Project Proposal
Douglas C. Wadle

EVENT PERCEPTION AND CONCEPTION IN THE AUDITORY DOMAIN

This project combines approaches and insights from the philosophy (of cognitive science and perception) and psychology (of event perception and psychoacoustics) to explore the benefits of studying event perception in the auditory domain for our understanding of the perception, individuation, and conceptualization of events and what this can tell us about their metaphysics. It builds upon my prior work in the philosophy of cognitive neuroscience pertaining to auditory perception [30], the approach to perceptual representation for cognitive science developed in my dissertation, and work on event perception and cognition that I have been pursuing at USC's Meaning Lab [31].

The proposed research will (a) draw on results in the philosophy of audition to motivate the benefits of focusing on event perception within the auditory domain, (b) draw on research in psychoacoustics and music cognition to design experiments examining the low-level perceptual features involved in auditory event perception, and (c) draw out implications for the nature of our event concepts and the metaphysics of events.

(a) Philosophy of Audition and Event Perception

This phase develops the conceptual underpinnings and benefits of the study of event perception through the study of auditory perception, to be presented in a paper intended primarily for a philosophical audience. Audition is a natural place to turn in the study of event perception. On the most prominent theory of the ontology of sounds, they are events involving their sources [7, 18]. (Even on most of the competing theories – e.g., that they are pressure waves [17, 19-20] or properties of vibrating surfaces [21] – they are consistent with an event interpretation: waves and vibrations are things that happen to air molecules and surfaces.)

Elaborating on arguments in the philosophy of audition [17, 28], I will argue that we experience sounds and their sources as distinct objects of perceptual experiences and that, in some circumstances (e.g., musical listening), we perceive sounds *without perceiving their sources*. This suggests that, if sounds are indeed events, then we can experience events independently of the objects (sources) they involve. This supports the claim that events are treated as fundamental particulars within our cognitive economy, on a par with objects [4-5; cf. 14-15].

(b) Experiment Design

The vast majority of work in the psychology of event perception has focused on the segmentation of goal directed actions in visually presented scenes [9, 11-12, 25, 36-37]. While impressive results have been generated with respect to goal-directed agential actions, not all events are goal directed or performed by an agent – a branch falling to the ground is neither. It is, therefore, uncertain that these models will generalize to all event perception.

Furthermore, evidence suggests that goal-attribution is learned on the basis of low-level perceptual features [13]. We should expect, then, that low-level perceptual features continue to play a role in the perception of non-agential, non-goal directed events. The limited research conducted on the role of low-level perceptual features in event perception have exclusively focused on the visual domain [27, 31, 33-35].

In this phase of the project, I build upon the results of (a) to suggest three benefits from turning to the auditory context to study event perception:

(i) Auditory stimuli can avoid a potential confound that plagues visual studies: The visual presentation is contained within visible boundaries – whether an animation window on a screen, a puppet theater, or simply the spatial confines of the room in which the experiment takes place – that can induce event segmentation (e.g., segmentation might occur whenever an animated shape comes within a certain

distance from the top of the animation window). Auditory stimuli, by contrast, are not confined by a presentation window and can be designed to eliminate spatial features that might factor in their individuation.

(ii) Auditory stimuli also allow us to disentangle temporally-based principles for event individuation from spatial individuation principles belonging to object individuation, thereby guaranteeing that event individuation is not merely parasitic on object individuation. For example, in [34], event individuation is associated with 'natural' path shapes, but it is unclear whether the individuation is based upon a static representation of the shape traced by the object in the animation or by the activity of tracing that path.

(iii) The ease with which listeners engage directly with sounds without regard for their sources, as in musical listening, will also help avoid worries about agency attributions: Even when using simple shapes, there is a worry that agency attributions will occur, given the well-known results from [10].

I will leverage these benefits to design a series of experiments examining the low-level perceptual features involved in auditory event perception. Particular attention will be paid to the design of stimuli, drawing on current research in psychoacoustics on the perception of musical form [3, 6, 16, 22]. The description of these benefits and the principles underlying the experiment design will be presented in a paper intended for an interdisciplinary audience.

I will conduct preliminary studies with these materials to address the questions: Do we get the same sorts of agency attribution as we see in vision? If so under what conditions? Do these stimuli invoke conceptual categorizations in listeners that might be used in top-down, predictive event segmentations? Once these preliminary studies are complete and I am confident that my stimuli target the relevant low-level perceptual features, the full study will be launched.

(c) Event Concepts and the Metaphysics of Events

This project will also explore the links between event representations in perception and cognition and the metaphysics of events. Invoking a principle that our perceptual representations need to be – if not entirely accurate – at least good guides for successfully interacting with our immediate surroundings, I will explore which inferences we are warranted in making from facts about event perception to facts about events themselves. I will also examine the relationship between the perception of events and the conceptions of events underlying our talk of events. Here I draw on work at the interface of linguistics and perceptual psychology [31, 33-34] and draw out conclusions about the extent to which the logical analysis of event statements can properly inform our metaphysics of events [8]. This work will be presented in a paper geared towards philosophers, linguists, and psychologists.

(d) Further Work

Once the core research has been concluded, I will considering the extent to which the results from my experiments implicate processes for individuation that are wholly auditory and the extent to which they are multisensory, pulling on work from individuation literature (including my own [29-30]). This will result in a paper evaluating the prospects for a unified set of perceptual criteria for event individuation and will examine a potential role for multimodal imagery.

References

[1] Bach, E. (1986a). 'The Algebra of Events', *Linguistics and Philosophy,* 9(1): 5-16.
[2] Bach, E. (1986b). 'Natural Language Metaphysics', in R. B. Marcus, G. J. W. Dorn, and P. Weingartner (eds.), *Logic, Methodology and Philosophy of Science VII*. Amsterdam: Elsevier Science, pp. 573-595.
[3] Besson, M. & Faita, F. (1995). 'An Event-Related Potential (ERP) Study of Musical Expectancy: Comparison of Musicians with Nonmusicians;, *Journal of Experimental Psychology: Human Perception and Performance*, 21(6): 1278-1296.
[4] Brand, M. (1977). 'Identity Conditions for Events', *American Philosophical Quarterly*, 14: 329-377.
[5] Brand, M. (1984). *Intending and Acting: Toward a Naturalized Action Theory*. Cambridge, MA: MIT Press.
[6] Bregman, A. (1990). *Auditory Scene Analysis: the Perceptual Organization of Sound*. Cambridge, MA: MIT Press.
[7] Casati, R. & Dokic, J. (2005). 'Sounds', in E. N. Zalta (ed.), Stanford Encyclopedia of Philosophy, available at <https://plato.stanford.edu/entries/sounds/>.
[8] Casati, R. & Varzi, A. (2008). 'Event Concepts', in T. F. Shipley and J. Zacks (eds.), *Understanding Events: From Perception to Action*. New York: Oxford University Press, pp. 31-54.
[9] Hard, B. M.; Recchia, G.; & Tversky, B. (2011). 'The Shape of Action', *Journal of Experimental Psychology,* 140(4): 586-604.
[10] Heider, F., & Simmel, M. (1944). 'An Experimental Study in Apparent Behavior', *The American Journal of Psychology*, 57: 243-259.
[11] Ji, Y. & Papafragou, A. (2020a). 'Midpoints, Endpoints and the Cognitive Structure of Events', *Language, Cognition and Neuroscience* <https://doi.org/10.1080/23273798.2020.1797839>
[12] Ji, Y. & Papafragou, A. (2020b). 'Is There an End in Sight? Viewers' Sensitivity to Abstract Event Structure', *Cognition* <https://doi.org/10.1016/j.cognition.2020.104197>
[13] Levine, D.; Buchsbum, D.; Hirch-Pasek, K.; and Golinkoff, R. M. (2018) 'Finding Events in a Continuous World: A Developmental Account', *Developmental Psychobiology* 2018: 1-14.
[14] Lombard, L. B. (1979). 'Events', *Canadian Journal of Philosophy*, 9: 425-460.
[15] Lombard, L. B. (1986). *Events: A Metaphysical Study*. London: Routledge.
[16] Neuhaus, C. (2013). 'Processing Musical Form: Behavioral and Neurocognitive Approaches', *Musicae Scientiae*, 17(1): 109-127.
[17] Nudds, M. (2009). 'Sounds and Space', in M. Nudds and C. O'Callaghan (eds.), *Sounds and Perception*, Oxford: Oxford University Press, pp. 69–96.
[18] O'Callaghan, C. (2007). *Sounds*. Oxford: Oxford University Press.
[19] O'Shaughnessy, B. (2000). *Consciousness and the World.* Oxford: Oxford University Press.
[20] O'Shaughnessy, B. (2009). 'The Location of Perceived Sound', in M. Nudds and C. O'Callaghan (eds.), *Sounds and Perception*, Oxford: Oxford University Press, pp. 111–125.
[21] Pasnau, R. (1999). 'What Is Sound?', *Philosophical Quarterly*, 49: 309–324.
[22] Phillips, M.; Stewart, A. J.; Wicoxson, J. M.; Jones, L. A.; Howard, E.; Willcox, P.; du Sautoy, M.; and De Roure, D. (2020). 'What Determines the Perception of Segmentation in Contemporary Music?' *Frontiers in Psychology*, 11: Article 1001.
[23] Prince, J. B. & Loo, L.-M. (2017). 'Surface and Structural Effects of Pitch and Time on Global Melodic Expectancies', *Psychological Research*, 81: 255-270.
[24] Prychitko, E. (2021). *Event Perception*. Dissertation, University of Washington, St. Louis, Philosophy.
[25] Radvansky, G. A. and Zacks, J. M. (2011). 'Event Perception', *WIREs Cognitive Science* 2011(2): 608-620.
[26] Rips, L. J. & Hespos, S. J. (2015). 'Division of the Physical World: Concepts of Objects and Substances', *Psychological Bulletin* <http://doi.org/10.1037/bul0000011>
[27] Sharon, T. & Wynn, K. (1998). 'Individuation of Actions from Continuous Motion', *Psychological Science*, 9(5): 357-362.
[28] Scruton, R. (2009). 'Sounds as Secondary Objects and Pure Events', in M. Nudds and C. O'Callaghan (eds.), *Sounds and Perception*, Oxford: Oxford University Press, pp. 50-68.
[29] Wadle, D. C. (2021). 'Sensory Modalities and Novel Features of Perceptual Experience', *Synthese*, 98(10): 9841-9872
[30] Wadle, D. C. (Forthcoming). 'Restricted Auditory Aspatialism', *British Journal for the Philosophy of Science*.
[31] Wadle, D. C. & Wellwood, A. (MS). 'Temporal Shaping and the Event/Process Distinction'
[32] Wagner, L. & Carey, S. (2003). 'Individuation of Objects and Events: A Developmental Study', *Cognition* 90: 163-191.
[33] Wellwood, A.; He, A.; & Farkas, H. (2019). 'Events and Processes in Language and Mind', *Baltic International Yearbook of Cognition, Logic and Communication*, 13: 1-25.
[34] Wellwood, A.; Hespos, S. J.; and Rips, L. J. (2018). 'How Similar are Objects and Events?', *Acta Linguistica Adademica*, 65(2-3): 473-501.
[35] Wynn, K. (1996). 'Infants' Individuation and Enumeration of Actions', *Psychological Science*, 7(3): 164-169.
[36] Zacks, J. M.; Speer, N. K.; Swallow, K. M.; Braver, T. S.; & Reynolds, J. R. (2007). 'Event Perception: A Mind-Brain Perspective', *Psychological Bulletin* 133(2): 273-293.
[37] Zacks, J. M. & Tversky, B. (2001). 'Event Structure in Perception and Conception', *Psychological Bulletin* 127(1): 3-21.