

Affective Neuroscience: Jaak Panksepp's 'rat tickling theory of emotion'

John Hook 

SUMMARY

This article reviews the seminal work of Jaak Panksepp: *Affective Neuroscience: The Foundations of Human and Animal Emotions*. It outlines the basis of his theory of Basic Emotional Command Systems as common to all mammals and goes on to specify some of the key fields that have grown out of his research.

KEYWORDS

Panksepp; affective neuroscience; neuropsychanalysis; basic emotional command system; consciousness.

Jaak Panksepp was loved and respected by many who knew him as colleague and friend. Sadly, he died in 2017 at the age of 73 when he still had much to offer.

Panksepp's writing is very accessible to the non-specialist even though he is describing and evaluating complex neuroscientific research. This in itself is a considerable skill and makes it stand out in the world of academic writing. He begins *Affective Neuroscience: The Foundations of Human and Animal Emotions* by outlining his central theme:

'Our emotional feelings reflect our ability to subjectively experience certain states of the nervous system [...] Such states remain difficult – some claim *impossible* – to study empirically [...] As I will seek to demonstrate, that viewpoint is incorrect [...] Fortunately, a psychobiological analysis of animal emotions [...] makes it possible to conceptualize the basic underlying nature of human emotions with some precision, thereby providing new insights into the functional organisation of mammalian brains' (Panksepp 1998/2004 reprint: p. 9).

Emily Langer, writing in the *Washington Post* following Panksepp's death, quoted him as saying:

'I think the more we know about the emotions of other animals, the more we will understand our own emotions [...] the more we know about our animal emotions, which support the rest of our mental apparatus, the more ideas we will have about how to be better people. As we follow the old philosophical advice to "know thyself," the more options we will

have for being good to others and the world' (Panksepp, cited in Langer 2017).

Theory

In *Affective Neuroscience* Panksepp elucidates his findings of seven basic emotional systems, although he was not wedded to there being only seven. The seven are the ones that he found were common to all mammals in their anatomical and neurochemical pathways. He capitalised them in order to distinguish them from their everyday meaning. They are PLAY, SEEKING, PANIC/GRIEF, FEAR, RAGE, LUST, CARE. These are the basic emotional needs that we must all meet for our development and survival as persons. What is immediately clear is that they are fundamentally relational and therefore social. We cannot meet these needs on our own. He defines these emotions as those mechanisms that specifically connect us to our environments. Emotions let us know that something is happening in our environment, in much the same way as pain or fever alert us to something happening in our bodies.

The book is divided into three parts: Conceptual background; Basic emotional and motivational processes; and The social emotions. It is not possible to pick out any one chapter as key, as each is important in its own right. By way of example, and of particular relevance to the current debate on gender identity, he neatly defines the nature of gender diversity. He describes regularly asking his students how many genders there are. Mostly the answer was 'two'. His answer was 'four or more'. He goes on to state that some Native American tribes 'believed that in addition to the prevailing variants of *man within man* and *woman within woman*, nature sometimes created a *man's mind in the body of a woman* and a *woman's mind in the body of a man*' [emphasis in original]. He continues 'Indeed, one could argue that there can be an "infinite number" of permutations along the biologically determined gradients of brain masculinization and feminization' (Panksepp 1998/2004 reprint: p. 232). This example is typical of his level-headed approach to

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First received 4 Aug 2023
Final revision 29 Nov 2023
Accepted 9 Dec 2023

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topics that engender high emotion and conflict but, as he has identified, are at bottom neurally mediated. At the same time he acknowledges socio-cultural factors that also play a role in determining sexual and gender identities and is not saying these are biological givens over which we have no choice. If we were able to give his work sufficient recognition we might be able to limit the misunderstandings that have arisen and engage in gender debates with less aggression and more rationality. In my view the manner in which he presents his scientific studies makes them relevant not only to psychology but also philosophy and other related disciplines.

Panksepp's discoveries challenged the prevailing idea that emotions come from the cerebral cortex. His research detailing the anatomy and neurochemistry of these systems showed that in fact emotions originate in more primitive areas of the brain, such as the amygdala and the hypothalamus. His research also challenged two other dominant views that emotions could not be studied and that they were experienced only in humans and not in animals. He is quoted as saying 'People don't have a monopoly on emotion. Rather, despair, joy and love are ancient, elemental responses that have helped all sorts of creatures survive and thrive in the natural world' (Panksepp, cited in Langer 2017).

Prior to his research, mainly with rats, which share similar brain structure with humans, nobody thought it possible to measure emotion directly. Hence, most neuroscience was cognitive and focused on the cerebral hemispheres. He demonstrated that emotion can be measured through observation of rat behaviour using their high-frequency emissions, inaudible to the human ear. Rats PLAY and they enjoy it! (Fig 1). Even now



FIG 1 Panksepp with a happy rat! Credit: Henry Moore Jr, CVM/BCU, Washington State University, USA. Reproduced under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>) from Davis & Montag (2018).

his findings are strongly disputed by those who continue to believe that emotion cannot be measured.

Philosophically, Panksepp's theories 'followed a dual aspect monism of unity between mind and brain, which he expressed as BrainMind and MindBrain. Panksepp's findings show that this is biologically, evolutionarily and developmentally social' (Bacha 2019).

Panksepp's work is a prime example of what Freud hoped for when he wrote:

'The deficiencies in our description [of mental processes] would probably vanish if we were already in a position to replace the psychological terms with physiological or chemical ones [...]

[...] We may expect [biology] to give the most surprising information and we cannot guess what answers [it] will return in a few dozen years of questions we have put to [it]. They may be of a kind that will blow away the whole of our artificial structure of hypothesis' (Freud 1920: p. 232).

Developments from his work

In *Affective Neuroscience* Panksepp has provided the foundation for a major review not only of Freudian theory but of all psychological therapies. Thus, this book is remarkable not only in its own right but more so in its continuing influence, particularly through his collaboration with Professor Mark Solms, a psychoanalyst and neuroscientist, with whom he cofounded the Neuropsychoanalysis Association in 2000, which 'explores the interface between neurobiological knowledge and psychoanalytic models of the human mind' (Neuropsychoanalysis Association 2024). This remains a central part of Panksepp's legacy. Affective neuroscience is now a well-established, thriving and diverse field of research beginning to lead to changes in clinical practice in talking therapies.

Professor Solms, first with Panksepp and continuing since Panksepp's death, has been able to reformulate key aspects of Freudian theory, bringing fresh insights from Panksepp's work on the basic emotional command systems combined with his own and others' research in the field of affective neuroscience. For example Solms has built on Panksepp's model to reformulate Freudian drive theory from two – libido and death instinct – into these seven emotional drives. Although neuropsychoanalysis has been the focus of this collaboration, Panksepp's work has broader influence across neuroscience, psychological therapies and philosophy through the understanding of how the human brain is driven by these basic emotions and their role as the basis of consciousness – the feeling of what it is to be me – one of the great problems for science and philosophy (Solms 2021).

Panksepp's work has been developed directly and indirectly in a number of directions, including but by no means limited to memory (Axmacher 2017); the importance of PLAY in developing socialisation, giving developmental significance to the latency period as well as the development of mental disorders (Flores Mosri 2021); empathy (Watt 2016); affective touch (Fotopoulou 2022); and the development of sense of self through interoception and exteroception (Fotopoulou 2017).

In addition to these new perspectives his work offers the possibility to take into account the emotional and motivational systems in understanding mental disorders such as depression (Panksepp 2014), addiction, psychosis, autism and attention-deficit hyperactivity disorder and it provides an evidence base for novel treatments. For further commentary on the impact of Panksepp's and related research see Mizen & Hook (2020). The theory of affect gives greater depth to the underpinning of psychiatry as a biopsychosocial model.

Neuropsychanalytic research has reached a point where it is possible to translate these research findings into clinical practice. Solms, for example, argues that the aim of psychoanalysis to undo repression is not possible because what is originally repressed (illegitimate emotional models designed to allow development within the constraints of what has been experienced) is stored in non-declarative memory. The aim therefore is to help people become aware of dysfunctional repeating patterns and develop new ones with new memories and emotions to counteract them (Solms 2021). This is linked to Bayesian brain theory as elaborated by Friston in his theory of the brain as developing predictions of the world as it is experienced and constantly updated to reduce 'free energy' (Friston 2010).

Panksepp the man remembered

It is not possible to write about this book without saying something of the man. In tributes following Panksepp's death Dr Mark Smaller, past president of the American Psychoanalytic Association, described him as:

'A brilliant, creative, and humble person, no one was more generous toward younger researchers, no one more enthusiastic about psychoanalysis and neuroscience, and no one with a better laugh, especially noted when discussing the PLAY system of the brain' (Neuropsychanalysis Association 2017).

Professor Katerina Fotopoulou wrote:

'Jaak was a pioneer in neuroscience, arguing for the importance of the subcortical and the

"affective" in neuroscience when others were and sometimes are still lost in the narrow lenses of behaviourism. His views have influenced our work on primary emotions, social relating, oxytocin, attachment, consciousness, pain and affective touch. His contributions to the field of Neuropsychanalysis are simply irreplaceable. [He] was a generous and wise mentor to more junior scientists, the kind of person you wanted to meet in conferences and get his perspective on your life as much as you wanted to tell him about your science' (Neuropsychanalysis Association 2017).

He is much missed in the neuropsychanalytic and neuroscience communities and there is much more to be mined from this seminal book. Surely it is not too strong a statement to say his work was of Nobel Prize winning quality in its innovation, scientific validity and continuing impact.

Data availability

Data availability is not applicable to this article as no new data were created or analysed in this study.

Funding

This work received no specific grant from any funding agency, commercial or not-for-profit sectors.

Declaration of interest

None.

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