# The Resonant Biology of Emotion

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**> Upshot** • The enactment view echoes the deeper biology and chemistry of emotion. Music resonates innately because emotional evaluation is the evolutionary grandfather of all senses.

« 1 » Alejandra Vásquez-Rosati's constructivist prescience offers a timely and valuable methodological approach than can enhance the ecological validity of laboratory emotional induction. But the theoretical implications of the connection between music and embodied emotion are even more intriguing. They ask: Why are good and bad feeling sensations so deeply engrained in our body and personal experiences? How do we make sense of the "embodied sense-making" reported?

« 2 » The nature of emotion has been debated for centuries, yet there remains no consensus upon what elements, states, and processes should be studied under that label (Scherer 2000). Investigations are stymied by preemptive theoretical assumptions, outdated biology, and over-emphases on brain mechanisms, with the neuroimaging data itself pointing to the need for more complex, "network-based" representations of emotion (Hamann 2012). Further, there are strong phylogenetic reasons to look beyond the dynamics of neural networks (Menary 2010a), to broaden the scope and revisit our evolutionary past for evidence of proto-emotion, proto-affect (Ortony, Norman & Revelle 2005), embodied cognition (Thelen 1995; Garbarini & Adenzato 2004), or "mind" in simpler living creatures.

« 3 » What is needed is an *ecological* approach, wherein the "network" extends to include the entire organism within its immediate environment and the ongoing interactions between them. Enter Vásquez-Rosati, who (indirectly) draws upon the enactive "4E" model of mind (Varela, Thompson & Rosch 1991; Rowlands 2010) wherein mind is *embodied* (in the physical structure and chemical processes of the organism); *embedded* (in the immediate environment), *enacted* (through ongoing, cybernetic, interactions between organism and environment), and *extended* (via adaptive learning and niche expansion). But where might affective valence, "embodied sensations" – good and bad feelings – fit in this story?

« 4 » In search of an answer, in (Peil 2014) I examined the chemical sensory-motor circuitry of the E coli bacterium, whose chemotaxis exhibits "hedonic" behavior (toward that which is beneficial and away from that which is harmful) – a pattern of behavior observable across the entire animal kingdom (Medicus 1987). This chemical circuitry (instantiated in transmembrane receptor complexes on the bacterium's cellular membrane) constitutes a three-step informational feedback control loop between organism and environment, allowing the bacterium to sample, evaluate, and respond accordingly to a variety of environmental stimuli. In other words, this loop is functionally analogous to the 4E mind, with the receptors likened to sense organs of more complex organisms, delivering *sensations* that then trigger a *perceptual evaluation* and a *motor* response, just as a brain would. For psychologists, there is a clear distinction between sensation and perception, the former associated with the body and the latter with the mind, and this functional distinction is also apparent in the simple bacterium.

« 5 » Indeed, the circuitry involves two intracellular signaling pathways that operate upon different time scales. The first (via phosphorylation marking) delivers a real-time (milliseconds) reading of external environmental stimuli a signal that immediately triggers the appropriate approach or avoidant behavior. The second signal, operating in concert (using a second messenger methylation mark) but on a longer time scale (of seconds), facilitates a *record* – an *evaluative memory* – of which stimulus had previously been avoided or approached, providing good-for-me or bad-for-me evaluative categories and ushering anticipatory behavior. In short, this circuit is arguably the first vestiges of the enacted mind. It delivers sensation, "cognitive" perception and adaptive memory – with no brains whatsoever. The punchline of this work is that it also adds a 5th E to the 4E model: *evaluative* (Kauffman 2015).

« 6 » The ultimate conclusion of this work was that emotion constitutes the inaugural *sensory system*, as ancient as life itself, the grandfather of all higher senses, with its affective valence still evident in them all (visual aesthetics, resonant sound, (un) pleasant aromas, etc.). Its function is "self-regulation," wherein pleasure and pain serve as homeodynamic feedback signals (elicited by "self-relevant" environmental stimuli, LeDoux 1989), those that trigger corrective behaviors that rebalance the organism within its environment. The "self" by this definition is a fully embodied, network distinction that begins with the chemistry of genetic, epigenetic and immune regulation, and extends to the schematic structures of *developing mind*. In terms of evolution, pleasure and pain serve as subjective reflections of the criteria for natural selection, working together to mediate both the s*elf-preservation* of body, and the ongoing *adaptive self-development* of the enactive mind. In short, emotions are *first-person experiences* that play a crucial role in physical health, well-being, and indeed, evolution itself.

« 7 » In this context, Vásquez-Rosati's emphasis on embodiment and the use of music and an innate inducer has tapped this deeper biochemistry of emotion. Indeed, the complex cell-to-cell signaling processes in multicellular organisms still utilize these ancient chemical tools in genetic, epigenetic, and immune regulation – largely *peptides* posited as the "molecules of emotion" (Pert 1998). Vásquez-Rosati's implication is that the deep visceral connection between music and emotion concerns *biorhythms,* the exquisite timing of dynamic molecular regulatory activity across a variety of temporal scales, orchestrating the cells, tissues, and organ systems into a coherent whole.

« 8 » In fact, in a phylogenetic analysis of the receptome (the evolutionary tree of cell-membrane "sensory" receptors) we find the common seven-transmembrane receptor (7TM), from humans all the way down to our last Universal Common Ancestor (LUCA) and the emergence of multicellularity itself (Ben-Shlomo et al. 2003). The 7TM sensory receptor responds to such basic stimuli as light, EM fields, simple ions, lipids, modified amino acids and peptides (our molecules of emotion). They are directly responsible for all biorhythms delivered

by our internal clocks on every scale, those that ensure that the right gene products are available at the right places and at the right times. These are the ultimate life-giving values of the 5E mind, and this work suggests they do indeed sing to us in music, as well as within all sensory systems as our embodied sense-makers.

« 9 » Vásquez-Rosati's summary statement in §8 captures the self-regulatory model quite well: "The emotional experience is characterized by an embodied sense-making, which occurs according to the relevance of the relation world-life and the ontogeny of the organism." This, more biologically guided, line of inquiry holds promise toward resolving many time-honored controversies and conundrums in emotion theory.

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## Author's Response

# Beyond the Boundaries of Third-Person Methods in Emotion Research: The Accuracy of the Micro-Phenomenological Interview

Alejandra Vásquez-Rosati

**> Upshot** • The micro-phenomenological interview is a methodology that enables us to accurately guide subjects in describing an emotional experience. With this guide, it is possible to know the structure of a particular experience, which is helpful to understand the different processes related to it. The incorporation of the micro-phenomenological interview into emotion research can extend the limits set until now by third-person methodologies and give an integral comprehension of emotions.

« 1 » First, I would like to thank my commentators who contributed with valuable insights and made it possible to clarify some ideas. In this response, I would like to address the following observations:

- In response to **Dylan van der Schyff** (§2) I will explain how phenomenology relates to the micro-phenomenological interview and then clarify some methodological concerns about the micro-phenomenological interview such as the accuracy of the method and its replicability, questioned by **Julian Cespedes-Guevara** (§§7, 9)
- I will give then a brief explanation of why music is useful to induce an emotional state, a question raised by **van der Schyff** (§2), and elaborate on the emotional experience induced by it, in response to **Cespedes-Guevara** (§4)
- Furthermore, I will address the comments of **van der Schyff** and **Katherine Peil Kaufmann** about the enactive approach as a framework for the study of emotions and discuss its methodological implications, in response to **Cespedes-Guevara** (§10).
- Finally, by giving the context in which the study presented in the target article was framed, I will review the relevance of integrating first- and third-person methodologies in emotion research.

## Methodological bases of the micro-phenomenological interview

« 2 » The micro-phenomenological interview is grounded in phenomenology, in particular in Edmund Husserl's methodology of phenomenological reduction. The phenomenological reduction implies redirecting our thought into the world in the way it appears to us, "we are interested not in *what* things are in some naïve, mind-independent or theory independent sense, but rather in exactly *how* they are experienced, and thus as strict relational correlates of our subjectivity" (Thompson 2007: 19). In order to describe a particular phenomenon, we need to suspend judgments, beliefs and assertions about "objective reality." In this sense, the micro-phenomenological interview is used to investigate the structure of experience, to identify the invariant, essential structures of psychic life (Petitmengin & Bitbol 2009: 393). As explained below, the micro-phenomenological interview is a tool for both analyzing and conducting experiments in order to obtain the structure of a particular experience.

« 3 » The analysis of the micro-phenomenological interview involves a process of progressive abstractions that aim at identifying the *diachronic* structure of the experience, i.e., the succession phases that describe the unfolding of the experience in time, and the *synchronic* structure, that is the different experiential categories that describe the configuration of experience at a given instant (Petitmengin & Bitbol 2009). The comparisons between the diachronic and synchronic structures of different experiences of the same kind allows the identification of invariants between them and thus the proposal of a generic structure of a "type" of experience.

## Accuracy of first-person description

« 4 » **Cespedes-Guevara** §7 questioned whether participants are able to describe their experience accurately. To defend the method against this criticism, let us review the details of the micro-phenomenological interview. It is a technique with specific tools to help the interviewee connect with her experiences and describe them with precision. A distinctive feature of the micro-phenomenological interview is that it works with specific, concrete experiences, rather than asking about interviewees' experiences more generally. The first step is to help the interviewee to get in contact with her experience. For this, the micro-phenomenological interview guides the interviewee into the evocation state, which "is a procedure whose final aim is to acquire an increasingly fine reflective awareness of one's experience in real time" (Petitmengin & Bitbol 2009: 384). To enter the evocation state, episodic or autobiographical memory is recalled involuntarily (not through discursive thought); generally the route of activation is through rediscovering the sensations linked to the experience. Once the interviewee is in contact with the specified experience, the interviewer uses actions as an axis of questioning