

Mechanisms and Individual Differences in Music-Evoked Imaginings

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In their letter responding to our Forum piece “Using music to probe how perception shapes imagination” [1], Küssner and Taruffi [2] propose that to advance the field, future research should focus on the sense modalities and causal routes that underlie imaginative responses. We agree with this general sentiment, but emphasize here that a much broader set of modalities and causal routes should be considered to promote understanding of the nature and variability of music-evoked imaginings.

Küssner and Taruffi highlight two causal routes that might connect sensory input to an imagining: immediate, whereby external stimuli (such as a passage of music) directly cue something in the imagination (such as an image of a peaceful meadow), and mediated, whereby the external stimulus cues something (e.g. imagined body movements), which then elicits an imagining in another sense modality (e.g., the visual image of a dancer). But the range of possible mechanisms extends beyond these two options. Imaginings in one sensory modality can integrate with perception in another, leading to a fused multisensory percept that is not so neatly partitioned [3]. Indeed, research on music-evoked imaginings demonstrates that they unfold dynamically, in temporal alignment with events in the acoustic signal, pointing to the possibility of a tightly linked crossmodal experience [4]; the theme from the movie *Jaws*, for example, can be experienced as a menacing shark, such that the separation between what constitutes sound and what constitutes imagery, thoughts, and feelings is not at all clear. In addition to modality-specific components, research has identified a core modality-independent component to the human imagery system within the default mode network [5]. Moreover, the causal route between sensory input and imagining may go not through individual sensory modalities, but through a memory or emotion [6]; a song might cue an emotion, to which listeners might attach a conventional story, or which itself might cue a suite of crossmodal associations [7]. Furthermore, stories imagined by music may not be primarily visual; the degree to which various music-evoked imaginings occur within individual sense modalities or combinations of sense modalities is not yet known. Sorting through these possibilities will require careful attention to work in the philosophy of mind [8], as well as creative and controlled experiment design capable of unraveling the timelines of the associations.

Küssner and Taruffi observe that “the proposed uniformity” of within-culture imaginings may only be homogenous “on the surface;” however, neither our original Forum piece nor the work it reviews propose uniformity in how imaginative responses emerge. Rather, this work highlights remarkable within-culture consistency in the content of responses to a highly unconstrained task, modulated both by acoustic features (musical excerpts) and listener experience (cultural background), suggesting that the contexts within which people typically encounter particular sonic patterns [see 9] shape their imaginative affordances. Consistency does not, however, imply uniformity. While studying the responses of people with special abilities related to imagery (such as aphantasia or synaesthesia) is important, typical listeners already show individual differences that warrant further investigation. Listeners vary in their general imaginative tendencies [10], their musical experience [11], their creativity [12], and in myriad other ways that connect to how similar their imagined story might be to other participants’. Although listeners in the reviewed research showed high within-culture consistency in imaginative responses, the findings also hint at potential differences in imaginings between, for example, people of different age groups in the same geographic location, who might have been exposed to distinct corpora of mass media across their lifespans. Moreover, even for listeners in a more homogenous sample, some people imagine very typical stories and others more idiosyncratic ones. The same Natural

Language Processing tools used to measure similarity between sets of stories can be applied to measure the distance between any individual's imagining and the typical imagining for a particular excerpt. Studying these distances as a function of other measures of individual difference has the potential to reveal more about the inherent variability in musical imaginings than the responses of specialized populations.

In sum, we suggest that the questions raised by Küssner and Taruffi about the original Forum piece must be broadened significantly beyond what they suggest. What constitutes a musical imagining? How does it relate to sensory modalities, and how broad are the range of imaginings at play? How do different pieces of music and different background experiences tend to push imaginings in one direction or another? What kinds of experience do two people need to have previously shared in order to independently generate highly similar imaginings to a particular piece of music? These questions are critical not just to research on music, but also to research about the nature and functioning of the human imagination.

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