



**Martin E. Rosenberg.** Research Associate, The New Centre For Theory and Practice. [Martin](#) wrote his [dissertation](#) on the cultural work, in philosophy, and across the arts, of the scientific concept of “emergence,” beginning with Henri Poincaré, Henri Bergson, and Marcel Duchamp, and ending with Gilles Deleuze and Félix Guattari, Ilya Prigogine, Francisco Varela and Thomas Pynchon. He has written articles on Deleuze and [Freud](#), [Ezra Pound](#), [Duchamp](#) and [Thomas Pynchon](#),

Samuel Beckett, John Cage, Kiki Smith, and the avant-garde architects [Arakawa and Gins](#). He published a widely read article on emergent behaviors in [jazz improvisation and composition](#) that are visible in music notation, and currently researches the philosophical implications of the cognitive neuro-science of improvisers. Martin has programmed [instructional software](#), theorized about hypermedia and [interaction-design](#), and contributed articles on the role of [metaphor](#) in [trans-disciplinary inquiry](#). He co-directed the first completely digital global academic conference—[AG3-Online: The Third International Arakawa and Gins: Architecture and Philosophy Conference](#). He has an essay on jazz and cognition forthcoming for a volume on narrative and cognition from the University of Nebraska Press, and will be headlining a pioneering conference on the [philosophy of jazz](#) next May. Originally trained in jazz composition at the Berklee College of Music, he has returned (after thirty years) to performing in the Pittsburgh area.

[martinerosenberg53@gmail.com](mailto:martinerosenberg53@gmail.com);

<https://thenewcentre.academia.edu/MartinERosenberg>

# **Cognition, Complexity and Non-Linear Time during Jazz Improvisation**

Contemporary research into the cognitive neuroscience of jazz improvisation demonstrates that the question of intentionality with respect to improvised content becomes complicated by how jazz musicians move from preparing for improvisation (what Berliner calls “thinking in jazz”), to the processes of improvisation “in-the-moment,” while in “conversation” with other improvisers “saying something,” as Ingrid Mosen puts it. There is a complex relationship between thinking musically, and interacting musically: Both Charlie Parker and John Coltrane describe the need to learn everything one can about music, and then, when the moment comes, forgetting everything and just play; while Sonny Rollins says “Don’t play the music, man; let the music play you.” I argue that their statements are empirical, not poetic.

I call these two stages “projective apprehension,” which describes the top-down visualization of harmonic, melodic and rhythmic pathways on an instrument and their ‘capture’ in spatial schema and proprioception; and “proprio-sentience,” which involves the spontaneous enactment of those pathways in visceral response to the aural stimuli emerging from the other members of the ensemble, also “saying something.” The first requires feedback loops that stabilize as a global neuronal ensemble emerges within each individual embodied performer. The second requires feedback loops from the individual’s proprioceptive responses to the other members of the ensemble, and then, in a process that sometimes creates interference patterns, from the ensemble back to the individual, whose intentionality becomes altered by that feedback.

Neuroscience research on jazz improvisation, particularly that shaped by the paradigm that Francisco Varela and Evan Thompson call “embodied and enactive” cognitive science, suggests there can be no linear narrative of the complex processes involved in preparing for and performing improvisation. Where this complexity is most apparent is in how difficult being “in the moment” really is, given the lag in time between receiving sensations and their register with self-conscious awareness located in executive function. That lag makes performing in response to others impossible while trying to “think.” Further research indicates that several different time scales seem to co-exist during improvisation in ways that recall Varela’s account in his justly famous essay “The Specious Present” (1999), as well as Daniel Kahneman’s more recent and accessible account in *Thinking, Fast and Slow* (2011). For example, the phenomenon of “getting lost” that all jazz musicians experience results from the precarious balance of immediate visceral response to aural sensation (1/10 scale), while attempting to remain aware of the narrative frame of the song form itself (10 scale). What follows is an attempt to model this non-linear narrative of the complexities of improvised performance in a way that may shed light on how jazz musicians respond viscerally without thinking, while still contributing novel complex conceptual content.

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