erratic and fragmentary) flux of thought. Instead the sensory activity is replaced by what happens in the brain. Could it be that activation of a neuronal module causes a *product* that is a private or subjective state of consciousness? Are the activation of action potentials in the thalamus and in the sensory-somatic cortex the main cause of the conscious perception?

A difference in perspective suggests that the structure of neural activity does not represent the stimulus. It is the person's meaning that is based on experience. The quality of *my* or *your* conscious experience has variations according to the cognitive processes involved (the various components of consciousness). Either it is the attention or the reflection on the qualities of things (*phenomenological consciousness*).

After the sixties, the cognitive paradigm of information processing, consciousness, is seen as a "function" due to the fact that we access it and we are effective in its transmission. Furnham (2008) outlined that we are aware of how information processing is consciousness. It is relevant to say

that in the functionalistic ideology, machines can have conscious. A fuller understanding of what it represents – what does it mean to be a person? – requires first understanding that consciousness must be considered in its environment. The main question is: why does an emotional experience precede consciousness? A revolutionary change leaded by Philiph Bard and Walter Cannon (1929) suggested that the hypothalamus is a key part of the emotional brain.

The major finding was that brain structure is different from a homogeneous black box (e.g. behaviouristic position). Canadian psychologist and biologist Roger W. Sperry (1968 and 1974) made the first inter-hemispheric surgical separation, cutting the corpus callosum, showing how the two hemispheres seemed to work independently. This procedure was first shown in small mammals and in severe epileptic humans (split-brain). Along with Ronald Myers, Sperry showed that a cat could learn a task (pulling a lever to receive food), while having a half of the brain activity ignored by other half of the brain.

How do two split minds cohabitate in the brain? A well-studied case is the one of a butcher with absence of inter-hemispheric communication. Usually, if a person lost the command of his left hemisphere (Springer & Deutsch, 1993), that person loses the control of one of the hands. That suggests that the brain architecture has differences between hemispheres. Epilepsy patients can have inter-hemispheric separation surgery. Fewer are those who have suffered strokes with brain lesions in only one or both hemispheres in a specific supplementary motor area (SMA) and the corpus callosum. In this case, the person perceives what is called a “conflict between hands” (Gazzaniga, 1967) or “a strange hand”, a disease known by patient M.P. (Parkin, 1996). In this case, M.P. was increasingly able to perform daily activities. Despite the fact that her left hand had "helped her" making a tortilla, it prevents her from fulfilling daily tasks on several occasions. This phenomenon is not exclusive of schizophrenia, here called "split personality”.

## The Second Turning Point: Integrated Neuroscience

The phenomena of double consciousness can also be thought of following Damásio’s terms (1999): *consciousness* (the phenomenological flow, the temporal course of consciousness and its contents); and *consciousness of the self* (and the sensation of self), thus the sense of phenomenology to an entity (the *self* who feels *being*). We think and feel ourselves thinking (metacognition).

In early 1960 cognitive neuroscience adhered to the concept of consciousness as a continuum of bodily manifestations, which are heterogeneous phenomena at a perceptive and reflective level, and, as mentioned, the way each body experiences life (subjectivity).

In regards to self-consciousness, Damásio interprets it as a narrative self, within the character caught up in *the stage*, when someone adopts different identities (Mlodinow, 2012). It was by leaving the identity of the self that Damásio (1999) suggested another reality on the cortical level and on the subcortical level. The theory expands consciousness in terms of intentionality, as our experiences have meaning. The representation of an experience and the wide range of experiences we have are connected. Damásio (1999) emphasized the current situation in *storytelling*, a function of the brain that captures intentionality, i.e. the fact that the psychic contents "relate to... (…something external to the mind)". This does not imply examining the "existence" in neurosciences. This is in the sense that consciousness is the knowledge we have of our existence. This does not imply that we should not study an *extended consciousness*, which Damásio mentioned by outlining *the human*, *the complex* and *the* "*superior*".

The "revelation of consciousness" was also presented by Damásio (1999). Here, biological mechanisms regulated by the body were introduced (associated to emotions). The aspect of self-regulation was also envisioned due to the relationship with the environment. Consequently, civilization is not an *extended consciousness,* which occurs in the minds provided with *core consciousness*. The interaction with social media is attributed to the collective minds of emotion, memory, language and intelligence. Secondly, these aspects suggested that consciousness was an *extended consciousness* and the concept of *self*. The new metaphor for the brain had a captivating *audience* of representations of *themselves*, as it included the body, constantly supporting its storytelling. Since then, consciousness includes the sense of *self*, coupled to the act of *knowing*. These theories identify a *thinking being* ability to *perceive* what is knowledgeable, and the knowledge of him or herself.

## The Third Turning Point: Unconscious Emotions

> Nobody enjoys failing to explain their own rationales or intentions (Gazzaniga, 1992).

Since the eighties, the models of information processing integrated correlated emotions as cognition. Frijda (2007) and other scientists formulated that there is no true distinction between emotion (with certain general rules) and reason. Through the cognitive theory of emotions,

without simple wishes or cognitive states, emotions would be over determined by deliberate intentions – "the readiness of states in action". So, emotions are not "passions" opposite to "actions". They are accompanied by subjective feelings, giving clues to others about our thoughts and desires. Are there emotions disconnected from the bases of our reactions, in conjunction with an overall situation? Emotions are not always conscious intentions.

Nowadays, emotions constitute a primary system of meaning, and intentions are mixed beliefs and desires. The evolution of emotions involves that they are not "derangements" of human "positive" development, communication and interaction.

Joseph LeDoux has extensively studied fear conditioning, in the processes involved by two different brain mechanisms: a reflex system and a dependent system of thought and interpretation. In 1996, he showed emotional outbursts in animals, such as "false anger" because, as Walter Cannon would have said, they do not have a "conscious feeling of anger" (Cannon 1929, cit. by LeDoux, 1996). LeDoux (1996, 2012) changed the explanation on emotions, in agreement with the theories of James-Lange (we react to a stimulus and then we feel an emotion, only after the reaction), and Cannon-Bard (we have separate bodily reactions and emotional reactions). Thus, he was the first one to concisely explain emotions, from the perspective of William James, one hundred years after William James (1884). He devised a new circuit of fear named as *shortcut of LeDoux* ("we run away, and then we get afraid"), in which the passage of the input is in the order of thousands of seconds faster than the long circuit – "we have fear, and then we run away" (Fig. 13-1). His revolutionary breakthrough moment was based on works of Gazzaniga (1967, 1998); he extended on the knowledge of the "conflict between hands". He described the split-brain condition. While the patient beats his wife with one hand, he would protect her with the other hand. After all, we can carry a *mute prisoner* in our head (the right hemisphere), with a *distinct personality* from the everyday personality we have or we want to be (LeDoux, et al., 1977). The suggestion was that the left hemisphere controls most of the aspects of language processing, reasoning, and storytelling. The right hemisphere works in absence of interpretation of the world, and justified beliefs. The left hemisphere for its part gives us our "motivated reasoning", an extremely positive self-image, as we believe in our goodness, competence or control (Mlodinow, 2012).

As manifestations of split-brain were known with better technical resources, Gazzaniga used the absence of inter-hemispheric communication to explore functions of the sensory and motor cortex on the control of

emotional and unconscious behaviours (LeDoux, 1996). Experiments on the full cerebral cortex of cats which had their cortex removed resulted in indicators of emotional arousal, once a cat was provoked: they cowered, bent the back, meowed, retracted the ears, bristled their fur, showed their claws and their teeth, they bit objects when presented by hand, among other reactions (Kaada, 1960, 1967; cit. by J. LeDoux, 1996). Under these circumstances, decorticated cats activated the autonomous nervous system: their fur bristled, their pupils dilated, their blood pressure and heart rate increased. In conclusion, their behaviour was changed. They had unregulated emotional reactions and they were not able to control their animal rage. Therefore, it was impossible to continue accepting the rational that cortical regions controlled these emotional reactions (Head, 1921, cit. by J. LeDoux, 1996). Once these areas where removed, there was bilateral coordination loss.

The classical fear conditioning was based on the amygdala (detection and evaluation of the affective perceived content, emotionally modulating memory), a small structure on the frontal interior area of the temporal lobes. Thus, the emotional theory of Joseph LeDoux is an alternative to the dominant cognitive theories of emotion, with pioneers such as Richard Lazarus (stress research), Stanley Schachter (eating behaviour and cognition research) and Magda Arnold (relationships in personality and emotions research).

From the sixties until the end of the twentieth century, we believed that emotions emerged once a person interpreted a situation as a whole. The current idea was that the state of the body is affected by its surroundings; even if an emotion is "weak" and transitory, one would experience the intrusion of a thought (e.g. looking out of a window, meditating, one or two seconds). So, it was thought that there is a *control precedence* of an emotional occurrence (Frijda, 2007). However, we have different cognitive systems for different emotions. One cognitive system is acting as a reflex system (regardless of thought and interpretation), while the other system is functioning as dependent of thought and interpretation. On the one hand, a person has reactions acting upon the brain and body, while on the other the reactions act upon memories and interpretations, both systems involving emotion (Fig. 13-1).

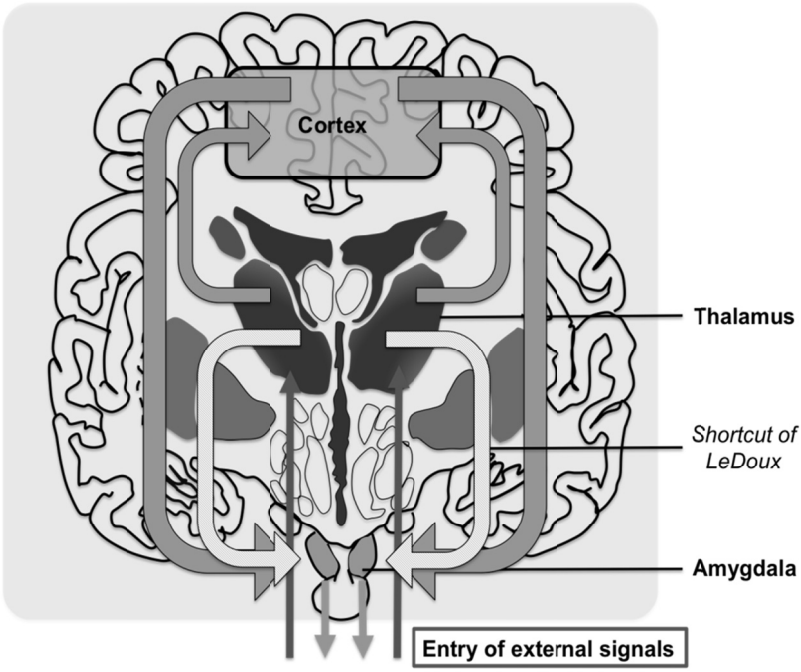


**Fig. 13-1.** Scheme of the flux of emotional information in the brain. The entry of external signals passes through the thalamus and can follow two paths: one through the amygdala or another through the cortex (conscious mind). The *shortcut of LeDoux* represents the shorter path through the amygdala, thus emotional unconscious reactions are faster than conscious ones.

When a baby reacts with an expressive-motor form (sensorimotor) to the environment that evokes their biologically adapted "answers", the baby already evaluates with the amygdala what is "good" or "bad" for themselves. Therefore, the fear connected to amygdala activation requires no cognitive interpretation. But complex guilt lies in cognitive interpretation and memories of previous events. By that (r)evolutionary approach (Amorapanth et al., 2000; Davidson & Begley, 2012), emotions arise at some occasions as brain-body interconnected reactions, while with some events they come up as part of conscious memories and interpretations of a given situation. The idea that emotions come from a deeper order than the frontal cortex, because there are more connections expanding from amygdala (unconscious emotional generator) to the cortex (medial temporal lobe, orbitofrontal cortex and the frontal lobe) than in the reverse

direction (from the cortex to the "limbic system") was innovative. Emotional control is imposed. The conscious mind is not at the center of emotion operations.

Biological or psychological emotional states are tested when we are unable to make cognitive decisions, and lack the impulse control due to frontal lesions (see Phineas Gage). Despite the large number of emotional connections to the frontal lobes, this does not mean that parts of the frontal lobes are not involved in motor control.

## The Fourth Turning Point: The *New Unconscious*

In communication, we express different "types" of coherence. If communication gets across to the listener, it is legitimate, and we feel confident on our own identity of the self. The study of social self, conduct and relations exists within human civilization, a field nowadays called *social neuroscience* (which implies a structure within a previous frame).

Neuroscientists of the last four decades introduced the concept of "superior" level of the mind, including how automatic mental processes change us (Bargh, 2007). It suggests that the development of these working processes evolved for a better human adaptation (Wilson, 2002). These findings clearly show that animals not only have an instinctive behaviour, but also act beyond most common instinctive actions (Kolb & Whishaw, 2004; Mlodinow, 2012). Therefore human and other species share the beyond instinctive behaviour and neocortical tissues.

Recently, emotional unconscious terminology has changed, and it has been categorized in different dimensions: the implicit, the tacit, or the hidden mind. The work of Sigmund Freud (1856-1939) has been reassessed (Solms, 2004), with theoretical improvements, which resulted from the increasing molecular, cellular, neural and psychological research: such as in neuropsychoanalysis (Berlin, 2011) and *social* neuroscience (Galbis-Reig, 2004; Wilson, 2002).

Nowadays, most of the mental processes can be labeled as two types: conscious and unconscious (Kihlstrom et al., 1992). Unconscious processes led to the study of some mental processes such as visual perception (Barbur et al., 1993), "inattention blindness" (Levin & Simons, 1997), and false memory (Loftus, 1974, 2005; Levin & Simons, 1997; Simons & Levin 1989).

The birth of social neuroscience can be dated to a meeting in 2001 (Ochsner & Lieberman, 2001). Their research was not only advanced by the increase in novel imaging techniques (Naselaris et al., 2009), but also by the large amount of psycho-social studies included. In addition to the

inherent subjectivity of who has to react to images or sounds (i.e. someone who is asked to think of *A* or *B*), in the context of brain research, the sophistication of human-like reaction is already well replicated by machines. Naselaris et al. (2009) used fMRI to monitor the flow of information in the brain when a person is asked to think of a place *A*. Subsequently, a computer is programmed to recreate with extreme precision (for a computer reconstruction) what the thought of the "real" image *A* represents.

First of all, these results raise the question of how the unconscious matrix is realigned with the emerging neuropsychological and social knowledge. Notably a third of the brain size is devoted to vision (sensory) and consciousness-associated systems (Mlodinow, 2012). In the unconscious vision, the temporal lobe becomes important to fill the gaps in our vision (as complementary to vision by the occipital lobe).

Secondly, unconscious processes are the result of operations performed as "logical machines" and its activity reflects the reflex domain (Baars, 1988). By that cognitive awareness perspective, the unconscious processes of consciousness perform very specific tasks fast, sometimes make little mistakes, and do not suffer interference from other processes, dealing with large amounts of data, operating in parallel, for specific and limited areas.

Thirdly, the intricate relation between the conscious and the unconscious suggests that we do not have the expectation that we control what we dream or what happens or goes around us (Hassin, et. al., 2005), simply because we do not have only a conscious mind (Mlodinow, 2012).

Our ignorance about the *hard* philosophical problem should remain, but it will only remain about "raw" experiences (*lived*), with fading traces at the level of immediate memory. One reason for this is that the experience we have is recreated by ambiguous theories of consciousness.

Finally, brain injuries and chemistry improve our understanding of consciousness, therefore we need to continue exploring more about it, also due to the frontal cortex being involved in dementia. Other conjectures come from computational developments, as we will see next (Nili et al., 2015).

## The Fifth Turning Point: the Step to Conscious Machines

Human-machine interfaces (HMI) are welcome in society (Negroponte, 1989). The brain is not a silicon-based technological material, nevertheless it has its self-regeneration capacity and its sensory component in common with technology, in other words, to be a "mission control center"

(Eagleman, 2011). However, a silicon-based material acts as a gender-neutral "social actor" (Nass et al., 1994, 1997).

In an age of technological changes, machines put an end to behaviorism, the so-called "cognitive revolution" (Bruner, 1986; Gardner, 1986). Since the eighties, with *connectionism*, cognitive psychology has been associated to neurosciences, building the ideas of "executive routines/programs" and "mental models" (Johnson-Laird, 1983), with parallel processing and interdependent operations such as in computers. These methods of brain analysis came to replace the sequential, linear or serial operations (e.g. *associationism*). Following this, the structure of the nervous system would become decentralized, to be either hierarchical or vertical (Mountcastle, 1978; Edelman, 1987).

It is foreseeable that with non-invasive methods the brain will be increasingly better understood. At this stage, biological-integrated robots will be used for the study of memory, other neurological processes and diseases. Due to its complexity, scientists have only been able to replicate some parts that we can electronically understand, outside the body (Nili et al., 2015). Nili et al. have recently reported the first electronic multi-state memory cell, giving information of multiple processes. Once compared with actual human memory, this replica could overcome human memory capacity. In the brain, we have simultaneously old personal memories (episodic memory) and declarative memory (explicit memory of facts and events). This system is inspired in the human brain in the sense that the "electronic long-term memory cell can mimic the way the human brain processes information" (Joshi, 2015). Nili et al. (2005) suggest that the human brain and the ionic brain will be similar.

Nowadays, the *hard problem* of consciousness is shared between understanding the human brain and the emerging machine paradigms: what is the nature of experience? What is the nature of the social mind and the networked systems? An interesting example to study these phenomena is physical pain. Subjectively, pain can be programmed in a bionic brain (Joshi, 2015). It is not yet possible for a robot to feel pain in the same way that humans do, because of physiological differences. The ideas of Epicurus (341–270 BC), Descartes (1596-1650), Condillac (1715-1780) and La Metrie (1709-1751) emphasized that differentiated systems exist around us at different times of our lives (little bits of matter as *atoms*, sensitive statues, and other things). Mathematician Thomas Hobbes (1588-1679) said: "thinking is calculating". Descartes associated animals to machines, and Leibniz (1646 –1716) made a design of a reasoning machine to solve differences of "opinion" (beliefs) (Leibniz, 1685).

The last turning point of this text is the discussion of common ideas about the power of facts/fictions in consciousness, what could be called *factions*. A common *faction* is a complex system such as a machine that causes divergence and deviance, an organism that is capable of causing "damages" to the human being while doing it *consciously*.

Recent blockbuster filmography has initiated a public discussion on the following questions. Is it possible that a person possesses beliefs or feelings for an operative system (OS) or an artificial intelligent (AI) machine? Can a machine have and *cause* mental states in someone else?

Consciousness is an essential process to motivate oneself to feel that other person is capable of acting upon oneself. It was suggested that actions can "sneak up" without sufficient intent on our part (Wegner, 2002). Actions can become unpleasantly inconsistent compared to previous intentions (e.g. to create an emotional machine), therefore to urge an action that creates a new intention (e.g. to create a beautiful smile).

The AI field is working on "adapted" mental states that can be produced by other system besides humans. A small robot-cockroach learned how to behave and be accepted as a group member, in contact with other cockroaches. The aim is not to compare the robot-cockroach to the human brain, which is evolutionary and has neuroplasticity. Instead, the aim is to push the limits of self-learning computation.

In the realm of science fiction cinema, movies such as *Her* (Jonze, 2013) or *Ex machina* (Garland, 2015) suggest a different future of OS and AI machines. These movies question if it will ever be possible for a (sensitive) person to share a conscious experience with a purchased OS or an AI machine. In *Her*, an OS was the "personality" in the voice of *Samantha* (Scarlett Johansson). Voice is something ineffable and ephemeral, as thinking. In the movie the main character *Theodore* (Joaquin Phoenix) is asked by his friend: "what do you like *more* to see in *Samantha?*" What is the source of love in the relationship? Is the vocal enchantment that captivates him? It is difficult to think about the subtleties of our understanding of each other.

Norbert Schwarz et al. (2009) called for the concept of "fluency effect" in information (a metacognitive experience) which is difficult to comprehend, as it affects the information *substance*.

The idea of exchanging messages with a virtual entity (without a body) is also portrayed in OS character *Samantha*. Nowadays, with the explosion of online dating services (also portrayed in the movie), these questions curb the user's brain, since the user does not know if the person they are interacting with is in fact a human being, because they have never actually met previous to the virtual encounter.

Since approximately one third of the brain is specialized in vision (Eagleman, 2011), perception has a tendency to be ambiguous. What we see is a refugee of belief in that particular help context, however there are some tricks and assumptions. Alex Garland (director of the movie *Ex machina*, 2015) foresees these complex dilemmas, since he makes us imagine a "real" AI (Ava) that can pass the abysmal gap of achieving consciousness. The relationship based on meeting Ava distinguished itself from the scientific domain, originally dedicated to knowledge of AI, not feeling of AI. In *Ex Machina*, the willpower and knowledge of the *other* give Kaleb (Domhnall Gleeson) the feeling of self-knowledge.

This process of conscious analysis follows Friedrich Hayek thought "classification processes" or self-organization: "much of what we think we know about the outside world is indeed knowledge of ourselves" (Hayek, 1952b).

Ava (Alicia Vikander) becomes a "conscious" interlocutor because Ava is "connected", therefore conscious. Movie character of creative computation guru *Nathan* (Oscar Isaac) asks *Kaleb* at the beginning of the movie: "the challenge is to show that it [Ava] is a robot. And see if you still feel that it is aware (...)". Intentionality, this is the first dimension for a "theory of mind" (TM), when a person debates about dispositions, beliefs or desires, and Ava is there to do so. Other dimensions of intentionality are to know about *the other*, and IA is adapted to complex human relations, including verbal and non-verbal communication.

Hayek said "We cannot discard, but only develop what we do not understand" (Hayek, 1979). To feel loved, hated or betrayed, there can be delusions or illusions, such as a schizophrenic delusion that may let us believe that the brain has been exchanged with another one, such as with Ava.

Why is consciousness central? Perhaps it is to anticipate upon other people's minds, and fight against *bad* operations of survival of Ava. What about the sensitivity of feeling that defines the "explanatory gap" of consciousness? The brain has the mind and the body at various levels. However, what characterizes psychosis is the feeling of powerlessness to control daily life events. For its part, the subjective experience of a depressive person could be the appearance of life, as a gap, or a fragmentation of unconnected events.

# Final Remarks

"Emotions are a collection of unconscious neural responses to *qualia*."
—Damásio

There may be a large gap between implicit or emotional knowledge and awareness.

Mind and culture are developed concomitantly and not successively (Hayek, 1979). Distinct forms of consciousness rest on other prior conditions: unconscious mental schemes are therefore abstract cognitive structures that generate experience, by recurrent models (Neisser, 1987b), or by themes about advanced knowledge on a given subject. The brain accepts *schemata*, "schematic structures". These schemes are not represented in the mind, but in the body (Johnson, 1987).

The shifting turning points of knowledge about consciousness are outlined and discussed in the light of different times and approaches. From the sensible receptivity, we think of a literary work and a philosophical one (Churchland, 2008): How to live in terms of "the experiential self"?

*Qualia* is a term philosophy of mind uses to refer to the mental states of senses. This refers to smell, colors or sounds. From daily experience, as soon as a person wakes up, a real sensory experience is felt (a phenomenon). This can be the smell of coffee, without the conscious process.

The turning points represent scientific moments of comprehension and fictional motivated constructs to explain consciousness. Below are summarized the main key points: (1) functional biopsychology – split-brain and human functionality – a new reality of split-brain, with *two minds* in a brain; illusion of the two minds – corpus callosum connects them; (2) integrated neuroscience – the *extended conscious* and an (unconscious) neural reaction to a certain stimulus – the emotion level; illusion of the cortex command – connection between cortical and subcortical areas; (3) emotions realm – two types of emotions – conscious (cortex) and automatic/unconscious (amygdala), and the (still unconscious) sensing of this body state (feeling); illusion of super control and body power; (4) the new unconscious – multiple people with a complex ensemble of neural activations in their brains – multiple talking minds – and feelings; illusion of mutual understanding; and (5) the step to conscious machines – two systems and complex shared feelings – the "simulator" hypothesis – a "shared activation mechanism" is needed, at a motor and intentional level, beyond the "theory of mind"; psycho-techno-thrillers illusion – multiple minds and enlarged dimensions are aware and sensible of multiple inputs and outputs.

There is a large gap between what a person knows but does not know how is known (implicit knowledge) and what that person is aware of. In the paper "Attention alters the visual plasticity", Gutnisky et al. (2009) showed that the brain absorbs what is seen, like Ava, the character from the movie *Ex Machina*, by Alex Garland, does with consciousness.

Firstly, in order to make those cerebral psycho-techno-thrillers alive or understand them, we must grasp some mental criteria, as said by Eagleman (2011): "All vision is illusion". What the brain creates is a mental script of things. Neuroscience social knowledge reflects upon other illusions, which we thought were memories (Schacter, 1987) or "realities" of perception, more than realities as we see them. Our brain "creates" the experience that we thought of as a sensory perception. Here it is important to remember Immanuel Kant's (1724-1804) *a priori* concepts, or George Berkeley's (1685-1753) old idea: "to be is to be perceived" (*esse est percipi*). The discrepancy between what our brain registers and what we see (think and remember) is tremendous. Hence, a lot of information is always lost from the sensory system.

Secondly, the brain "waking consciousness" is always active, whether we are asleep or awake and it is difficult to know what is "normal", as we make quick decisions about mindfulness. We must be aware of the human limitations that lead us to dichotomous thought categories, such as "to be awake", when sleep is not opposed to be aware. When we think of the abstraction of a linguistic idea such as "to become awake", it is a "surface structure" of language. In that structure, transmitting the idea of being awake (e.g. by saying that a person is in possession of a *normal consciousness* or a *waking consciousness)* is not sufficient to transmit that information (tactile, unconscious or implicit). Since we enjoy the awakened experience, we have modes of storytelling about our existence and about *what happens*. That serves to the construction of the self and the world. To think on the waking process brings concrete facts and imagination to consciousness – fantasies, desires, with emotional and sometimes intense internal reactions.

Thirdly, conscious knowledge does not refer to "fatal visions" – such as ASC, as in *Macbeth* (Shakespeare, 1623) – "Art thou not, fatal vision, sensible / To feeling as to sight? / Or art thou but / A dagger of the mind, a false creation, / Proceeding from the heat-oppressed brain?" Can a sudden emotion that is terrifying, as that one, block the most *lucid dream*, and does his frontal cortex diminish the shock of emotion? His mind would wander round in hallucination, when interpretations are already erroneous behaviors. Wouldn't Shakespeare be concerned before he understands the

interpretation of what his *other mind* would do? Would that *other mind* wonder about the hallucination of his first mind?

Finally, consciousness is seen with a social neuroscience perspective and the focus on relationship, proximity and intimacy, with not "easy" gender-neutral questions (Fitzpatrick, 2012). The network between *us* and *them*, the "family resemblance" (Wittgenstein, 1997) appears to be fundamental to realize how the categorization process happens. Representation of human characteristics increases with increasing similarities between people and no bizarre entities.

## References

Amorapanth, P., LeDoux, J., & Nader, K. (2000). Different lateral amygdala outputs mediate reactions and actions elicited by a fear-arousing stimulus. *Nature Reviews Neuroscience*, *3*, 74-79.

Baars, B. (1988). *A cognitive theory of consciousness*. Cambridge: Cambridge University Press.

—. (2002). The conscious accept hypothesis: Original and recent evidence. *Trends in Cognitive Science*, *6*, 47-52.

Baptista, A. A. (1985). *Os nós e os laços*. Lisboa: Presença.

Barbur, J., Watson, J., Frackowiak, R., & Zeki, S. (1993). Conscious visual perception without V1. *Brain, 116,* 1293-1302.

Bargh, J. (2007). *Social psychology and the unconscious: The automaticity of higher mental processes*. N.Y.: Psychology Press.

Baron-Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind*. Cambridge, MA: The MIT Press.

—. (1997). Is there a language of the eyes? *Visual Cognition*, *4*(3), 311-331.

—. (2011). *Zero degree of empathy*. London: Penguin.

Becker, C. (1992). *Living and relating: An introduction to phenomenology*. London: Sage.

Bennett, M., Dennett, D., Hacker, P., & Searle, J. (2007). Neuroscience and philosophy: *b*rain*, m*ind, and language*. N.Y.: Columbia University Press*.

Berlin, H. (2011). The neural basis of the dynamic unconscious. *Neuropsychoanalysis*, *13*(1), 5-31.

Bruner, J. (1986). *Actual minds, possible worlds*. Cambridge, MA: Harvard University Press.

—. (1991). *The narrative construction of reality*. *Critical Inquiry*, *18,* 1-21

—. (1990). *Acts of meaning*. Cambridge, MA: Harvard University Press.

Carey, B. (2008). Blind, yet seeing. The brain subconscious visual sense. *The New York Times*, Dec. 23, 2008.

Carter, R. (1998). *Mapping the mind*. London: Weidenfeld & Nicolson.

Celesia, G. (2010). Visual perception and awareness: A modular system. Journal of Psychophysiology, 24(2), 62–67.

Churchland, P. (2008). The impact of neuroscience on philosophy. *Neuron 60*, nov. 6, 409-411.

Cowen, P., Harrison, P., & Burns, T. (2012). Shorter Oxford Textbook of Psychiatry (6th Ed.). Oxford: Oxford University Press,

Crick, F. (1994). *The astonishing hypothesis: The scientific search for the soul*. N.Y.: Scribner.

Crick, F. & Koch, C. (1995). Are we aware of neural activity in primary visual cortex? *Nature, 375,* 121-123.

Crick, F. & Koch, C. (1998). Consciousness and neuroscience. *Cerebral Cortex*, *8*, 97-107.

Damásio, A. (1994). *Descartes' Error: Emotion, reason and the human brain*. London: Piscator.

—. (1999). *The feeling of what happens: Body, emotion in the mankind of consciousness*. N.Y.: Harcourt.

Damásio, H., Grabowski, T., Tranel, D., Hichwa, R., & Damásio, A. (1996). A neural basis for lexical retrieval. *Nature,* 380 (6574), 499–505.

Davidson, R. & Begley, S. (2012). *The emotional life of your brain*: *How its unique patterns affect the way you think, feel, and live--and how you can change them*. London: Penguin.

Doidge, N. (2007). *The brain that changes itself: stories of personal triumph from the frontiers of brain science*. London: Penguin.

Drevets W., Price, J., Simpson, J. Jr, Todd R., Reich, T., Vannier, M. &, Raichle, M. (1997). Subgenual prefrontal córtex abnormalities in mood disorder. *Nature*, 386, 6527, 284-287.

Eagleman, D. (2011). *Incognito: The secret lives of the brain*. N.Y.: Pantheon.

Edelman, G. M. (1987). *Neural darwinism: The theory of neuronal group selection*. N.Y.: Basic Books.

Edelman, G. & Tononi, G. (2000). *Consciousness: How matter becomes imagination*. N.Y.: Basic Books.

Fletcher, P., Happé, F., Frith, U., Baker, S. C., Dolan, R., Frackowiak, R., & Frith, C. (1995). Other minds in the brain: a functional imaging study. *Cognition*, *57*, 109-128.

Fridja, N. (2007). *The Laws of emotions.* N.J.: Lawrence Erlbaum Association.

Frith, U. (1989). *Autism: Explaining the enigma*. Oxford: Blackwell.
Fitzpatrick, S. (2012). Functional brain imaging: Neuro-turn or wrong turn? In M. Littlefield & J. Johnson (Eds.), *The neuroscientific turn*: *Transdisciplinary in the age of the brain* (pp. 180-198). Ann Arbor: University of Michigan Press.
Furnham, A. (2008). *50 Psychology ideas you really need to know*. London: Quercus Editions.
Galbis-Reig, D. (2004). Sigmund Freud, MD: Forgotten contributions to neurology, neuropathology, and anesthesia. *Internal Journal of Neurology*, *3*(1).
Gardner, H. (1986). *The mind's new science: A history of the cognitive revolution.* N.Y.: Basic Books.
Garland, A. (2015). Director of *Ex Machina*, Produced by DNA Films.
Gazzaniga, M. (1967). Split brain in man. *Scientific American*, *217*(2), 24-29.
—. (1992). *Nature's mind: The biological roots of thinking, emotions, sexuality, language and intelligence*. Harmondsworth: Penguin Books.
—. (1995). Consciousness and de cerebral hemispheres. In M. Gazzaniga (Ed.), *The cognitive neuroscience* (pp. 1391-1400). Cambridge, MA: MIT Press.
—. (1998). The split brain revisited. *Scientific American*, 279, 1 (Jul. 1998). 51-55.
Graziano, M. (2013). Conscious and the social brain. Oxford: Oxford University Press.
Gutnisky, D., Hansen, B., Iliesen, B. & Dragoí, V. (2009). Attention alters visual plasticity during exposure-based learning. *Current Biology*, *19*(7), 555-560.
Hassin, R., Uleman, J., & Bargh, J. (2005). (Eds.). *The new unconscious*. Oxford: Oxford University Press.
Hayek, F. (1952b). *The sensory order*. Chicago: University of Chicago Press.
—. (1978). *New studies in philosophy, politics, economics, and the history of ideas.* Chicago: University of Chicago Press.
James, W. (1884). What is an emotion? *Mind*, *9*(39), 188-205.
Jonze, S. (2013). Director of *Her*, Annapurna Pictures
Johnson, M. (1987). *The body in the mind: The bodily basis of meaning, imagination and reason*. Chicago: University of Chicago Press.
Johnson-Laird, P. N. (1983). *Mental models*. Cambridge: Cambridge University Press.
Joshi, M. (2015). Can we experiment on a bionic brain if it feels human pain? On website: http://bigthink.com/ideafeed/roboethics-can-we-

experiment-on-a-bionic-brain-that-is-capable-of-human-pain (accessed at 27 Mars 2015)

Kaas, J. H. (2006). Evolution of the neocortex. *Current Biology*, *21*(16), 2006, R910-914.

Kandel, E., Schwartz, J., Jessell, T., Siegelbaum, S., & Hudspeth, A. (2000). *Principles of neural science* (4th. Ed.). N.Y.: McGraw-Hill.

Keenan, J., Nelson, A., O'Connor, M., &, Pascual-Leone, A. (2001). Self-recognition and the right hemisphere. *Nature*, *409*, 305.

Kihlstrom, J., Barnhardt, T., & Tataryn, D. (1992). The psychological unconscious: Found, lost, and regained. *American Psychologist*, *47*(6), 788-791.

Koch, C. (2009). "Minds, brains and society" (lecture in Caltech, Pasadena, CA, 21 Jan. 2009).

—. (2012). *Consciousness: Confessions of a romantic reductionist.* Massachusetts: The MIT Press.

Kolb, B. & Whishaw, I. (2004). *An introduction to brain and behaviour*. N.Y: Worth.

Kosslyn, S. & Rosenberg, R. (2004). *Psychology: The brain, the persona, the world* (2nd. Ed.). N.Y.: Pearson.

Kringelbach, M. (2005). The human orbitofrontal cortex: Linking reward to hedonic experience. *Nature Reviews: Neuroscience*, *6*(9) 2006, 691-702.

LeDoux, J. (1996). *Emotional brain: The mysterious underpinning of emotional life.* N.Y.: Simon & Schuster).

—. (2012). Rethinking emotional brain. *Neuron*, *73*, 653-676.

LeDoux, J., Wilson, D., & Gazzaniga, M. (1977). A divided mind. *Annals of Neurology*, *2*, 417-421.

Leibniz, G. (1685). *The art of discovery.* In P. Weiner (Ed.), *Selections* — Gottfried *Wilhelm Leibniz.* N.Y.: Charles Scribners.

Leopold, D. & Logothesis, N. (1996). Activity changes in early visual cortex reflect monkeys' precepts during binocular rivalry. *Nature*, 379-549-553.

Lerner, M. (1980). The belief in a Just World*: A fundamental delusion*. N.Y: Plenum.

Leslie, A. (1991). The theory of mind impairment in autism: Evidence for a modular mechanism of development. In A. Whiten (Org.), *Natural theories of mind* (pp. 63-78). Oxford: Blackwell.

Levin, D. & Simons, D. (1997). Failure to detect changes to attended objects in motion pictures. *Psychonomic Bulletin & Review*, *4*(4), 501-506.

Lillard, A. & Skibbe, L. (2004). Theory of mind: Conscious attribution and spontaneous trait inference. In R. Hassin, J. Uleman, & J. Bargh (Eds.), *The new unconscious* (pp. 277-308). Oxford: Oxford University Press.

Llinas, R. R., Ribary, U., Joliot, M., & Wang, X.-J. (1994). Content and context in temporal thalamocortical binding. In G. Buzsaki, R. R. Llinas, & W. Singer (Eds.), *Temporal coding in the brain*. Berlin: Springer Verlag.

Loftus, E. (1974). Reconstruction of automobile destruction – Example of interaction between language and memory. *Journal of Verbal Learning and Verbal Behaviour, 13*(5), 585-589.

—. (2005). Planting misinformation in the human mind: S 30-year investigation of the malleability of memory. *Learning & Memory*, *12*, 361-366.

Logothetis, N. (2008). What we can do and what we cannot do with fMRI. *Nature*, *453*, 869-878.

Maslow, A. (1954). *Motivation and personality*. N.Y.: Harper.

Miguéis, J. R. (1958). *Leáh e outras histórias*. Lisboa: Editorial Estúdios Cor.

Mlodinow, L. (2012). *Subliminar: How your conscious mind rules your behaviour.* N.Y.: Vintage Books.

Mountcastle, V. (1978). An organizing principle for cerebral functions: The unit module and the distributed system. In G. Edelman & V. Mountcastle (Eds.), *The mindful brain* (pp. 1-50). Cambridge MA: The MIT Press.

Naselaris, T., Prenger, R., Kay, K., Oliver, M., & Gallant, J. (2009). Bayesian reconstruction of natural images from human brain activity. *Neuron 63*, 902-915.

Nass C., Tauber J., & Reeves E. (1994). Computers are social actors. Proceedings of CHI'94: Human Factors in Computing Systems, 72-77. Boston, MA, Association for Computing Machinery.

Nass C., Moon, Y., & Green, N. (1997). Are computer gender neutral? *Journal of Applied Social Psychology*, *27*(10), 864-876.

Natsoulas, T. (2001). On the intrinsic nature of states of consciousness: Attempted inroads from the firs-person perspective. *Journal of Mind and Behaviour*, *22*, 219-248.

Negroponte, N. (1989). From Bezel to Proscenium. In Proceedings of SigGraph '89.

Neisser, U. (1987b). *Concepts and conceptual development: Ecological and intellectual factors in categorization*. Cambridge: Cambridge University Press.

Nili, H., Walia, S., Kandjani, A., Ramanathan, R., Gutruf, Ph., Ahmed, T., Balendhran, S., Bansal, V., Strukov, D., Kavehei, O., Bhaskaran, M., & Sriram, S. (2015). Donor-Induced Performance Tuning of Amorphous $SrTiO_3$ Memristive Nanodevices: Multistate Resistive Switching and Mechanical Tunability. *Advanced Functional Materials*, April 14, 2015.

Nir, Y. & Tononi G. (2010). *Trends in Cognitive Sciences*, *14*(2), 88-100.

Northcutt, R. & Kaas, J. (1995). The emergence and evolution of mammalian neocortex. *Trends of Neuroscience*, *18*(9), 373-379.

Ochsner, K. & Lieberman, M. (2001). The emergence of social cognitive neuroscience. *American Psychologist 56*(9), 717-728.

Parkin, A. (1996). Explorations in cognitive neuropsychology. Oxford: Oxford University Press.

Payne, D., Elice, C., Blackwell, J., & Neuschatz, J. (1996). Memory illusions: Recalling, recognizing, and recollecting events that never occurred. *Journal of Learning & Memory*, *35*, 261-285.

Pegna, A., Khateb, A., Lazeyras, F., &, Seghier, L. (2005). Discriminating emotional faces without primary visual cortices involves the right amygdala. *Nature Neuroscience*, *8*(1), 24-25.

Penrose, R. (1989). *The emperor's new mind*. Oxford: Oxford University Press.

Premack, D. & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behaviour and Brain Sciences*, *4*, 515-526.

Rakic, P. (2010). The evolution of neocortex: Perspective from developmental biology. *Nature Reviews Neuroscience*, *10*, 724-735.

Rosenthal, D. (2005). *Consciousness and mind*. Oxford: Oxford University Press.

Rossano, M. (2003). Expertise and the evolution of consciousness. *Cognition*, *87*(3), 207-236.

Schwarz, N., Song, H., & Xu, J. (2009). When thinking is difficult: Metacognitive experiences as information. In M. Wänke (Ed.), *Social Psychology of Consumer Behaviour* (pp. 201-223). N.Y.: Psychology Press.

Schacter, D. L. (1987). Implicit memory: history and current status. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *13*, 501-518

Shakespeare, W. (1623). *Macbeth*. London Penguin (Version of 1988).

Silvia, P. J. (2002). Self-awareness and emotional intensity. *Cognition & Emotion*, *16*, 195-216.

Simons, D. & Levin, D. (1989). Failure to detect changes to people during a real-world interaction. *Psychonomic Bulletin & Review*, *5*(4), 644-648.

Singer, W. (1998). Consciousness and the structure of neuronal representation. *Philosophical Transactions of the Royal Society Britannica*, *353*, 1829-1840.

Solms, M. (2004). Freud returns. *Scientific American*, *5*, 83-88.

Sperry, R. W. (1968). Hemisphere disconnection and unity in conscious awareness. *American Psychologist*, *23*, 723-733.

—. (1974). Hemispheric specialization: scope and limits. In F. Schmitt & F. Worden (Eds.), *Neuroscience: Third Study Program* (pp. 5-19). Cambridge, MA: The MIT Press.

Springer, S. & Deutsch, G. (1993). *Left brain/right brain* (4th. Ed.). N.Y.: W. H. Freeman.

Striedter, G. F. (2005). *Principles of brain evolution.* Sunderland, MA: Sinauer Associates.

Tiberghien, G., Abdi, H., Desclés, J.-P., Georgieff, N., Jeannerod, N., Le Ny, J.-F., Livet, P., Pynte, J., & Sabah, G. (2002). *Dictionnaire des sciences cognitives*. Paris: Arman.

Varela, F. & Shear, J. (1999) (Eds.). *The view from within: First person methodologies*. London: Imprint Academic.

Yasnitsky, A. (2009). Ocherk istorii Khar'kovskoj psikhologicheskoj shkoly: pervaya nauchnaya sessiya Khar'kovskogo gosudarstvennogo instituta i poyavlenie "Khar'kovskoj shkoly psikhologii" (1938) [An outline of the history of the Kharkov school: first scientific session of the Kharkov state pedagogical institute and the emergence of the "Kharkov school of psychology" (1938)]. *Cultural-Historical Psychology* (2), 95–106.

von der Malsburg, C. (2002). How are neural signals related to each other and to the world? *Journal of Consciousness Studies*, *9*, 47-70.

Wagner, U., N'Diaye, K., Ethofer, T., & Vuilleumier, P. (2011). Guilt-specific processing in the prefrontal cortex. *Cerebral cortex*, *21*, 2461-2470.

Wegner, D. (2002). More than good intentions: Holding fast to faith in free will. *The New York Times*, 31 Dec. 2002.

Weiskrang, L. (1986). *Blindsight: A case study and its implications*. Oxford: Clarendon Press.

Welborn, B. & Lieberman, M. (2015). Person-specific Theory of Mind in medial prefrontal cortex. *Journal of Cognitive Neuroscience, 27*, 1-12.

Wilson, T. (2002). *Strangers to ourselves: Discovering the adaptive unconscious*. Cambridge, MA: Belknap Press, 5.

Wittgenstein, L. (1997). *Philosophical investigations.* Oxford: Blackwell (Originally published 1953).

Zamith-Cruz, J. (1996). Trajectórias criativas: O desenvolvimento humano na perspectiva da psicologia narrativa. Unpublished doctoral dissertation, Universidade do Minho – Portugal.