Greš et al. Scr Med. 2024 Jul-Aug;55(4):511-6. DOI:10.5937/scriptamed55-49738

CURRENT TOPIC

Consideration of Emotions and Sensations in a Neuroscientific Context

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Abstract

Understanding emotions and sensations from a neuroscientific context is essential for unravelling the complex mechanisms underlying human behaviour and cognition. Emotions are created by maintaining a positive or negative relationship of an individual towards the experiences and facts of reality. Sensations are the result of the influence of the material world on our senses or receptors. Recent advancements in neuroimaging techniques, such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) have provided unprecedented insights into the neural circuitry underlying emotions and sensations. Additionally the role of neurotransmitters, neural networks and brain regions are implicated in emotion regulation, sensory processing and their integration. Furthermore, there is impact of emotional and sensory dysregulation on various psychiatric disorders, including anxiety, depression and post-traumatic stress disorder (PTSD), highlighting potential avenues for therapeutic interventions. Overall, the importance of interdisciplinary research is in bridging the gap between neuroscience and psychology, paving the way for a deeper understanding of human emotions and sensations which is reflected in both simple experiences is emphasised.

Key words: Emotions; Sensation; Cognition; Neuroimaging; Interdisciplinary research.

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Citation:
Greš A, Staver D, Radovančević LJ. Consideration of emotions and sensations in a neuroscientific context. Scr Med. 2024 Jul-Aug;55(4):511-6.

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Received: 9 March 2024
Accepted: 23 June 2024

Introduction

"I don't want to be at the mercy of my emotions. I want to use them, to enjoy them and to dominate them."
— Oscar Wilde

Emotions and sensations are fundamental aspects of human experience, shaping perception, behaviour and cognition. Emotions are complex, multidimensional phenomena involving cognitive, physiological and behavioural components. While traditionally they are studied within the realms of psychology and philosophy, recent advances in neuroscience have provided invaluable insights into the underlying neural mechanisms of emotions and sensations.[1] Neuroscientific research has identified key brain regions and neural networks implicated in emotion processing, including the amygdala, prefrontal cortex and insula. The amygdala plays a central role in the evaluation and processing of emotional stimuli, while the prefrontal cortex regulates emotional responses and decision making.[2] Additionally, the insula integrates interoceptive signals with emotional states, facilitating subjective awareness of emotions. Neurotransmitters such as serotonin, dopamine and norepinephrine modulate emotional processing, underscoring the

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role of neurochemistry in emotion regulation.[3] Sensations encompass a wide range of perceptual experiences, including touch, taste, smell, vision and hearing. Neuroimaging studies have delineated the neural pathways involved in sensory processing, highlighting specialised brain regions dedicated to each sensory modality.[4] For instance, the somatosensory cortex processes tactile stimuli, while the primary visual cortex is responsible for visual perception. Cross modal integration occurs in higher order cortical areas, enabling multisensory integration and perception. Neurotransmitters such as glutamate and gamma-aminobutyric acid (GABA) modulate synaptic transmission within sensory circuits, shaping perceptual experiences.[5]

The brain is the birthplace of sensations and emotions. The brain is hardware and feelings and emotions are software, but there is no software without hardware and there is no software without hardware. There is a mutual "interplay" and mutual neural influence of emotions on sensations and *vice versa* - sensations on emotions. Sensations can evoke emotions.[6] They are closer to the brain *via* the peripheral nerves and *via* the vegetative nervous system (VNS) and emotions arise in the brain. Somehow they are more hardware than software, but without a brain they do not exist.[7]

Understanding the neurobiological basis of emotions and sensations has profound implications for mental health research and clinical practice. Dysregulation of emotion-sensation interactions has been implicated in various psychiatric disorders, including anxiety disorders, depression and post-traumatic stress disorder (PTSD).[8] Targeted interventions aimed at modulating neural activity within emotion and sensory circuits hold promise for alleviating symptoms and improving treatment outcomes. Neurofeedback, pharmacological agents and psychotherapy approaches informed by neuroscience principles offer novel therapeutic strategies for addressing emotional and sensory dysregulation.[9]

Discussion

Emotions and sensations are intricately linked, influencing each other through bidirectional interactions. Emotional states can modulate sensory perception, altering the salience and interpretation of sensory stimuli.[1] Conversely, sensory inputs can evoke emotional responses, eliciting affective reactions based on contextual cues. Neuroimaging studies have revealed overlapping neural circuits involved in emotion and sensory processing, suggesting a common neurobiological basis for their integration. Dysregulation of this interplay has been implicated in psychiatric disorders characterised by emotional and sensory disturbances.[10] Function and material base are one of the fuel through emotions. Fats burn on the fire of carbohydrates, so do emotions - feelings burn in the brain, they burn suffocatingly - they arise (*in statu nascendi*). There is a two-way flow of emotions and sensations in the brain, where they find their source - their starting point. The brain is the foundation and source of sensations and emotions. Emotions - long-lasting and short-lived effects, phenomena representing excitement, joy, fear, love, anger - rage, astonishment, flammability, agitation, anxiety, depression and mania.[11] They are expressed sensory through the VNS: redness, pallor (low respiratory rate - RR), arrhythmia, hypo-hyperesthesia, unconsciousness, tremor, depression, palpitations, incontinence (crying), escape, stress, etc. This is the link between emotions and sensations.[12] Sensations inform the brain - its attributes, instances of personality - ego, consciousness, pain sensations in the visceral organs and proprioceptive in the joints - position, movement; latin *organa sensuum* - five senses: sight, hearing, smell, taste and touch. The sixth sense is metaphorically called intuition - premonition - precognition. This is already an extrasensory ability.[4]

The brain serves as the material base for the psyche, which encompasses emotions, feelings, cognition, memory, fantasy, imagination, intelligence, spirituality and aesthetics. Emotions are bodily manifestations that connect to the afferent source of feelings and sensations and the efferent return from the place of manifestation.[3] Similarly, all subsequent experiences of beings and events are transmitted through various types of nerves, including motor, sensory, peripheral nervous system (PNS) and autonomic nervous system (ANS), which builds the components of psychic life. These elements of consciousness are arranged and pushed into the unconscious, but also emerge from it, often in dreams, works of art, reactions and mistakes, before plunging back into the unconscious. Throughout this process, they are being processed.[13] These contents do

not remain isolated in the subconscious, but are triggered by events in reality. Provocations of conscious traumas and their effects appear as symptoms in reality. These symptoms are markers that stem from the unconscious and are generated in the central nervous system. Senses and feelings, whose functions are separated but also intersect in their roles, can also be in causal consecutive correlations. Senses can cause feelings and emotions, which can be understood metaphorically. For example, feelings of pain can be equated to love, which is the strongest positive emotion, while fear is a negative emotion.[14] Feelings can act as warnings, similar to symptoms of disorder, disease or dysfunction. They alert consciousness to be careful with the consequences of withdrawal or generate the "fight or flight" decision, which is evaluated by the brain, ie the psyche and the unconscious. Summarising negative sensations can lead to depression, such as sadness, grief and a sense of loss for the organism.[14]

Sensations arise through evolution and serve to inform the brain, which then takes steps to maintain the integrity of the organism. For example, the gustatory sensation of sweetness on the papillae of the tongue signals the arrival of glucose in the blood, which is necessary for the body's functioning, particularly the brain. Similarly, the sensation of salinity alerts the body to maintain proper blood pressure. Hearing also detects potential dangers or pleasures, as well as supposed pleasures, while the sense of smell plays a role in detecting odours.[16] The connection between sensations and emotions can be immediate. Unconsciously, events and regulation of visceral sensations serve to defend or work the organism and to warn of disorders (such as pain in the womb), all through the brain's relay. This can cause reactions such as vomiting, diarrhoea, constipation, hunger or thirst. Olfactory, visual and tactile senses can also play a significant role in pleasure, for example, in sexual experiences. Instincts for self-preservation (conservative instinct) and the preservation of the species (sexual) serve as senses and emotions for reproduction and procreation. Sensations provide indirect urges and emotions provide feelings of gratification and satisfaction. Both emotions and sensations are subjective conscious experiences, and objective sensations were registered by the senses in some neuro-scientific instrumentation.[17]

Sensations and emotions are distinct experiences. While sensations can trigger emotions, it is important to exclude subjective evaluations unless clearly marked as such. For instance, the sensation of pain can cause fear, which may prompt rescue action. In contrast, the emotion of love is not equivalent to a sensation. The tactile sensations of caressing and being caressed can elicit a pleasant feeling in both the mother and child, which is associated with the emotion of love. Therefore, these sensations and emotions can be interrelated in their experience. It is important to maintain objectivity in writing and avoid subjective evaluations unless clearly marked as such.[18] The experience of an event is subjective, while the event itself is objective. Sensations are milder than pain and are transmitted to the brain through sensory inputs from organs such as the eyes and ears. These inputs can be either conscious or unconscious, depending on whether they originate from the body's surface or its periphery.

The PNS and the VNS receive sensory information from both the external and internal environment.[19] This information is then processed by the brain to form emotions and concepts. The brain has a predisposition towards earlier memories and uses visual, auditory, olfactory, gustatory and tactile data to form more complex mental images, including those related to music, smell, taste and hearing.[20] Neural brain networks start to develop during embryonic development, which is predetermined and archetypal due to the species' hereditary memory in humans. Therefore, the brain interacts with the external and intrinsic environment through sensations and emotions. Both emotions and sensations are consciously experienced, such as pain from a skin stab or distension of the intestine due to gases. Cancer cells and bones are not painful, but the periosteum is.

The brain selects and categorises important information while reducing noise.[21] It processes concepts and informs cognitive consciousness and the individual's perception of the environment. The brain makes us aware of what it sees and reduces what it finds useless. Through sensation, the eye perceives a tangible table and the brain forms a concept of a table based on all previously seen tables. The brain also generates an appropriate emotional response, such as happiness when seeing a rich buffet table.[22] Emotions are formed not only

through sensory input but also through intuition, empathy and memory. The brain, specifically the temporoparietal and dorsomedial parts of the *praecortex* and *praecuneus*, is responsible for forming emotions, including those related to other people and situations. The brain's functions are not separated or in conflict, generating both emotions and cognitions. These phenomena are in continuous interaction and are born in the neuronal networks of the central nervous system (CNS). The excitation networks of the brain and the whole organism are activated to produce these effects. For instance, pain can cause fear and pleasant smells or tastes can create social emotions when we see someone's facial expression. The CNS generates emotions that are influenced by interpersonal and transpersonal factors, such as hostility.[23]

There is a strong correlation between the sense of sight and emotions in the sphere of art. Fine art, like all other forms of art is based on emotions. An artist, as well as any creative person, conveys their emotions to other members of the community. This has been the case from prehistoric times to the present day.[24] The consumer of art, whether a viewer or listener, experiences this emotional transmission. The consumer experiences aesthetic emotions, although the seemingly contradictory emotions of disgust, ugliness and repulsion also exist. These emotions originate from sensory perception, particularly visual perception. A work of art plays a significant role in this perception. The brain, which is the seat of emotions is responsible for processing these sensations.[25] Emotions are generated when an artist's feelings, the use of colours and the canvas interact. Cognitive emotional processing occurs mostly in non-social situations such as fear, sadness, anger and happiness. In contrast, social situations involve ethical and moral categories and connections.[26] Communication in person differs from communication over the phone.

As previously mentioned, emotions of attachment can develop between a baby and its mother. The feeling of self-perception is a prerequisite for experiencing emotions, as it requires consciousness and self-awareness. In the animal kingdom, emotions are closely tied to instinct and the concept of self does not exist.[27] Neuroscience findings suggest that the feeling of compassion cannot be separated from the cognitive process of empathy. Compassion involves emotional resonance, while empathy is preceded by compassion. In compassion, identification with another's emotion is more cognitive and does not involve induction. This preserves the boundaries between participating subjects, such as a psychotherapist and client. The term empathy was created to differentiate it from compassion.[28] The sense of sight provides information about another individual, which the brain processes. This can create feelings of joy. Sensations become conscious and emotions are stimulated by the environment, whether internal or external. The speed of CNS connection can be almost reflexive.[29] The brain, including that of humans, perceives both the external world and intrinsic (unconscious visceral sensation) milieu through the five senses. Emotions and sensations are subjective experiences, with sensations also being detectable through neuroscientific tools.[1] The term "sensory sense" is a tautology, as "sensirium" already implies "sense". Cognitive sensation is a cognition, not an emotion. A feeling is a feeling and an emotion is a type of feeling. Sensation is a milder experience than pain, although both are types of sensations. The use of "limes" in place of "limits" is unclear and should be corrected.[30]

Conclusion

The neuroscientific perspective on emotions and sensations provides a comprehensive framework for understanding the neural mechanisms underlying human experience. Integrating findings from neuroimaging, neurochemistry and cognitive neuroscience enhances our understanding of the interplay between emotions and sensations and their relevance to mental health. Future multidisciplinary research should continue to explore the complex interactions within the brain's emotional and sensory circuits.

Ethics

This study was a secondary analysis based on the currently existing data and did not directly involve with human participants or experimental animals. Therefore, the ethics approval was not required in this paper.

Acknowledgement

None.

Conflicts of interest

The authors declare that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Data access

The data that support the findings of this study are available from the corresponding author upon reasonable individual request.

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