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Introduction

“4E” approaches in cognitive science see mind as embodied, embedded, enacted, and extended. They observe that we routinely “offload” our thinking onto body and world. Tilting our head to make sense of a rotated image or text, for example — instead of rotating an internal representation — reduces information-processing demands (Risko & Gilbert, 2016). Similarly, we use gesture to represent solutions to mathematical problems (Goldin-Meadow, Nusbaum, Kelly, & Wagner, 2001), sketchpads to scaffold artistic creation (Loughlin, 2012), models to better understand scientific theories (Toon, 2015), and smartphones, search engines, and cultural institutions to support memory (Gallagher & Crisafi, 2009). These beyond-the-head targets of our offloading generate ongoing feedback loops that transform our cognitive profile in real-time and, in so doing, help us negotiate complex cognitive tasks. From a 4E perspective, understanding how minds work requires looking beyond heads. And for a 4E view called the “extended mind thesis”, these materially-scaffolded feedback loops are so important for driving thought and experience that they should be seen as part of the (extended) mind itself (Clark & Chalmers, 1998; Menary, 2010).

4E theorists have recently turned to music cognition: from work on music perception (Clarke, 2005; Kersten, 2014; Krueger, 2009, 2011a, 2011b; Leman & Maes, 2015; Matyja & Schiavio, 2013) and musical emotions (Cochrane, 2008; Krueger, 2014a, 2014b; Schiavio, van der Schyff, Cespedes-Guevara, & Reybrouck, 2016; Witek, 2013), to improvisation and music education (Elliott & Silverman, 2015; Schiavio & Høffding, 2015; van der Schyff, 2017). I continue this trend. I argue that music — like other tools and technologies — is a beyond-the-head resource that affords offloading. And via this offloading, music can (at least potentially) scaffold various forms of thought, experience, and behavior. To develop this idea, I consider the “material” and “worldmaking” character of music, and I apply these considerations to two cases studies: music as a tool for religious worship, and music as a weapon for torture.

Music as material for worldmaking

In everyday life, music shows up for us as something we interact with and bring into use (Clarke, 2005; Krueger, 2011a, 2015; Menin & Schiavio, 2012). In other words, we encounter music as *material* — an “aesthetic technology” driving experience and behavior (DeNora, 2000).

Consider portable listening technologies like MP3 players and smartphones, along with the streaming music services that flow through them. These are portable and personalized technologies for on-demand “self-care” (Skånland, 2013). We use them to craft transient, site-specific soundworlds specifically to regulate how we feel and what we do — whether at work, play, or rest. And because we have these technologies with us constantly, musical interactions are no longer rare occurrences; they’re never more than a touchscreen away. For example, if we feel our energy flagging and need an affective boost to propel us through a strenuous workout, we can scroll through our MP3 player until we find just the right track (Fritz et al., 2013). Because music is materialized in an array of portable technologies, it’s thoroughly interwoven into everyday activities from reading and writing to cooking, exercising, shopping, socialising, worshipping, resting, and commuting.

So music is something we do things with. And one of things we routinely do with music is construct and organize *space* — musically-structured environments that we experientially inhabit, explore, and manipulate. This “worldmaking” dimension of music flows from its materiality. Because music is materialized in aesthetic technologies, we use it to manipulate physical and social spaces — think of common examples like playing music to set the right atmosphere at a party, or in a waiting room or retail space — as well as create individualized soundworlds nested *within* these spaces. For example, office workers in shared or open plan office settings routinely use music to construct “auditory bubbles” (Dibben & Haake, 2013). These private soundworlds reclaim individual space, block out environmental distractions by creating a preferred auditory environment conducive to work, and help manage attention and energy.

The spatial or worldmaking power of music also comes through in how we talk about music and musical experience. For example, when talking about pitch organization — a uniquely musical feature — we rely on spatial contrasts like “up and down”, “high and low”, “small and large”, etc. (Morgan, 1980). Spatial and movement metaphors are also central in descriptions of our strong emotional responses to music: “sad music helps you enter your own true feelings” (Peltola & Saresma, 2014); “suddenly I was in some inexplicable way drawn into the music. It felt as if I was somehow lifted up from my seat and sort of floated in the room...”; “The music crawled inside me; or was it me that crawled inside the music? In some way that was all that existed” (Gabrielsson, 2011, pp. 79–80).

The takeaway point is that our experience of music *qua* music involves the perception of musical space, a musical world (Clarke, 2013). Moreover, because music is mediated by materiality (e.g., aesthetic technologies), we can *do things with it* — including manipulate the spaces of our environments and, simultaneously, ourselves. In virtue of its materiality, music integrates with and dynamically reorganizes physical and social spaces, opening up new possibilities for musically-scaffolded experience and action.

Offloading and Musical Worlds

I now consider the idea that music affords offloading. Music’s material and worldmaking character are what make this offloading possible. As will become clear, sometimes this offloading is voluntary, and sometimes it’s not. Two case studies will help clarify this idea: music as a tool for religious worship, and music as a weapon for torture.

Music and worship

Music has long been central to religious practice (Wynn, 2004). When we enter a church, mosque, or temple, we enter not just religious but also musical space — soundworlds fashioned specifically to scaffold religious emotions, beliefs, memories, and behavior.

To begin with emotions: there is a well-established connection between music and emotion regulation. As we've already seen, we use music throughout our lives, and in many different contexts, to regulate our emotions (Saarikallio, 2011). It's especially well-suited for this task. This is because music's dynamic and temporal nature, along with its bodily impact on listeners — the fact that musicking enacts continuous feedback loops of musical “re-soundings” (Nancy, 2007), from vibrations in our bones and muscles to complex patterns of neurophysiological and motoric entrainment — means that we are quite literally bodily and affectively *captured* by the musical worlds we construct and inhabit.

This picture is supported by a great deal of empirical work. For example, neuroimaging studies have found that musical responses involve many of the same brain regions involved in generating, detecting, maintaining, and regulating emotions (Blood, Zatorre, Bermudez, & Evans, 1999; Koelsch, 2014; Overy & Molnar-Szakacs, 2009). But music impacts more than just our neurons. Musicking — whether listening alone with headphones or dancing with thousands of people at a concert — is a richly cross-modal and whole-body experience. And the musical worlds we inhabit elicit, and directly modulate, a cascade of emotion-specific processes at neurophysiological, behavioral, and experiential levels. Exploring the details of these processes would take us too far afield. The important point is that via iterative cycles of motor entrainment and synchronization unfolding in response to musical features, musical worlds pull emotions out of us and regulate their dynamics *in real-time* as they unfold over short and long-term listening episodes (Elvers, 2016; Janata, Tomic, & Haberman, 2012; Lundqvist, Carlsson, Hilmersson, & Juslin, 2009; Witek, Clarke, Wallentin, Kringelbach, & Vuust, 2014). Music in this way functions as part of our extended (i.e., beyond-the-head) emotion-regulatory system. The music we play, or that is played around us (e.g., in spaces of worship), becomes part of a listener-environment feedback loop that drives, structures, and regulates the character and development of our emotions. This is a case of emotional offloading. We

let music take over self-regulatory dynamics that would normally fall within the scope of our own internal capacities and do some of the emotional work for us (Krueger, 2014a, 2014b).

To make this idea concrete, consider music at a religious funeral. The musical soundworld of a funeral is selected to scaffold the appropriate feelings. Slower reverent music — Christian hymns like “Abide with Me”, for example, or classical pieces like Elgar’s Variations or Pachelbel’s Canon in D Major — are chosen for their capacity to establish an affective atmosphere gently nudging participants toward quiet grief and introspective remembrance.

But not all funerals are somber affairs. Within the Southern Baptist tradition in the United States, for instance, African American funerals often begin with mournful hymns and prayer. But they soon transition into something very different: joyful celebrations of the deceased’s reunion with Christ, complete with shouting and dancing that spills out of the pews and into the aisles. These emotional displays are scaffolded by uptempo praise hymns. The musical soundworld in this context organizes and guides this transition, driving participant’s emotions and behavior, both individually and collectively, as they pass through various phases of this process.

Other forms of musical offloading can be found within religious contexts. For example, music scaffolds social cognitive processes — e.g., social bonding — by synchronizing moods and emotions of a large number of people (via the entrainment processes discussed previously), which regulate the large-scale synchronization of joint action and behavior. This is a central ritualistic function of music. Rituals are patterns of organized behavior that follow a prescribed form. They can unfold at multiple time-scales, from moments to years or a lifetime, and can involve a few people or many. Music often plays a crucial role in driving the different practices and behaviors that make up religious rituals.

Musical qualities like rhythm, melody, and pulse order the temporal sequence of a worship service and organize behavioral coordination between participants. They do this by providing

external time-keeping cues enabling groups to move and act in time, as one. For example, in a Christian service, organ or choral music signals when to sit, stand, kneel, pray, or greet one's fellow worshippers; musical cues also signal the start of the gospel reading, tell participants when to approach the front of the church for communion, and even determine what sort of actions are appropriate during a particular phase of the service (e.g., when walking back to one's pew after communion versus post-worship mingling).

In this way, music encodes action scripts constitutive of a given ritual or worship service. What's important for our purposes is that, instead of participants having to remember each and every movement, they can instead off-load this responsibility onto the music by letting it take over and govern their behavior. Music thus materializes ritualistic time: musical dynamics indicate that things are happening *right here, right now* — and these dynamics tell listeners what to do and when to do it (Rouget, 1985).

Canonical music in this way preserves ritualistic practices and action scripts over many generations, scaffolding not just individual or even collective but also *intergenerational* memory. Songs, hymns, chants, and sung prayers continually remind worshippers of their religious duties and actions; and as we've seen, they elicit and regulate appropriate moods or emotional responses. But they also preserve and communicate the stories, myths, legends, beliefs, and practices of a religious tradition across multiple generations. Rhythms and melodies chunk words and phrases, for example, identify line lengths and stress patterns, and also help listeners focus on and recall important words of a text, such as those found in a religious scripture or creed (Wallace, 1994). In sum, in addition to its impact on our emotions, music is a memory technology that scaffolds processes of learning, retrieving, remembering, and reconstructing the rituals and texts constitutive of our religious life.

Music and torture

Inhabiting religious and musical spaces is generally a voluntary and uplifting affair. But not all instances of musical offloading have these qualities. Music weaponized as an instrument of torture is one such case.

It's well-established that United States military authorities use music as an element of "harsh interrogation" in the so-called "global war on terror" (Bayoumi, 2005; Cusick, 2013; Peisner, 2006). Via loudspeakers in individual cells or interrogation rooms, or positioned just outside communal prison blocks, high value detainees are routinely subjected to punishingly loud music for hours or days at a time — often while standing or kneeling in an uncomfortable posture.

To better understand the phenomenology of musical torture, and how (involuntary) offloading is central to the experience, two points are worth noting. First, as Gruny (2012) observes, sounds *penetrate* us in a way that doesn't seem to be the case with other perceptual modalities. As he puts it, "the audible is organized around degrees of intensity, and it seems to imply a rather different relation between activity and passivity" than we find in other experiences (Gruny, 2012, p. 209). If I'm in a brightly lit room or outside in direct sunlight, say, I can move to shade or cover my eyes and enjoy some relief; similarly, I can plug my nose and escape an unpleasant odour or shift my body away from an irritating tactile sensation.

We do have some autonomy over the intensity of our auditory experiences. But we also seem uniquely vulnerable to sounds. This is because we *resonate* with sounds — particularly music — down to our bones. Music played at high volume bombards the listener's body with relentless acoustical energy and, as we've seen, elicits neurophysiological and behavioral response over which they have little control. This aspect of music's materiality makes it a uniquely powerful tool for control and domination.

Second, we often enter and become deeply affected by shared musical worlds not of our making. Focusing on MP3 players as technologies of self-care might lead us to think of musical

worlds as primarily solitary environments. But as the discussion of music and worship highlighted, musical worlds are often collaboratively-constructed environments. And more to the point, musical worlds created by others often co-opt *our* attention and emotions, and regulate *our* behavior in deep and subtle ways — even if we’re not aware it’s happening. For example, background music while shopping influences what consumers buy and how much they’re willing to pay for their purchases (North, Sheridan, & Areni, 2016; Turley & Milliman, 2000). So this is another way we seem uniquely vulnerable to sound and music.

To return to music and torture: these cases of weaponized musical worlds, I suggest, are powerful examples of what Jan Slaby calls “affective mind invasion” (Slaby, 2016). Affective mind invasion occurs when an individual’s affective and emotional dispositions fall in line with the interaction routines determinative of their local subcultures. The latter refers to things like corporate workplaces, social web-based groups, academia, the world of sports, or police and military culture. Over time, individuals within these domains adopt idiosyncratic “affective styles”: ways of speaking, gesturing, and moving, patterns of interpersonal interaction, emotional experience and expression, etc., that are normative in the domain in question (Colombetti & Krueger, 2015). The individual is affectively “invaded” to the extent that these styles regulate thought and behavior without their full awareness or consent.

Musical torture is a particularly brutal case of affective mind invasion. Part of its brutality comes from the fact that aspects of one’s bodily-affective style are not so much reconfigured as they are dismantled and destroyed. Prisoners are drawn up into a hostile musically extended self-regulatory system without their consent.

Reports suggest that much of prisoners’ disorientation comes from the fact that music played so loudly and repeatedly is drained of its aesthetic qualities and instead becomes all-consuming

violent sound. The individual can no longer selectively attend to or entrain with qualities like melody or rhythm. Instead, their agency is diminished and they are completely *subsumed* by the music:

“[...] after a while, you don’t hear the lyrics, all you hear is heavy, heavy banging...you can’t concentrate on the drums, or what the person’s saying, all you hear is just loud shouting, loud banging, the metal clashing against metal...It doesn’t sound like music at all” (Cusick, 2008, p. 3).

Another individual describes the isolating character of the experience: the removal of access to external cues, such as voices and other sounds, that situate us in the physical and social world:

“Nothing focused in terms of, like, let me think now of, for example, a topic or story. Nothing comes to your head: it’s just that the experience you’re going through is so intense...that it takes you away from everything else, everything else besides it” (Cusick, 2013, p. 287).

In contrast to the timekeeping function of music in religious worship, music in the context of torture is used specifically to *disrupt* the subject’s experience of time and remove connections with the physical and social world. Even when the music eventually stops, the inmate above reports feeling like a cat “just turning in a spot, saying “What’s going on? What’s going on?” (*ibid*, p.287).

Other prisoners affirm the materiality of music as an active force in the world: “You feel like your body is being bombarded with something...It’s like you’re being hit with a hammer, din din din din. When it stops, it’s like a beating has stopped” (*ibid*, p.288). When played at a high volume for extended periods, music’s acoustical energy becomes “a vibrating presence of power that can deliver a miraculously ubiquitous battering to the sympathetically vibrating bones and skin of a man, beating him from within and without, while leaving no marks” (*ibid*, p. 288).

This process of affective mind invasion destroys the individual’s sense of interiority and exteriority, private and public. By forcing the individual to unwillingly offload self-regulatory

processes onto a hostile musical world not of their making, the music removes individual agency and consent. Prisoners are, accordingly, drawn up into a musically extended system crafted not to augment and enhance but rather dismantle and destroy.

To conclude, these cases studies — despite their differences — highlight the profound manner by which music can take over and regulate various processes responsible for the development and maintenance of our embodied subjectivity. The larger takeaway from all this is that the musical worlds we construct and inhabit afford this kind of offloading. Musical worlds shape musical minds. And understanding the latter therefore requires looking beyond the head.

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