

Representation in a Field of Musical Operations

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Abstract. Working historically with the development of ideas about representation in the areas of distributed cognition and cognitive ecology, this paper outlines a conceptual framework for studying representation in the cognition of music performance. Charts and drawings from lessons on the guitar are used to illustrate a situated analysis of cognitive processes in musical activity. By identifying the basis for participation, field of operation, informational resources, and musical events we can begin to see how the particulars of musical thinking may be constrained by genre and state of the activity.

Keywords: Representation, Cognitive Artifacts, Musical Activity, Ecological Validity

1 Cognition in Music Performance

In 1992, ethnomusicologists John Bailey & Peter Driver opened up the question of representation in their analysis of musical thinking on the guitar [1]. They hypothesized that “musical patterns are remembered and executed not solely as aural patterns but as sequences of movements, and that the music is therefore represented cognitively in terms of movement patterns” [2]. Despite this promising first step, the idea of movement as a basis for representation in musical thought has not received the widespread attention it deserves. Recent work hypothesizes a type of “instrumental space” within which a musician might operate [3]. This work draws partially on the ideas of James J. Gibson, aiming to operationalize the *affordances* of an instrument [3, 4]. It is fitting to begin with Gibson’s characterization of the operational field [5, 6] as a way to think about cognition in the person/instrument system.

James J. Gibson famously rejected the idea that perception is mediated by internal representations of things in the world (i.e. the auditory image [3]). Perception, he argued, is contextually driven, determined by the informational needs of the perceiver [7]. He said, “an affordance points both ways, to the environment and to the observer” [8]. In other words, it is not enough to study the physical properties of an instrument; one must study the instrument *in relation to the person using it* [9].

An accessible way to understand the value in Gibson’s idea of affordances can be found in his 1938 paper, a field-analysis of automobile driving [10]. In this paper he describes a “field of safe travel” which is not a measure of the physical space through which the vehicle moves, or a hypothesis about the map a driver might draw of that space, but a characterization of the informational resources called up by the driver in

the activity of driving. A field of musical operations, then, should characterize the informational resources in relation to the performance goals of the musician in a particular situation, not by some universal standard of measurement (i.e. patterns of sound in time) [9].

1.1 Ecological validity

Musicians operate within a range of social, perceptual, and informational constraints [9]. It is important for research on cognition in music performance to account for different cultural systems of music making [11], different genres, and different states of musical activity [9]. Following Hutchins [12], I outline an ecological approach to the study of cognitive processes distributed between musicians and their instruments, and between musicians at different units and levels of ensemble activity [9]. The following is a sample analysis of charts and drawings from lessons on the guitar. A comparison of two charts of the same musical work emphasizes the flexibility of the guitar as a cognitive artifact for music making and sheds light on the nature and function of representation in musical thinking with the guitar.

2 Analysis of Cognitive Artifacts from Lessons on the Guitar

The guitar is arguably the most versatile musical instrument [1]. Music making on the guitar can be *designed* by manipulating the layout of the instrument and by mapping the fretboard in different formulations. A guitarist can play the same note or chord in different positions on the guitar, and modulation (movement between key centers) is often simply a matter of shifting the same movements of the left hand up or down the neck of the guitar.

In any chart or drawing, some information will be explicit, other information implicit [13]. Comparing the salient features of charts and drawings can expose aspects of the informational resources that are focal by way of their visual salience in the chart. These charts can be viewed as “persistent external representations” [14] for musical thought.

Table 1 (below) shows a comparison of action notation and standard notation as used by the same person for different stages of musical activity. The action notation was useful for bringing the movements of the left-hand into focal awareness. The annotated standard notation of the same musical work was used as an external representation of a musical interpretation [9]. Stated in terms of Polanyi’s structure of tacit knowledge [15], a guitarist comes to recognize an aspect of physical engagement, attend to it focally as a perceptual unit, understand and use it as a source of meaning, and comes to recognize this aspect as a source of creativity in the negotiation of musical meaning [9]. In the action notation, movements of the left-hand were the target of focal awareness. In the annotated standard notation, the interpretative goals of the performer were the target of focal awareness.

Sources of musical meaning can be identified in different domains of musical activity. In some genres, musical interpretations are performed for highly trained listeners

(e.g. analysts of music). In other musical genres, patternwork is performed and extended as a source of musical meaning. These are different *bases for participation*. Thus, we can say that genre constrains representation in music making on the guitar in a very important way. Furthermore, models of cognitive processing in music should begin to accommodate this more situated understanding of representation in musical thought and activity.

Table 1. Action Notation vs Standard Notation for “Bicycle Tune”

	Action Notation	Standard Notation (annotated)
Basis for participation	to become aware of left-hand shapes	prepare a recording
Field of operation	grid chart	standard notation
Informational resources	drawings of left-hand shapes	annotations as focal targets
Musical event	movement between shapes	interpretive events

References

1. Baily, J., Driver, P.: Spatio-Motor Thinking in Playing Folk Blues Guitar. *The World of Music* 34(3), 57-71 (1992).
2. Baily, J., Driver, P.: Spatio-Motor Thinking in Playing Folk Blues Guitar. *The World of Music* 34(3), 62 (1992).
3. De Souza, J. *Music at Hand: Instruments, Bodies, and Cognition*. Oxford Scholarship Online. Oxford: Oxford University Press (2017).
4. Huron, D., Berec. J.: Characterizing Idiomatic Organization in Music: A Theory and Case Study of Musical Affordances. *Empirical Musicology Review* 4(3), 103-122 (2009).
5. Gibson, J. J.: *The ecological approach to visual perception*. Boston: Houghton-Mifflin (1979, 1986).
6. Reed, E., Jones, R. (eds.): *Reasons for realism: selected essays of James. J. Gibson*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers (1982).
7. Gibson, J. J.: *The ecological approach to visual perception*. Boston: Houghton-Mifflin (1979, 1986) p. 127.
8. Gibson, J. J.: *The ecological approach to visual perception*. Boston: Houghton-Mifflin (1979, 1986). p. 129.
9. Kaastra, L.: *Grounding the analysis of cognitive processes in music performance: distributed cognition in musical activity*. New York and London: Routledge/Taylor & Francis (2021) pp. 63-75.
10. Reed, E., Jones, R. (eds.): *Reasons for realism: selected essays of James. J. Gibson*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers (1982) pp. 119-136.
11. Stevens, C. J.: *Music Perception and Cognition: A review of recent cross-cultural research*. In *Topics in Cognitive Science* 4(2012): 653-667.
12. Hutchins, E.: *Cognition in the Wild*. Cambridge, MA: The MIT Press (1995).
13. Norman, D.: *Things That Make Us Smart: Defending human attributes in the age of the machine*. Menlo Park, CA: Addison-Wesley Publishing Company (1993).
14. Kirsh, D.: *Thinking with External Representations*. AI & Society. London: Springer (2010).
15. Polanyi, M.: *The Tacit Dimension*. Garden City, NY: Doubleday & Company, Inc. (1966).