

From sensations to perceptions, from emotions to feelings: "transformations" linked to consciousness

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Abstract

Sensations and emotions are physiological phenomena, most of which are generally mature from birth. Neurological maturation and emotional development allow the baby to appropriate these physiological phenomena and lead to their transformation into perceptions and feelings. Based on these two major transformations, consciousness—that is, the capacity we have to think in the first person—can emerge. Thus, in typical human development, the organism and the psyche forge strong, enduring bonds. Certain pathologies exist that hinder or destroy these bonds.

Keywords: sensations-perceptions, emotions-feelings, consciousness, psychomotricity

Introduction

The concept of sensoriality was already being considered in ancient Greece. According to Coren (2003), Plato (428–348 BC) spoke of the apprehension of objects through the senses and with the "mind." For him, sensory inputs were variable and imprecise, providing—at best—only an imperfect copy of objects and their relationships within the world. For the Greek thinker, it was the role of reason and intelligence to correct the inaccuracies of the senses and provide a true and accurate representation of the world. In the 18th century, Kant (1724–1804)—again according to Coren (2003)—argued that sensory systems provide only limited information. For him, it was the role of intelligence to shape conscious reality. Yet, we are accustomed to using the terms "sensation" and "perception" in everyday language. What, then, is a sensation, and how does it differ from perception? How do sensory systems function, and how do we extract information from them? Let us take this further and observe that the same reasoning applies to emotions—genetically programmed and functional from birth—which transform into feelings through the process of neurological and psychological maturation.

From Sensations to Perceptions

What is a sensation? Coren (2003) posits that the role of sensory systems is to detect stimuli and that, for von Helmholtz (1821–1894), the foundations of sensory experience are physiological, implying that sensory receptors specific to each modality "must exist." This view is now widely accepted. Mather (2006) defines sensation as a "simple conscious experience generated by the stimulation of a sensory organ, such as the eye [...]. The different types of sensations are called sensory modalities [...]. Sensory modalities are qualitatively different from one another, such that no modality can be confused with the others." When a stimulus encounters the appropriate sensory receptor, the latter triggers a physiological response in the form of an action potential that travels to the processing centers of the central nervous system. Sensations are therefore primitive phenomena induced by sensory stimulation. Sensation is thus an elementary physiological event. The collective term for sensory systems is "sensoriality."

Regarding the classification of sensory systems, there is now a broad consensus in modern neuroscience: three major categories are recognized—exteroception, proprioception, and interoception. Exteroception encompasses the following sensory systems: vision, hearing, taste, olfaction, light touch, pressure, warmth, cold, vibration, pruriception (itch sensation), and pain. Proprioception concerns information regarding the positioning of various body parts relative to one another, movement (kinesthesia), and the force required to adjust to the weight of an object being

moved (Breedlove et al., 2012). According to Héroux et al. (2022), the term "proprioception"—introduced by Sherrington (1907)—can be defined as awareness of the mechanical and spatial states of the entire body and its various segments. Regarding position, a distinction is made between information about the position of limbs relative to one another and relative to the outside world. Proprioception is the body schema acting in coordination with the vestibular system and visual input regarding movement (Pireyre, 2021). Proprioceptors are located in the muscles, tendons, and joints.

Interoception refers to the set of sensory systems associated with internal organs. Interoceptive signals traveling to higher nerve centers are relayed through the brainstem (specifically the nucleus of the solitary tract and the parabrachial nucleus) and the thalamus before reaching the insula and the cingulate cortex. Compared to other sensory systems, interoceptive information is more diffuse and can only be localized very roughly. Hunger, thirst, digestion, respiration, heart rate, and endocrine secretions—which constitute interoceptive information—play a vital role in homeostasis. When a homeostatic imbalance arises in these areas, the organism must initiate appropriate corrective behaviors.

What is perception? The scientific study of the distinction between sensation and perception took place during the nineteenth century, benefiting from advances in the understanding of the nervous system that began early in that same century. A key figure is von Helmholtz, for whom converting raw sensation into "perceptual knowledge" was essential. Thus, perceiving is a matter of solving a problem. Individuals react differently to the same stimulus; a person's history, age, and development influence how sensory stimulation is processed. Perception can therefore be illustrated as follows (Coren, 2003): "I have pain in my toe—that is a sensation; but I know I am in pain because I know I stubbed my foot—that is a perception." Perception therefore requires the intervention of "reason or the mind." According to Mather (2006), perception is complex and involves assigning meaning to our interactions with objects and events. Perception thus encompasses a range of mental events. Current theories of perception focus primarily on how the brain constructs and utilizes the representations it generates. This process requires the involvement of large regions of the brain; visual perception alone engages between one-third and one-half of all cortical neurons. According to Coren (2003), the vast majority of researchers and theorists agree on the distinction between sensation and perception. Perception is a psychological act that "must be accepted." This does not, however, preclude an examination of how the brain constructs perception from sensation, or how sensory thresholds vary from one individual to another.

Constructing Perception

According to Breedlove (2012), sensory systems are centripetal—or ascending—by nature. They most often travel via the spinal cord and brainstem before reaching the thalamus and the relevant cortical areas. Ascending sensory information is modulated by nerve centers. For instance, a small population of neurons in the brainstem sends axons to the very base of auditory receptor cells to "dampen" certain sounds. Furthermore, there is a strong interplay between sensory systems; the activation of one modulates the activity of another. Barker et al. (2019) introduce the concept of lateral inhibition. This is a peripheral process in which "the most active cells and axons inhibit adjacent, less active cells, thereby producing greater contrast in afferent information." Lateral inhibition enables better identification and localization of the stimulus.

Neuroanatomy and neurophysiology thus confirm the complexity of the act of perception, which relies on a vast array of central nervous system structures. Perceiving is a psychological act—specifically, one that is both cognitive and affective. Given the immaturity of the central nervous system in newborns, we posit that perception must undergo development, implying a primacy—or pre-existence—of sensation. Processing sensory information and establishing personalized sensory thresholds are sensorimotor achievements of early life. Thus, beyond the establishment of perception itself, sensorimotor development can be described as the process of transforming sensation into perception.

From Emotions to Feelings

Emotions have become a distinct field of neuroscience research. Authors generally agree in attributing physiological—and thus bodily—dimensions to emotions. Here, too, we are operating at the level of the organism. The number of distinct emotions appears to be limited (Pace-Schott et al., 2019); anger, anxiety, fear, disgust, joy, and sadness are commonly cited as the basic emotions. The first three are processed by the amygdala, a subcortical structure of the central nervous system. Disgust is primarily associated with the insular cortex, while joy and sadness appear to be processed by anterior brain structures.

The autonomic nervous and endocrine systems are involved in the "making of emotions." An emotion is therefore underpinned by a set of bodily phenomena. Nummenmaa et al. (2014) explain that we feel emotions "directly in our bodies." They prepare us to face changes and "challenges" posed by our environment. These same authors observed strong similarities in the bodily manifestations of emotions across European and East Asian cultures. Most basic emotions involve sensations in the head, reflecting the role of facial expressions as a channel for emotional communication. Sensations in the upper limbs are linked to anger or joy, whereas low activity in these same limbs tends to indicate sadness. Sensations felt in the digestive tract or throat are associated with disgust. Joy is unique in that it appears to involve most regions of the body. The construction of emotions thus relies on somatosensory and visceral manifestations. An emotion therefore manifests as changes in the body, consistent with Damasio's (2010) proposal that "emotions are genetically pre-wired." They are present from birth, and likely even before. As we can see, emotions are indeed expressed "on the stage of the body" (Damasio, 2010). Emotions are, therefore, bodily changes. Feelings, for their part, are the perception of these changes by affective and cognitive systems.

Feelings

Emotions are not feelings, and vice versa. Yet, the two are frequently confused in everyday language. Sometimes, the term "feeling" is even used to describe mental processes far removed from any objective reality—such as "I have a feeling something is going to happen..." A feeling is defined as the subjective experience of an emotion. It "emerges" or "emanates" from the emotion. It is a perception—a mental representation—of physiological changes associated with emotion (Pace-Schott et al., 2019). In other words, the physiological expression of emotions consists of changes within the internal organs. There is a coupling between these physiological changes and the emotional experience (Critchley & Garfinkel, 2017). Interoception is therefore crucial to the generation of emotions and, by extension, serves as the basis for feelings. Nummenmaa (2014) echoes this view: feelings are triggered by the sensation of bodily changes linked to emotions and located in the internal organs. These changes involve the autonomic nervous system as well as the muscular and endocrine systems. Feelings are produced primarily by the insular and cingulate cortices, as well as by cortical somatosensory areas. The formation of feelings is heavily influenced by cognitive processes (Koelsch et al., 2021). This aligns with Damasio's (2010) perspective that "feelings play out on the stage of the mind." A feeling is an affective and/or cognitive "view" of an emotion.

Feelings are thus a "variation" of emotions, with the cortical system regulating, controlling, and transforming the latter into feelings. Thus, it can be understood that fear is an emotion generated in subcortical regions and expressed through bodily sensations such as trembling, sweating, or muscle contractions. Apprehension is a variant—a less intense form—of fear. Regulated, controlled, and altered by the cortex and by affective and cognitive systems, fear undergoes a "transformation"—for instance, into apprehension.

Fear is an emotion; apprehension is a feeling.

Transforming emotions into feelings

Kerr et al. (2020) investigated the importance of the social environment in the development of

emotion regulation. For these authors, this skill is crucial for effective social interaction. Parent-child interactions influence the child's "emotional circuitry"—specifically the prefrontal, insular, and amygdala regions. Regulating emotions enables the child to adapt better to their environment. This process is facilitated by directly observing the emotional behavior of others, parental guidance, and the family's emotional climate. Indeed, it is known that children imitate others' facial expressions and seek to understand both their own emotions and those of others, as well as how to respond to them. Observation and imitation appear to rely on cortical networks with properties similar to those of mirror neuron networks; these networks include the insula, the cingulate cortex, and the amygdala. The importance of the parental role extends beyond early childhood, continuing even into adolescence (Kerr et al., 2020). Emotion regulation is a key skill in child development. Regulating an emotion means transforming it and establishing an emotional threshold; it means creating feelings.

To conclude this point, it can be said that emotions and sensations are physiological phenomena, whereas perceptions and feelings are cognitive and affective phenomena.

Transforming sensations into perceptions and emotions into feelings is a significant part of the sensorimotor development of babies, children, and adolescents. In the context of typical psychomotor development, these transformations occur through neurological maturation and the presence—verbal and physical, conscious and unconscious—of others.

Towards Consciousness

Consciousness is the phenomenon that allows one to view oneself as a subject thinking in the first person singular, and to recognize—first and foremost—one's sensations and emotions, as well as one's thoughts and memories, as one's own (Damasio, 2010 and 2021). Under this conception, speaking of "self-consciousness" is a pleonasm: consciousness is inherently self-consciousness. Starting from the premise that "we possess an organism animated by a conscious mind," the question of "ownership of the conscious mind" arises: endowed with consciousness, we own our minds. The mind belongs to us, and this sense of ownership enables us to think in the first person. It is because we are conscious that we experience our minds as belonging to us. The notion that the mind belongs to the self, contingent upon the presence of consciousness, is relatively new, yet at this stage, it requires us to explore the foundations of consciousness.

Consciousness rests upon primordial feelings, which constitute the "fundamental component of consciousness." Damasio distinguishes two categories of these: homeostatic feelings and emotional feelings.

Homeostatic feelings originate in the interoceptive sensory system, which encompasses respiratory, cardiac, digestive, and endocrine functions. The role of these major functions is to "contribute to the proper management of life in accordance with the requirements of homeostasis," and thus to participate in gathering real-time information regarding homeostatic conditions. In this way, the brain is constantly informed of the state of life within the organism. These major functions give rise to the creation of a genuine cerebral copy of the vegetative body. They rely on the activity of the following higher centers: brainstem nuclei (parabrachial, solitary tract, and periaqueductal gray), as well as the cingulate and insular cortices. An emotional state—whether positive or negative—is attributed to changes (pleasant or otherwise) detected by interoceptive sensory receptors. Thus informed, the brain can initiate behaviors to rectify imbalances; for instance, drinking water when the body's fluid reserves run low.

Emotional feelings play a slightly less critical role than homeostatic feelings in the formation of the mind. They arise from the emotional reactions—whether mild or intense—that we experience during our actions, perceptions, and mental representations, given that any sensory stimulus, however slight, triggers an emotion. This process involves the other two sensory systems: proprioception and exteroception. Within the central nervous system, the somatosensory cortices—including the temporoparietal junction (Ahmad et al., 2021)—are active in generating emotional feelings and, consequently, consciousness. This is how, when faced with the fear of danger, the

brain can trigger a flight response.

According to Damasio, feelings "serve to reflect the state of life within the body." In doing so, they constitute the "fundamental component of consciousness," facilitating the emergence of the mind's conscious nature.

Thus, consciousness can be said to originate in sensations (particularly interoceptive ones).

Transformed into perceptions through our relationships with others—primarily parents, in the case of a child—these sensations exist at the interface between the organism and the psyche, giving rise to emotions. These emotions, in turn, are transformed into feelings through the dynamic of relating to others. Consciousness is an accumulation of knowledge regarding the organism and its sensory and emotional changes. At times, according to Damasio, these changes become numerous enough to automatically generate the concept of the mind's sense of ownership or belonging. Consciousness originates in perceptions and feelings; the former stem from sensory systems that operate both in isolation and in a coordinated, integrated manner. Consciousness is thus built upon this foundation of perceptions and feelings. Consciousness has its origins in the body. It represents a specific type of link between the organism and the psyche (Pireyre, 2024).

The body schema

According to current neuroscience (see Pireyre, 2021), the body schema is proprioception. For the brain, this involves gathering information regarding the position of various body parts relative to one another, the force required to lift and/or move a weight, and kinesthesia—that is, the movement of different body parts. Visual feedback on movements may be necessary—for instance, to control the movements required to grasp very small objects. The vestibular system also plays a necessary role, as changes in position alter the body's center of gravity. In children under the age of seven, whose proprioceptive systems are still immature, visual input regarding movement takes precedence. The body schema is thus a coordinated set of sensations. However, as with other types of sensations, proprioceptive information undergoes transformation throughout physiological and psychological development; proprioceptive sensations thereby evolve into proprioceptive perceptions.

The question of the nature of the body schema thus leads us to reflect on the connections between the organism and the psyche.

The Body Image

For its part, the body image is the set of connections between the organism and the psyche that were established at the very beginning of life. These connections were formed during a period when both the organism (specifically, the cortical areas) and the psyche were immature. At this stage, the organism's development runs slightly ahead of psychological development, even though the infant already possesses a certain drive to develop—something akin to Spinoza's *conatus*, or the "tendency to persevere in one's own being." This concept differs from the psychoanalytic notion of "desire," as desire requires the presence of "the Other"—something absent at the start of life, a time when the infant is "equipped" with a distinction between self and non-self, but not yet one between self and other.

In the context of this article, the body image (Pireyre, 2021) encompasses the concepts of perceptions and feelings. Indeed, one could say that when the psyche "considers" sensations, it "sees" them as perceptions; likewise, when it "considers" emotions, it "sees" them as feelings. The same logic applies to the skin and the concept of an envelope, as well as to the spine and the body's axis...

Conclusion

Beyond the concepts of body schema and body image, there are significant differences between sensations and perceptions: sensations are physiological phenomena, whereas perceptions are representations of sensations. A similar parallel can be drawn between emotions and feelings. Perceptions and feelings are psychological phenomena and, as such, involve different thresholds.

Perceptions can vary in intensity, while emotions can vary in their level of regulation; hence the terms "sensory thresholds" and "emotional regulation." Hyper- and hypo-sensory processing, as well as emotional regulation disorders, are found in certain conditions such as autism spectrum disorders and specific forms of dementia. In these individuals, it is as if sensations fail to transform (or no longer transform) into perceptions, and as if emotions persist without becoming (or ceasing to become) feelings. In a sense, the body and the psyche fail to connect—or lose their connection—appearing almost disjointed. For the individual concerned, this amounts to living in a body that does not feel like their own—one that is incomprehensible and allows only a limited capacity for the construction of consciousness. Psychomotor therapists are the professionals tasked with treating these phenomena. Thanks to training that focuses on the links between the body and the psyche, these paramedical professionals are ideally positioned to support such patients. The use of targeted mediating techniques and an approach that takes into account communication via muscle tone or the autonomic nervous system constitute therapeutic tools well-suited to these types of difficulties. Ultimately, it can be argued that pathologies involving perception, feelings, and consciousness are indisputably psychomotor disorders.

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