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The Psychological Basis of Music Appreciation: Structure, Self, Source

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Research has investigated psychological processes in an attempt to explain how and why people appreciate music. Three programs of research have shed light on these processes. The first focuses on the appreciation of musical structure. The second investigates self-oriented responses to music, including music-evoked autobiographical memories, the reinforcement of a sense of self, and benefits to individual health and wellbeing. The third seeks to explain how music listeners become sensitive to the causal and contextual sources of music making, including the biomechanics of performance, knowledge of musicians and their intentions, and the cultural and historical context of music making. To date, these programs of research have been carried out with little interaction, and the third program has been omitted from most psychological enquiries into music appreciation. In this paper, we review evidence for these three forms of appreciation. The evidence reviewed acknowledges the enormous diversity in antecedents and causes of music appreciation across contexts, individuals, cultures, and historical periods. We identify the inputs and outputs of appreciation, propose processes that influence the forms that appreciation can take, and make predictions for future research. Evidence for source sensitivity is emphasized because the topic has been largely unacknowledged in previous discussions. This evidence implicates a set of unexplored processes that bring to mind causal and contextual details associated with music, and that shape our appreciation of music in important ways.

Keywords: music appreciation, structure, self and identity, contextual cognition, aesthetics

What are the psychological processes governing the appreciation of music?[1] Empirical investigations draw their inspiration from the paradigm of psychophysics and experimental aesthetics (Fechner, 1876), whereby researchers seek to identify the psychological rewards that arise when people interact with the physical stimulus of music. According to this viewpoint, people appreciate music because—for example—it triggers reward systems in the brain, alters emotional states, is perceived as beautiful, generates feelings of inclusion, or distracts from anxiety and other unwanted states. These experiential consequences have been linked to various levels of processing, from brain-stem responses to perception and abstract thought (Armstrong & Detweiler-Bedell, 2008; Belke et al., 2015; Juslin & Västfjäll, 2008; Koelsch et al., 2015; Leder et al., 2004). Within this framework, there is an emphasis on transient hedonic experiences that occur during music listening (Anderson, 2000; Blood & Zatorre, 2001; Cheung et al., 2019; Matthen, 2017; Menninghaus et al., 2017), and pleasure is often treated as a necessary condition for an experience to qualify as aesthetic. However, an exclusive focus on temporary feelings of pleasure and reward ignores important processes that occur during music appreciation, and the possibility that music appreciation often occurs in the absence of pleasure (Bullot & Reber, 2013b, 2017; Hanslick, 2018; Sherman & Morrissey, 2017; Skov & Nadal, 2020; Tiihonen et al., 2017). Neuroimaging studies that consider the contributions of different brain regions to aesthetic experiences suffer from the same limitation (Bullot, 2019; Chatterjee, 2013; Chatterjee & Vartanian, 2016), focusing on brain regions associated with pleasure and reward, rather than neural activity that might subserve broader categories of appreciation (Zatorre, 2018).

We contend that a more inclusive understanding of music appreciation is essential if the field is to move beyond its current narrow frame. Along similar lines, Skov and Nadal (2020) highlighted a longstanding tendency to conflate questions of *artistic* experience with those of sensory pleasure and valuation (see also, Pearce et al., 2016). Such a tendency has limited progress in both domains of inquiry. On the one hand, processes that subserve sensory pleasure are not restricted to artistic objects but encompass nonartistic objects studied in neuroeconomics such as food, money, and sex (e.g., Blood & Zatorre, 2001). On the other hand, music experience and appreciation engage processes beyond those that elicit pleasure.

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[1] The term "music appreciation" is often employed casually in various contexts, but our focus is on a *psychological* account (e.g., see Bullot & Reber, 2013a, 2013b; Leder et al., 2004).

To distinguish appreciation from sensory pleasure, we define music appreciation as

> the set of psychological processes implicated in an individual's inclination to engage with music. These processes occur when an appreciator listens to, imitates, imagines, remembers, performs, or responds to music; identifies musical genres and traditions; or interprets the intentions of musicians and others involved in the production of music.

Such a conception implicates processes that are unique to musical practices and experiences but extend well beyond appraisals of beauty or transient reward states. This definition is also distinct from the conceptualization deployed in college classrooms of the past, where courses in "Music Appreciation" attempted to teach people *how* to listen, often in formalized and abstract ways. The term as used here refers to psychological processes that underlie inclinations to engage with music and avoids evaluative or prescriptive assumptions.

The importance of contextual knowledge for artistic appreciation is a central concern of philosophers (Bullot et al., 2017; Carroll, 2010; Davies, 2011; Danto, 1964, 1983; Dutton, 1983, 2003; Elgin, 1993; Friend, 2007, 2017; Gaut, 2007; Goodman, 1968; Kieran & Lopes, 2006; Levinson, 2011), but it has remained largely ignored in psychological research and theory (for valuable discussions, see Clarke, 2005; Dibben, 2001). Conversely, theories of appreciation that equate hedonic responses with the entire spectrum of responses to art typically overlook or diminish the importance of contextual understanding. This omission is especially evident in theories inspired by psychophysical approaches to aesthetics (Fechner, 1876) and the communication model implied therein, whereby a sender (musicians) communicates a message (musical structure) to a receiver (listeners), whose appreciation is a by-product of decoding (Cheung et al., 2019; Harrison & Pearce, 2020; Huron, 2016; Miell et al., 2005; Pinker, 1997/2009; Thompson & Robitaille, 1992).

It will be important to marshal these factors together if researchers are to account for the diversity of psychological processes that explain how people come to appreciate music. Bypassing the significance that people place on their personal connection with music, and the causes and contexts of artworks—as though music were created and experienced in a vacuum—will not allow progress on abiding questions in the psychology of music. Such questions include: Why do humans in all known societies engage in music-like behaviors? What parts of the brain are activated by music? Is there a connection between music and nonmusical domains such as language, mathematics, and social cognition? Which aspects of music appreciation are unique to humans, and which are shared with nonhuman animals? What are the evolutionary origins of music appreciation? Answering such questions will require attention to forms of music appreciation well beyond sensory pleasure. Analogous to religious engagement (Henrich, 2020; Norenzayan, 2013; Tuzin, 1980), people engage in music experiences with knowledge about themselves, musicians, and the sources and contexts of the music they encounter. Until these contextual aspects of appreciation are fully acknowledged and investigated, the psychology of music appreciation will continue to suffer from a contested reductionist footing.

Toward a Music Appreciation Framework

This paper describes three forms of music appreciation, each associated with different outcomes of engaging with music: appreciating musical structure, self-oriented appreciation, and appreciating the causal and contextual sources of music. We do not claim that the three forms constitute the only way to 'carve nature at its joints' but contend that they usefully capture existing research and evidence. To date, extensive research relevant to all three forms of appreciation has been pursued, but largely independently of one another and without a guiding theoretical framework. Figure 1 depicts a psychological framework designed to reflect existing evidence and to guide future research that might help elaborate and refine the account. It characterizes music appreciation on different levels of analysis: the causal and contextual factors that support a music experience (top level); a musical event; the three forms of appreciation; the content of appreciation; and various outcomes and instances of appreciation (bottom level). Thus, the *inputs* to music appreciation include contextual factors and the musical event, whereas the outputs refer to the various outcomes of appreciation.

The central hypothesis of the framework may be summarized as follows:

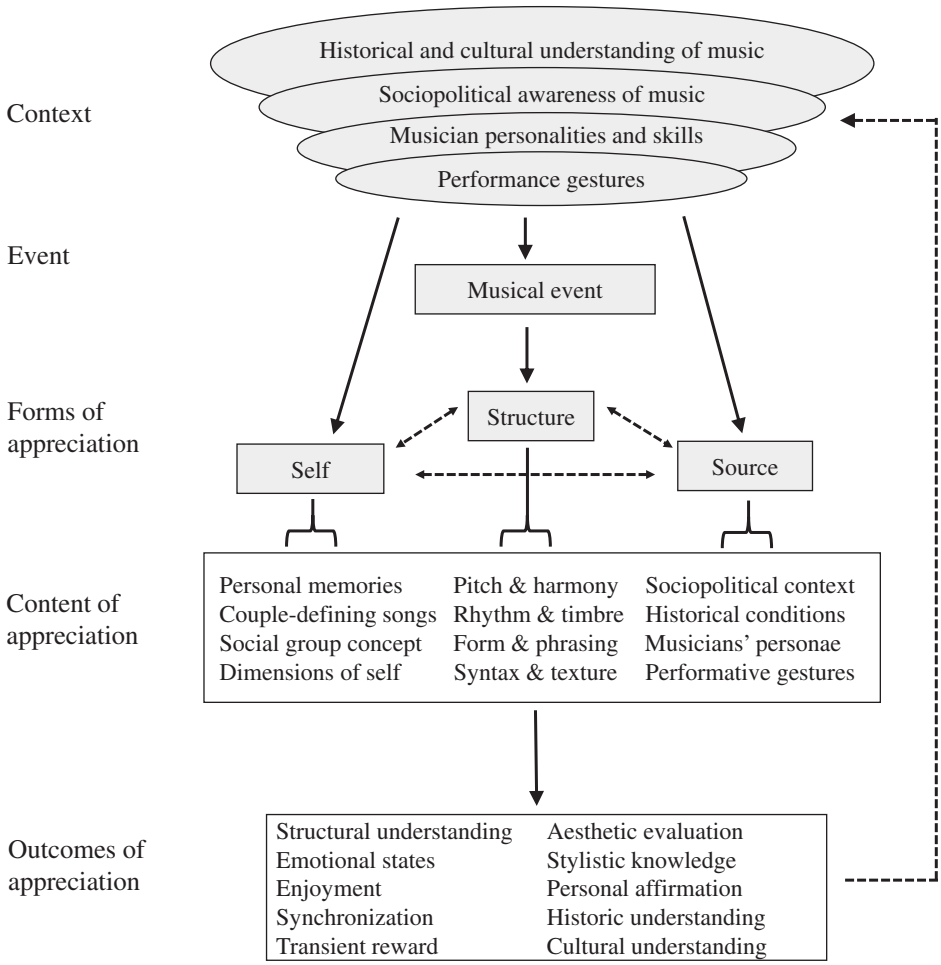
> Three forms of music appreciation have been identified that may occur simultaneously with varying degrees of prominence: one form involves perceiving and internalizing musical structure; another involves activating networks of personal significance, identity, and autobiographical memories; a third—called source sensitivity—involves identifying and engaging with the causes and contexts of music making, including the personal attributes of musicians, and the sociopolitical, historical, and cultural contexts of music-making.

The framework is descriptive rather than prescriptive, drawing on evidence from multiple fields about what music appreciation entails. The outputs of appreciation sometimes include enjoyment, aesthetic appraisals of beauty, and emotional responses, but the framework shows that many instances of music appreciation do not include such outputs. Indeed, a central assumption of the framework is that theories of appreciation that focus exclusively on appraisals of beauty, enjoyment, or emotional responses are limited in their capacity to capture experiences of music across contexts, people, cultures, and historic periods.

All three forms of appreciation typically coexist and interact during an appreciator's experience of music but may shift in emphasis during an experience or with repeated exposure. Displays of appreciation by listeners can influence the nature of concurrent or subsequent musical contexts, shown in Figure 1 as a feedback loop extending from appreciation back to contexts. In concurrent contexts such as a live performance, a musician's choices of production movements, gestures, facial expressions, and other actions during any performance are influenced by the appreciative feedback of audience members (Davidson & Broughton, 2016). For subsequent music-making contexts, musicians may choose to record songs that have received popular approval at concerts, or that are widely endorsed in social media. The internet and networks of the Information Age have made feedback loops based on market value pervasive and swift (Castells, 2010a, 2010b; Zuboff, 2019). Audiences also contribute to the social context of music: the social and political significance of the 1969 festival "Woodstock" was shaped not only by the musicians who performed, but by the political mood and social attitudes of appreciators.

Historical contexts can also be reinterpreted by appreciators in view of ethical or political considerations (Gaut, 2007). Consider how the #MeToo, #BlackLivesMatter, and #Ownvoices movements have raised awareness of patriarchal institutions and practices of

Figure 1
Music Appreciation Framework



entitlement. Such movements have encouraged us to reexamine the appreciation of successful hits such as Frank Loesser's "Baby it's cold outside," Ted Nugent's "Jailbait," or Gary Pucket and the Union Gap's "Young Girl." They have also impacted the way artworks in nonmusical domains are appreciated, raising questions about issues such as the lack of diversity in exhibitions at publicly funded art museums, the marginalization or omission of LBGTI characters in mainstream films, and the depiction of struggling immigrants in best-selling novels written by successful nonimmigrant authors.

The framework differentiates forms of appreciation arising from *structural* characteristics of the music—which include attributes such as rhythm, meter, loudness, timbre, dissonance, harmony, and melodic contour—from appreciation arising from *personal* associations (autobiographical experiences, identity affirmation) and *source sensitivity*. Personal associations and source sensitivity instantiate contextual cognition but are distinguished from one another by processes that distinguish internally generated information (e.g., memories) from information presented in the external world (e.g., biographies, program notes, Johnson et al., 1993; Simons et al., 2008). Personal associations are self-oriented responses to the music; source sensitivity entails an awareness that the music was created or communicated by specific musicians in social, historical, and cultural contexts.

There is ample evidence for all three form of music appreciation and associated psychological processes. This evidence will now be reviewed, followed by recommendations for future research in this area. However, as the perception of musical structure and personal associations with music have already been reviewed extensively elsewhere, we provide a more detailed discussion of the concept of *source sensitivity*, which has never been considered in previous psychological theories of music appreciation.

Appreciation of Musical Structure

A fundamental question in the study of music appreciation is why certain kinds of nonlinguistic sound vibrations are perceived as meaningful, coherent, emotional, and sometimes profound. The psychology of music has traditionally focused on experimental manipulations of structure to answer this question (Deutsch, 1999, 2013; Thompson, 2014c), revealing a tacit commitment to the notion that mental representations of musical structure lie at the

heart of appreciation. Perceptual processes are thought to permit listeners to extract, represent, anticipate, and retrieve musical structure. The process begins with an acoustic analysis of incoming soundwaves, registering sound qualities such as pitch, timbre, and temporal structure, after which increasingly rich mental representations of the musical structure are formed (Cuddy et al., 1981; Krumhansl, 1990; Sankaran et al., 2020). The concept of a *mental representation of music* refers to the neural correlates of music experience, which encode structure on multiple levels, from the attributes of individual pieces to the statistical regularities across entire genres of music. Such representations allow us to recollect specific pieces of music or anticipate continuations in music we have never heard. The perceptual and cognitive outcomes of these processes constitute a basic dimension of appreciation.

Research on the perception of musical structure reflects a long history of theorizing, with roots in Pythagoras and revisited in the mid-nineteenth century with the birth of psychophysics and advances in the science of music (Fechner, 1876; Helmholtz, 1954). Helmholtz's approach to music aesthetics was to explore "the boundaries of physical and physiological acoustics on the one side, and of musical science and aesthetics on the other" (p. 1). This focus on musical acoustics and psychophysics—the psychological impact of sounded music—has remained largely unchallenged, despite advances in understanding human sensitivity to the acoustic properties of music (e.g., Harrison & Pearce, 2020; McDermott et al., 2016; Plomp & Levelt, 1965; Seeley, 2020).

Models of music perception typically begin with auditory processes that are engaged when vibrations of air molecules impinge upon the cochlea. Acoustic input is analyzed into dimensions like pitch, temporal structure, loudness, and timbre. At this stage of processing, similar mechanisms may be engaged for all sounds (Bregman, 1990; McAdams & Bigand, 1993; Plomp, 2002; Thompson, 2014c), including wind, rain, animal sounds, speech, or music (Ma & Thompson, 2015). At later stages, domain-specific mechanisms are implicated. Although there is no universal agreement on the structures that are distinctively musical (Thompson, 2014b), or even on the definition of music itself (Davies, 2012; Thompson & Olsen, 2021), discussions of music processing for Western industrialized societies (the limited repertoire studied by the bulk of existing studies) have usually focused on pitch, harmony, key, and rhythm, listed in Figure 1 as examples of structural aspects of music.

Defining books in the field (e.g., Deutsch, 2013; Rentfrow & Levitin, 2019; Thompson, 2014c) include chapters on topics such as the perception of musical tones, timbre perception, intervals and scales, grouping, the processing of pitch combinations, and rhythm perception. When considering the role of such properties in music appreciation, researchers have primarily examined music processing in Western industrialized societies (Henrich et al., 2010; Jacoby et al., 2020; Thompson, Sun & Fritz, 2019), focusing on elements such as sensory impressions of consonance and dissonance, entrainment arising from the rhythmic dimensions of music, impressions of form and balance, and expectancy mechanisms that interact with music's syntactic structure.

The perception of pitch relations is a classic example of how music is represented and experienced—the aspect of music processing investigated most thoroughly by psychologists (Thompson, 2013). Humans are sensitive to both simultaneous and sequential pitch relations. Simultaneous pitch combinations are the foundation of *harmony*. A preference for consonance over dissonance is one aspect of the human sensitivity to harmonic structure. This preference has been observed in infants with little postnatal exposure to culturally specific music (Crowder et al., 1991; Hannon & Trainor, 2007; Masataka, 2006; Trainor et al., 2002; Trainor & Heinmiller, 1998; Zentner & Kagan, 1998). Such evidence raises the possibility that preference for consonance is innately determined, given infants have little time to internalize regularities in their musical environments. Such an instinctive preference can be explained by processing *fluency*—the ease with which information is processed in the brain (Reber et al., 2004). Consonance is associated with high overlap in the spectral information of constituent tones, and hence reduced demands on acoustic signal processing.

However, evidence by Plantinga and Trehub (2014) suggests that such preferences depend on early processes of enculturation (see also, Savage et al., 2015). Cross-cultural and musicological evidence also demonstrates that preferences for consonance vary within and across cultures (Jacoby et al., 2019; McDermott et al., 2016). Dissonance and acoustic nonlinearities are also prevalent in certain Western genres such as extreme metal (e.g., Sun et al., 2019; Thompson, Geeves, & Olsen, 2019), making it clear that dissonance is not always disliked. Indeed, acoustic beating and roughness are desirable qualities in genres such as Western jazz, Balinese gamelan orchestras, and music of the Middle East, North India, and Bosnia (Plantinga & Trehub, 2014; Vassilakis, 2005). By demonstrating that basic psychological mechanisms are impacted by enculturation, such findings highlight the limitations of theories of appreciation that emphasize responses to musical structure without considering cultural and contextual factors.

Humans are sensitive not only to simultaneous pitch relationships, but also to relationships between sequentially occurring pitches—called melodic intervals. When we hear a familiar melody, we recognize it from these relationships, and not from the absolute pitches themselves. Both local and large-scale melodic patterns have aesthetic significance, and discussions of aesthetic experience tend to focus on musical uncertainty, tension, surprise, and relaxation (e.g., Cheung et al., 2019; Lerdahl & Jackendoff, 1983). As an example of a local melodic pattern, when a large sequential interval is followed by a change in direction, it creates a "gap-fill" pattern (Meyer, 1973). The initial melodic "leap" is considered a point of tension (Boltz & Jones, 1986; Jones, 1987); the subsequent change in direction is thought to "discharge" the tension built up by the preceding gap, resulting in an impression of relaxation (for models of gap-fill melodies, see Huron, 2016; Temperley, 2008).

How can a sequence of tones generate tension and relaxation? One way is by eliciting *expectations* (e.g., Huron, 2006; Meyer, 1956; Salimpoor et al., 2015; Zatorre, 2018). When hearing a melody, listeners form expectations about upcoming notes or groups of notes. Transient feelings of tension arise when expectations do not eventuate (are "denied"); feelings of relaxation arise when expectations are fulfilled. Sometimes a particular note is expected, but usually expectations are only partially specified. Learning and exposure to musical styles strongly influence such expectations, but some expectations may occur intuitively. For example, tones that are proximal in pitch to the last tone heard are highly expected, and this expectation may not depend on experience (Thompson & Stainton, 1998; von Hippel, 2000; von Hippel & Huron, 2000).

According to the Implication–Realization model, expectations for music arise from a combination of bottom-up and top-down factors

(Narmour, 1990; Thompson, 1996). In Narmour's scheme, bottom-up factors refer to instinctive or innate cognitive and perceptual tendencies; top-down factors refer to expectancies that depend on internalized knowledge, either of music in general, or a particular musical piece. A factor like pitch proximity (expecting notes close in pitch) is thought to be a bottom-up influence on melodic expectancy, whereas a factor like tonality (expecting notes in proportion to their tonal function in music) is thought to depend on long-term exposure to tonal music. As listeners engage with the unfolding syntactic structure in a piece of music, they make predictions about upcoming events. These predictions and the ensuing varieties of surprise choreograph experiences of fluctuating tension and release that can absorb listeners in the expressive contours of the music. This kind of structural representation, while dependent on cultural exposure and experience (Krumhansl et al., 2000; Vuvan & Hughes, 2019), is an important component of music appreciation.

In their Generative Theory of Tonal Music (GTTM), Lerdahl and Jackendoff (1983) offer another framework for understanding the perception of melodic structure. The framework holds that in Western tonal music, certain notes form the essential skeletal structure of a melody while intervening ones function as ornaments that can be removed without disturbing the essence of the melody. Thus, a skeleton melody may be perceived by listeners as a simplified version of the original (Bigand, 1990; Dibben, 1994; Farbood, 2012; Lerdahl & Krumhansl, 2007; Palmer & Krumhansl, 1987a, 1987b). Distinguishing between essential and ornamental notes of a melody is deceptively complex and subjective, and GTTM addresses this challenge by considering both rhythmic factors and moments of tension and relaxation. Although GTTM was developed to describe the intuitions of experienced, enculturated listeners, it addresses appreciation in its contention that listeners gravitate toward certain interpretations of structure over others (articulated in the GTTM "preference rules").

Other research on musical structure has focused on mental representations of *rhythm* and *meter* (e.g., Honing, 2013; Keller & Burnham, 2005), as well as interactions between representations of pitch and time (Prince, 2014; Prince, Schmuckler, & Thompson, 2009; Prince, Thompson, & Schmuckler, 2009). This work, as with psychological investigations of musical pitch, demonstrates that mental processes operate to internalize the structural aspects of music, and these representations function to anticipate and interpret subsequent listening experiences.

Temporal patterns in music often feature hierarchically nested regularities that orient attention and engagement in listeners. Events at strong metric positions elicit higher goodness-of-fit ratings (Palmer & Krumhansl, 1990), and more accurate discrimination (Jones, 1987) compared to events at weaker metric positions. Even newborn infants register the position of individual musical events within the metric hierarchy in their earliest brain responses to music (Winkler et al., 2009). Listeners neurally entrain to temporal regularities within music (Doelling & Poeppel, 2015; Tierney & Kraus, 2014). Entrainment and rhythmic synchrony, in turn, support social bonds. Adults rate people with whom they have moved synchronously as more likable than those with whom they have not (Hove & Risen, 2009; Wiltermuth & Heath, 2009). Toddlers who have been bounced in synchrony with an experimenter while listening to music subsequently help that experimenter more (by returning dropped objects to her) than if they were bounced out of sync (Cirelli et al., 2014). Extracting temporal regularities from the musical surface and entraining to them allows sympathetic mirroring and mimicking that constitute a key part of musical appreciation for many people. Imaginatively and corporeally inhabiting the sounds creates a strong sense of communion and meaning.

The notion that continuity, form, and balance contribute to music appreciation is one of the most enduring ideas in Western musical aesthetics (Scruton, 1999). One foundational aspect of apprehending musical form is parsing the soundscape into its constituent parts or *sources*. Auditory scene analysis (Bregman, 1990) explains how listeners take a composite sound wave, representing the summed activity of multiple simultaneously-sounding sources, and extract the individual sound sources from that texture, hearing (e.g.) a flute, violin, soprano voice, and bass voice. Huron (2016) argues that eighteenth-century voice leading rules—principles for assembling concurrent musical lines in a multipart texture—serve to make auditory scene analysis as clear as possible for listeners. He likens the act, during music listening, of resolving the multiple sounding voices into their constituent parts to the act of solving a puzzle and claims a similar sort of pleasure or satisfaction arises. In addition to vertically parsing the soundscape (spectrally), listeners also parse it horizontally (temporally) into segments, phrases, sections, and groups as the music progresses. Not only are adults sensitive to grouping structure (Palmer & Krumhansl, 1987a, 1987b), but infants as young as 4–6 months of age prefer music that has been segmented according to conventional phrase structure over music that is segmented (using pauses) at inappropriate points (Krumhansl & Jusczyk, 1990).

Listeners often revisit their favorite songs repeatedly (Margulis, 2013), and they abstract thematic categories and relationships among themes across the course of these repeated listenings (Deliège, 1996; Pollard-Gott, 1983). Music is also unique in the high degree of repetition of thematic materials within pieces. By restating phrases and other structures that have already occurred, often multiple times, the creators of music (composers, improvisers) signal to listeners that such structures are significant, and worthy of revisiting for deeper reflection. The consequence of this repetition is that even listeners without formal training are highly sensitive to basic aspects of conventionalized structure, such as sonata form in a classical work or verse-chorus form in pop music (Granot & Jacoby, 2011; Neuhaus, 2013; Vallières et al., 2009).

All structural attributes of music—including tempo, dynamics, timbre, melody, harmony, tonality, and rhythm—interact with emotional systems (Gabrielsson & Lindström, 2010; Ilie & Thompson, 2006, 2011; Juslin & Laukka, 2003; Thompson et al., 2001; Thompson & Robitaille, 1992), preferences (Ladinig & Schellenberg, 2012; North & Hargreaves, 1996; Vuoskoski et al., 2012), and aesthetic appreciation (Juslin et al., 2010; Nieminen et al., 2012). For example, fast tempi elicit high levels of arousal, looming dynamics capture and sustain engagement, pitch structure can evoke positive or negative emotions, and certain vocalizations can soothe, calm, and lower arousal, as evidenced by the characteristics of lullabies across cultures (Trehub et al., 1993). More generally, ratings of affective qualities, such as perceived tension, track the structure of music (Krumhansl, 1996), demonstrating a close mapping between musical structure and appreciation. Such structural features constitute some of the *active ingredients* of music—ingredients that interact with a range of brain functions

to confer cognitive, psychosocial, behavioral, and motor benefits (Brancatisano et al., 2020).

Self-Oriented Appreciation

The capacity of music to evoke personal experiences and reinforce a sense of identity is pervasive in music practices worldwide. For the Indigenous people of Northern Siberia (*Nganasans*), songs can "belong" to a specific individual and their content will be experienced as autobiographical (Nikolsky et al., 2020). Personal songs are also important in the music of First Nations ("Flathead") North Americans (Merriam, 1964, 1967). Traditionally, personal songs are understood to be conferred upon individuals by guardian spirits, who provide instructions on what the song is for and when to sing it. For the descendants of First Australians, songs of loss have been used to tell personal stories of pain and healing surrounding the *Stolen Generation* that occurred up until the 1970s, when Aboriginal children were removed from their families as part of a colonial policy aimed at assimilating Aboriginal and Torres Strait Islander peoples into the non-Indigenous Australian community (Barney & Mackinlay, 2010; Burarrwaŋa et al., 2019; Minestrelli, 2016).

Among Western listeners in industrialized societies, music can trigger a range of personal, autobiographical memories (Janata et al., 2007), and these self-defining memories have important psychological and emotional functions (Juslin & Västfjäll, 2008; Platz et al., 2015). People have better memory and greater preference for songs from their teens and early adulthood, the time periods when they are establishing a sense of identity, and this music triggers a range of self-defining memories and associations in both laboratory (Holbrook & Schindler, 1989) and naturalistic conditions (Loveday et al., 2020). Music connects us to the people, places and times that define our identity, and is implicitly used to explore or affirm our identity and social agency (DeNora, 1999). Recognizing these functions, professional music therapists employ music to address problems of self in their clients, including low self-esteem, or anxieties about one's future (Lawendowski & Bieleninik, 2017; MacDonald et al., 2002). Such therapeutic outcomes reinforce the appreciation of music for the personal benefits it confers (Brancatisano et al., 2020).

These examples illustrate how music can contribute to an individual's sense of self. A challenge faced by research on this topic, however, stems from disputations on the concept of *self* (Bullot, 2015; Gallagher, 2011). It has been suggested that the self is not a unitary dimension of experience but should be understood as a multidimensional entity (Carruthers, 2011; Dennett, 1991; Gallagher, 2000, 2011). In a pioneering analysis, Neisser (1988) argued that sensitivity to oneself and self-knowledge pertain to five domains of experience: ecological, interpersonal, extended, private, and conceptual. As indicated in Figure 1, various aspects of the self are supported by music (Baird & Thompson, 2018).

Music supports the *ecological self*—our immediate bodily experiences that remind us of our physical self—because music engagement triggers physiological responses and bodily movements and awareness. These physical responses, in turn, provide feedback about the position and movement of our bodies in space. Music triggers activity in motor regions of the brain even during passive listening (Chen et al., 2008), and may induce explicit movement in the form of tapping, clapping, dancing, or otherwise moving in time with music (Janata et al., 2012). Such music-oriented actions, including imagined actions, reinforce a sense of self as an embodied agent. Shacher (2019) observes that "the body's characteristics and its capacities to resonate, re-enact and 're-member' physically provide the foundation for sonic experience … as musicians perform, they construct a temporally unfolding stream of movement dynamics that the listener–viewer re-enacts and coperforms through kinesthetic, corporeal resonances, and higher-order dynamic sensing. This state of active engagement is more akin to moving oneself than to sounding within oneself." (p. 62). According to Cox's (2016) mimetic motor imagery hypothesis, processing music involves overt or covert imitation of musical sound within the body, and this corporeal understanding is foundational to understanding music. Converging evidence from multiple neuroimaging studies shows that music listening elicits widespread activation of motor networks (Gordon et al., 2018). Music's capacity to support the ecological self also undergirds its use in rehabilitation and treatment for Parkinson's disease (Raglio, 2015; Lagrasse & Thaut, 2012).

Social interactions give rise to what Neisser classifies as the *interpersonal self*. Throughout the world, music is commonly experienced in groups (Savage et al., 2015). Music is inherently social and people often engage in musical activities with others. Not only adolescents (Schäfer & Sedlmeier, 2009) but also younger (Boer et al., 2011) and older adults (Hays & Minichiello, 2005) use music choices to define and communicate their social identity (Lamont, 2019). Singing or dancing together enhance feelings of affiliation with other group members (Pearce et al., 2015; Tarr et al., 2014), thereby reinforcing the interpersonal self. Rituals involving music (e.g., religious, rites of passage, and healing rituals) function to reinforce social norms to community members (Henrich, 2020; Tuzin, 1980). Such norms help people to organize their social lives and express their social identities, leading to feelings of belonging to a group with a distinctive identity, set of values, and history. When such feelings of group solidarity suddenly intensify, they can give rise to a unique communal emotion known as *kama muta* (Fiske et al., 2019; Zickfeld, 2018, Zickfeld et al., 2019).

Neisser's *extended self* is the autobiographical experience of continuity that extends from our earliest memories to the present, and to the person we expect to be in the future. Music can be a powerful trigger of autobiographical memories, primarily because it is personal, emotional, and intensifies concurrent experiences. Memories not only remind us of our past; they help us to understand the present and anticipate the future, thus supporting our past, present, and future selves (Mahr & Csibra, 2018). Janata et al. (2007) identified three types of music-evoked autobiographical memories (MEAMs): (a) a specific period of life, (b) a particular event, or (c) a person or place. MEAMs are evoked spontaneously, recalled rapidly, experienced positively, and characterized by greater emotional impact than voluntary autobiographical memories (Baird & Samson, 2014). MEAMs are also remarkably vivid (Belfi et al., 2016), and stable in the face of cognitive decline, often persisting in individuals with dementia (Baird et al., 2018; Cuddy et al., 2017; Janata et al., 2007) and severe acquired brain injury (Baird & Samson, 2014). Personal memories and self-reflection are supported by activation of the medial prefrontal cortex (MPFC), posterior cingulate cortex and precuneus—part of the default mode network and implicated in the integration of sensory information with self-knowledge (Heatherton, 2011; Janata, 2009). Along with daydreaming, strong experiences of aesthetic appreciation are associated with activation in these regions, supporting the

notion that artistic appreciation is often self-oriented (Vessel et al., 2013).

The *private self* is the sense of identity that is not explicitly available to others, but may be reflected in thoughts, feelings, intentions, and dreams. Because music is deeply personal, it can trigger private imaginative experiences that support or explore the private self. An influential method of music therapy exploits this capacity, using imagery for music as a springboard for personal reflection and discussion (Bonny, 1986). Music-evoked imagery is often highly personal (Bonde, 2007) and associated with one's emotional response to the music (Day et al., 2020; Juslin, 2019). Finally, Neisser identifies the *conceptual self* as a unified sense of identity generated from the other components of self. It includes an understanding of one's roles, personality traits, identities, and preferences. This overall sensibility is therefore supported by music in all the ways described above.

Persona theory posits that listeners frequently experience music as a virtual companion or surrogate friend with whom they can identify (Baumeister & Leary, 1995; Elvers, 2016; Schäfer & Eerola, 2020). Similarly, the Shared Affective Motion Experience (SAME) model claims that by activating the mirror neuron system, music induces an impression of the presence, actions, and emotional states of a virtual other (Overy & Molnar-Szakacs, 2009). Couple-defining songs (CDSs), where members of a couple strongly associate a particular song with their relationship, represent yet another illustration of the capacity of music to support the relational self (see Figure 1). Research suggests that CDSs are primarily associated with romantic relationships, but are remarkably common, with up to 60% of people in romantic relationships reporting that they share a special song with their partner (Harris et al., 2020). CDSs typically trigger positive relationship-specific memories that reinforce feelings of intimacy and cohesion within the relationship. Such songs support the interpersonal and extended self in that they support an individual's identity in relation to a romantic partner, and they reinforce the extended nature of this relationship by triggering shared memories. Finally, CDSs support the conceptual self by affirming one's personality, identity, and music preferences as part of a couple.

Many musical genres support a collective self (e.g., Deaux, 1992; Swann et al., 2009). North American music has a rich history of promoting social justice movements, including Pete Seeger's protest songs, Buffalo Springfield's *For what it's worth*, or Beyoncé's *Black Parade*. Such movements are dependent upon a collective self which, in turn, provides a powerful incentive for music listening. Death metal fans also have a strongly defined collective identity, and report experiencing joy and empowerment when listening to this genre of music, even when the lyrical content depicts acts of extreme violence (Thompson, Geeves, & Olsen, 2019). Death metal music often features brutal, hyper-masculinized vocals, intense and rapid textures with high levels of dissonance, and lyrics that depict violent forms of death such as brutal stabbings or decapitation. Struggling to make sense of the collective identity of this subculture, some outsiders have expressed concern about the lyrical content, leading to censorship of bands such as Cannibal Corpse. Fans, in contrast, contend the music is a welcome alternative to commercialism, and a vehicle for critiquing social and political dynamics across society (Kahn-Harris, 2006). Thus, aside from an appreciation of the structural and performative aspects of the music, a component of the appreciation lies in a shared commitment to the values of the musical subculture—values that support a collective self.

According to Juslin and Västfjäll (2008), personal associations with music constitute a core *mechanism* for inducing emotional experience—which may explain why episodic memories triggered by music have such a strong emotional impact (Juslin, 2019). Personal memories triggered by music also have aesthetic consequences (see Juslin, 2019, Chapter 22), probably because they are emotional and experienced positively. Such memories also have important psychological functions (Juslin & Västfjäll, 2008; Platz et al., 2015) and societal functions (DeNora, 1999; Elvers, 2016). DeNora (1999) proposed that music acts as a mirror through which participants can view themselves, validating the individual and social identities that they project onto themselves and others. Similarly, MacDonald et al. (2002) argued that "One of the primary social functions of music lies in establishing and developing an individual's sense of identity" (p. 5). Finally, Elvers (2016) proposed three distinct mechanisms that enhance a sense of self during music listening: empathic listening, social cohesion, and pleasure. Empathic listening contributes to enhanced self-awareness because it stimulates an understanding of how one's own experiences relate to others (Fiske, 1992; Zickfeld, 2018); social cohesion is strengthened by the sharing of values expressed in music, reinforcing one's social identity; pleasure arises from the stimulation of positive emotional states, which are often self-referential and intertwined with one's identity.

Appreciation of Musical Sources

Music listeners acquire detailed knowledge of the causal and contextual sources of music—a knowledge they often share with others in conversations and in comments made about music performances or musicians on social media sites. For example, the appreciation of Australian Indigenous Hip Hop typically extends beyond its sonic details and involves an awareness of the contexts and causes of the music, including the personal motivations of performers, past and present conflicts between Indigenous and settler values, spiritual practices, and political activism (Minestrelli, 2016). This *source sensitivity* plays an important role in music appreciation but has rarely been incorporated into psychological accounts of music. An appreciator of a musical event (work, performance, mental image, or other music-oriented experience) develops musical source sensitivity if that appreciator develops a capacity to keep track and represent the causes and contexts—or sources—associated with the creation and cultural transmission of the music. Source sensitivity refers to the appreciator's capacity to learn about a set of sources and respond emotionally, cognitively, and/or physically to these sources.

The *cognitive relations* that enable source sensitivity include, but are not limited to, acts in which an appreciator learns and acquires knowledge about a musical source and its context, shown in Figure 1 as having multiple levels of epistemic depth. An appreciator is sensitive to a source when the appreciator identifies, remembers, and updates information about a source, classifies it into cultural categories, and makes inferences about its causal history or social situatedness. Thus, source sensitivity includes processes of causal learning and reasoning (Waldmann, 2017). But this process extends to other forms of associative and contextual cognition (Bullot & Reber, 2013a; Cosmides and Tooby, 2000; Le Pelley et al., 2017).

The experiences associated with these relations have a content that is *about* or *dependent on* an object (e.g., about a performer, or dependent on a musical performance)—a characteristic referred to as *intentionality* (e.g., Brentano, 1874/1973; Bullot & Égré, 2010; Malle et al., 2001; Searle, 1983).

An artistic domain is a cultural context comprised of *source components*—or *sources* for brevity—that need to be described to explain the production of the work as a piece or event with a distinctive causal history. The social domain of an artistic work, sometimes referred to as an "artworld" (Danto, 1964, 1983; Dickie, 1984/1997, 2000), may include sources such as the human agents who composed or performed the work along with the systems of cultural learning enabling the social transmission of the work and the skills required to perform the work (Davies, 2012, 2015; Laland, 2017; Levinson, 2011; Richerson & Boyd, 2005; Sterelny, 2012; Tennie et al., 2009; Wimsatt, 2013, 2014).

Musical source sensitivity is developed by acquiring information about, and appreciation for, entities that either produce musical works (i.e., sources) or are associated with the production of musical works. These entities include (a) a *musician* or a *group of musicians*, and in particular their physical appearance, demeanor and personality, attitudes, struggles, abilities, biographies, and so forth; (b) musical *works*, including information regarding work categories (e.g., information about music derived from scores (Davies, 1994), recorded tracks (Kania, 2009), or performances), instruments and tools utilized, provenance and authenticity, and artistic and musical style; and (c) other types of *contextual information* about social and economic conditions supporting the creation of musical works, their *raison d'être* and common uses, including uses in mass media and advertisement. Contextual information related to musical sources may include historical situations described by narratives, communicative intentions, and presumed setting.

Music historians, musicologists, and ethnomusicologists study contextual information about musical works and their histories as the subject matter of scholarly investigations, while fans of specific artists or bands may read fan magazines or musician biographies. Even without such explicit strategies for acquiring source knowledge, listeners spontaneously form internal models of musical sources as part of their everyday engagement with music. Steinbeis and Koelsch (2009) presented listeners with atonal music written by composers of the second Viennese School. For half the pieces participants were told the music was composed (composer-condition); for the other half they were told the pieces were computer-generated (computer-condition). Compared with the computer-condition, the composer-condition was associated with increased brain activity in the aFMC (anterior fronto-median cortex), a neuroanatomical network associated with mental state attribution. Similar processes have been identified and investigated in text comprehension, where readers form mental models of agents and context (Johnson-Laird, 1983; Kintsch, 1988; Zwaan & Radvansky, 1998).

As depicted in Figure 1, source knowledge is acquired at different levels of processing, including direct perception of physical movements needed to play a musical instrument, monitoring facial expressions and ancillary gestures that performers might adopt, and acquiring information about the personal qualities of musicians, and the social and historical contexts of music making. These processes implicate multiple interacting brain areas including parts of the frontal lobe (damage to which can give rise to deficits in remembering the source of experience), as well as temporal and diencephalic brain regions (damage to which gives rise to disrupted memory for "context").

The most basic input to source sensitivity is the direct perception of musicians and their gestures in live or recorded performances (see Figure 1). This information includes facial expressions and body movements (Davidson & Correia, 2002; Thompson et al., 2008; Thompson & Russo, 2007) as well as verbal information available from on-stage commentary. In live contexts, facial expressions and body movements (henceforth *gestures*) function not only to highlight structural features (such as musical tension) and convey an emotional interpretation of such events, but also to reinforce an association between the sounded music and the musicians producing that music (Thompson et al., 2005). Structural features in the music are often exaggeratedly linked to a performer's actions—going beyond the motor requirements of music production such that the connection between performance actions and sounded music is over-determined. Such *ancillary gestures* enhance the listeners' awareness of the source of the music by putting the musicians and their expressive impulses squarely in the mind of the appreciators, as the producer or source of the music. They also provide clues about any emotional motivations behind the music, such as heartbreak, empowerment, loss, or joy.

Source sensitivity can also be internally or imaginatively generated based on inferences derived from the sound of the music (e.g., one might generate an image of a rap musician one has never seen). In studies involving free response descriptions, the most common way people described their listening experience was to recount an imagined performance, often with details about the concert venue or performers. Even for music listened to over headphones, people seem prone to supplying contextualization and apprehending music in terms of its implied sources (Margulis, 2017).

Conceptual source sensitivity relates to an experience that is influenced by the social, cultural, or historical contexts associated with the creation of a musical event. This type of sensitivity is confirmed in studies that identify bias effects among adjudicators in formal music competitions (e.g., McPherson & Thompson, 1998), or that reveal performer-specific comments in written responses to music (e.g., Gabrielsson & Wik, 2003; Istók et al., 2009; Kreutz et al., 2008). Conceptual source sensitivity may also be externally or internally generated. Externally generated source sensitivity is typically derived from documents, television, films, magazines, other media sources, and word of mouth. This sensitivity may be revealed in explicit discussions of music or in the thoughts and images that are evoked by music. For example, the stories that people imagine while listening to previously unfamiliar excerpts of music can be remarkably consistent within cultures (Margulis, 2017; Margulis et al., 2019; McAuley et al., 2021; Margulis et al., 2022).

Internally generated source sensitivity ranges from filling in gaps when externally generated causal information is incomplete, to imagining plausible music performances or contexts in which the music might be heard. Some listeners may even imagine filmic accompaniments for music that has never been experienced in a multimodal context. Such imagery may reflect hypothetical or imaginary sources of music (Cohen, 2001; Cook, 1998), drawing upon analogical and counterfactual mental processes (Holyoak & Thagard, 1997; Nichols & Stich, 2003). The prevalence of musical imagery also suggests that dynamic changes of tension, relaxation, and emotional connotation in music can be readily mapped onto an

imagined source with analogous dynamic structure (Day et al., 2020; Koelsch et al., 2019; Taruffi & Küssner, 2019).

The balance of external and internal influences on source sensitivity will depend on the availability of clear and reliable external information and the inclinations and goals of the appreciator. In some cases, internally generated source sensitivity may compensate for lack of factual information. In the absence of reliable source sensitivity, human perceivers may generate beliefs about musical sources, such as attributing a spiritual source for music in religious rituals. As such, there may be an inverse relationship between the degree of reliable source information and the prevalence of false beliefs about music (Thompson, 2014a).

The *quality* and *reliability* of source sensitivity vary as a function of different factors such as the appreciator's expertise level and the information available in the audience's learning context. Although robust knowledge of a source is an important kind of source sensitivity (particularly in the scholarly and legal appraisal of music), source sensitivity is not always reliable, detailed, or conducive to robust historical knowledge. It is common to appreciate the provenance of an instrument that was owned by an esteemed musician. In 2019, David Gilmour's "Black Strat" (Fender Stratocaster), which featured on "The Dark Side of the Moon" and other Pink Floyd albums, was auctioned at Christie's for 3.975 million U.S. dollars. It is understandable for aspiring musicians to feel inspired when holding or playing an instrument owned by an esteemed performer, but some individuals hold magical beliefs about the way an artifact can inherit the prestige of their makers or owners (Newman & Bloom, 2014; Newman et al., 2011). Such beliefs also count as source sensitivity, even if they are not veridical knowledge as understood by epistemologists (Goldman, 1986; Lehrer, 1990; Sosa, 2009; Wimsatt, 2007). Source sensitivity encompasses the information or states of affairs that an appreciator imagines, surmises, infers, understands, or construes (i.e., represents) as a description of the source of the music or musical event, regardless of the truth-value of that information.

Evidence of the Psychological Significance of Source Sensitivity

Source sensitivity and contextualization are considered fundamental to artistic understanding in art history (Freedberg & Gallese, 2007; Shiner, 2001), literary and fiction theory (Farrell, 2017; Friend, 2017; Robinson, 2005), the philosophy of art (Budd, 1995; Carroll, 2010; Danto, 1964, 1983), musicology and the philosophy of music (Alperson, 1987; Clarke, 2005; Connell & Gibson, 2003; Davies, 1994; Levinson, 1990; Scruton, 1987; Tanner & Budd, 1985), and artistic photography (Lopes, 2016). Source sensitivity has been a focus of psychological explanation of the visual arts for decades (Hagen, 1980a, 1980b; Kozbelt, 2001; Kozbelt & Seeley, 2007; Kubovy, 1986), and this tradition has produced advanced psychological models of the artistic depiction of visible sources (Hecht et al., 2003) and of artists' expertise in drawing sources (Kozbelt, 2006; Kozbelt & Ostrofsky, 2013, 2018). In the case of music, evidence indicates that if people are asked to describe a set of musical or nonmusical sounds, they most commonly describe them in terms of the physical, social, and cultural *sources* of those sounds (Baily, 1996; Dibben, 2001; Gaver, 1993a, 1993b; Vanderveer, 1979).

Consequently, we contend that the empirical study of the sources and contexts of music—which is already incorporated into other scholarly disciplines—should be incorporated into *psychological* explanations of music appreciation. Psychological explanations refer to processes carried out by mental and neural mechanisms and their parts (that which does the explaining, the *explanans*) to account for diverse types of experiences and behaviors (the phenomena to be explained, the *explananda*; Bechtel & Wright, 2019; Craver & Bechtel, 2006; Cummins, 2000). A *psychological* explanation of music appreciation, in turn, should identify processes that, from a range of inputs, generate outputs associated with music experience, understanding, and engagement.

This section presents evidence that processes of source sensitivity pervade musical appreciation. The evidence implicates a set of mental processes that enable appreciators to know about, differentiate, and communicate about musical works and musicians. These mental processes respond to a range of inputs (including contextual, causal, historical, and perceptual inputs) and generate outputs in the form of psychological and bodily changes. Such changes constitute the measurable indicators of music appreciation, and include emotional effects, physical responses, physiological effects, changes in understanding, and increased motivation for subsequent music engagement.

Appreciators Attend to Body Movements and Gestures of Musicians

Live performance necessarily involves bodily movements that are causally related to the sounded music. Such movements include skilled actions needed to produce sounds on musical instruments, as well as ancillary bodily gestures and facial expressions that convey emotional meaning or direct attention to important structural features (Kozbelt & Seeley, 2007; Seeley, 2020). B. B. King's dramatic facial expressions during his performances closely mirrored the emotional and structural qualities of his guitar playing, while Judy Garland supplemented stage performances with attention-grabbing facial, hand and body gestures to support and amplify appreciation (Thompson et al., 2005). In non-Western contexts, expressive gestures are also common, as exemplified in the hand and body movements of musician Nusrat Fateh Ali Khan while singing qawwali, a form of devotional singing that originated in Sufi Islamic communities of the Indian subcontinent (Qureshi, 1987; Sarrazin, 2013).

Godøy (2010) notes that "musical sound is a transducer of source-information" (p. 106). People acquire knowledge of sound production through experience, such as seeing music performances. Once the association between musical sounds and body movements is established, people represent music-producing gestures even when they hear music in the absence of any accompanying visual signal.

Audiences actively seek out opportunities to watch musicians perform (Black et al., 2007; Brown & Knox, 2017; Earl, 2001). That is, they prefer to witness performers and keep track of their multifaceted agency (Bullot, 2014, 2015) over situations in which they listen to "disembodied" sounds. When given an opportunity to supplement auditory experiences of music with visual information about the production of music, listeners overwhelmingly choose to enhance their experiences in this way.

Music listeners incorporate the facial expressions and body movements of performers into their music experience (Livingstone et al., 2009, 2015; Thompson et al., 2010). The gestures of musicians shape

judgments of emotional (Thompson et al., 2008), structural (Thompson & Russo, 2007), and artistic (Thompson et al., 2005) aspects of music. Thus, the ability to perceive and form an impression of musicians at live concerts—a form of source sensitivity—has profound effects on experience (see also, Davidson et al., 2008; Vines et al., 2006, 2011).

Understanding performance gestures can also assist in skill acquisition (Davidson & Correia, 2002). Emulating a performer's vocalizations, dance moves, or instrument playing (as in the popular "air guitar" competitions) are common responses in adults and children alike. The capacity to imitate behaviors from musical sources is integral to skill development, and experienced as an important component of music appreciation. This observation is congruent with the critical role of imitation in cultural learning (Heyes, 2018; Tomasello et al., 1993).

Source Knowledge Influences Appraisals of Music

Documented biases in formal music performance adjudication reveal that source sensitivity impacts upon music appreciation even when steps are taken to ignore it (for a review, see McPherson & Thompson, 1998). For example, performances labeled "student musician" are adjudicated more harshly than performances labeled "professional musician" or "former symphony player," even when such labels are arbitrarily and incorrectly applied to the same set of performances (Duerksen, 1972; Radocy, 1976). Performance *proportions* (whether a performance involves a soloist, small ensemble, or large ensemble) and performance spaces also affect appraisals of the sounded music (Morgan & Burrows, 1981). The use of expressive devices, such as pedaling or rubato, are also evaluated differently for each composer and historical period (Berry, 1989; Thompson, 1989).

Such biases are also evident in informal settings. People prefer performances claimed to have been performed by a "world-renowned professional" over those said to have been performed by a "student" (Kroger & Margulis, 2017). Such biases are strong and persistent—activation in reward circuitry triggered by the presentation of the *world-renowned professional* label remained evident across 70 s of the musical excerpt (Aydogan et al., 2018), a period that should have been sufficient to allow sensory cues to override informational framing if source sensitivity were not an essential aspect of music appreciation. Even young children incorporate source sensitivity into their appraisal of art. Four-year-olds called the same blotches of paint a mess if told they originated from a spill, or a painting if told it emerged from concentrated effort (Gelman & Bloom, 2000).

A central assumption within the profession of music promotion and marketing is that the perceived quality or esteem of a musician or performer is critically important for appreciation. It is not uncommon for people to pay over $150 to hear violinist Joshua Bell perform in the world's great concert halls, but when he played in the Washington, D.C. subway wearing a hat so that his identity wouldn't be apparent even to fans, he was given only $32.17 after 43 min of playing his priceless Stradivarius. People were unable to access the rapture-inducing aspects of the sounds he draws from the instrument without additional source cues, like his famous name or billing at a major hall (Weingarten, 2007). Similarly, knowledge that music was composed and performed by a respected songwriter is integral to our appreciation of the music. When Paul McCartney released the album "Thrillington" under the pseudonym *Percy "thrills" Thrillington*, it was a commercial failure. Presumably, enthusiasm by listeners was dampened by lack of name recognition, and it is also possible that McCartney's song writing skills were diminished when he imagined himself as an unknown artist. Such expectation biases are overlaid with a converse bias in which music produced under "improbable" causal contexts attract attention and praise, such as performances by autistic savants or prodigies. A performance that might seem mediocre coming from an adult professional or subway busker may seem astonishing and chills-inducing when coming from a small child.

The influence of these aspects of source sensitivity can have troubling real-world consequences. Performances by males tend to be described as "powerful" and "strident" whereas performances by females are more often described as "sensitive" and "delicate" (Green, 1994). Such influences may have practical applications for the adjudication of performances in elite-level competitions. Tsay (2013) presented competition-level performances to a large sample of participants, and asked them to identify the winner based on silent-video or audio-only recordings. Identification of the winner was well above chance in the silent-video condition, but below chance in the audio-only condition (note that video does not always trump audio; see Mehr et al., 2018). Such a finding confirms that the mental mechanisms enabling bodily movements and gestures (the *explanans*) played a role in the formal adjudication of performances (the *explanadum*), even though such judgments should only reflect the quality of the sounded performance.

One reason why source sensitivity impacts upon appraisals of music is because listeners—even trained adjudicators—are surprisingly unreliable at evaluating performances based on acoustic input alone. When people were told they would hear two different performances of the same piece, but were then played the same recording twice, three quarters of them believed they had heard different performances (Anglada-Tort & Müllensiefen, 2017). Similarly, when participants heard the same audio recording paired with visual footage of two different performers playing it, musically trained and untrained judges perceived differences in the expressive approach between versions, presumably because they attributed them to different sources (Behne, 1999; Behne & Wöllner, 2011).

Appreciators Value the Authenticity of Musical Sources

In 2016 in Belgium, superstar Rihanna was booed by 60,000 fans at a concert because they sensed that she was lip synching her songs. The same year in Australia, hundreds of fans of Janet Jackson walked out of her concert for the same reason. Authenticity in performance is valued by fans, so the Musicians' Union in the U.K. launched a campaign insisting that artists and promoters explicitly inform audiences if any performance is mimed. The widespread use of contemporary technology in concerts is at the point where it is difficult for fans to tell whether an act is mimed or sung authentically: the difference between the two circumstances is barely perceptible but fans place far greater value on music experiences generated by live than recorded conditions (see also Barker & Taylor, 2007).

Aside from the authenticity of vocal production during live performance, music listeners also value the authenticity of body movements made by live musicians, evaluating some as sincere and necessary to generate a particular sound or mood, and others as

superfluous, showy, or false (Davies, 1987; Kivy, 2002, 2007, chapter 7). Whether engaging with music at a rock concert, the opera, or a devotional *qawwali* performance, people attend closely to body movements to infer and appraise the psychological intentions of those movements, and incorporate these appraisals into their appreciation of the music (Qureshi, 1987; Thompson et al., 2005).

An understanding of historical antecedents also contributes to historical appreciation. Should baroque music written for the harpsichord be performed on the piano? How much rubato is appropriate in performances of J. S. Bach, W. Mozart, and F. Chopin? Performance practice in historical music is strongly influenced by debates over stylistic and historical authenticity (Kivy, 2002), with some critics arguing that performers should duplicate practices of the time of the composition, and others arguing they should embrace changes associated with contemporary practice. Both sides of the debate place source sensitivity at the center of the argument, but disagree on the focus of that sensitivity (historical versus contemporary performance practice).

The value of authenticity is especially tangible in cases of musical copyright law. Legal processes and standards (e.g., International Standard Recording Codes) facilitate knowledge of the causal history of musical works. Decisions that connect specific features of a musical artwork to a source (a composer or songwriter) can be explained by a framework that posits a critical role of the source for adjudicating "value" in music. In copyright disputes, claimants must demonstrate a link between particular attributes of music and specific sources. Such links typically refer to the degree of musical overlap, but some claims relate to stylistic similarity, as in the copyright claim by Marvin Gaye's family against Pharrell Williams and Robin Thicke for their song "Blurred Lines." Conversely, failure to encode and retain source sensitivity for musical input can lead to source confusion, whereby a songwriter mistakenly attributes an imagined song to an internal creative process rather than an external source. Source confusion was the legal determination in the copyright infringement suit by *Bright Tunes* against George Harrison for his song "My Sweet Lord," with Harrison being found guilty of "unconscious plagiarism" of the earlier song, "He's so fine" by the Chiffons.

The concept of authenticity has been understood in two ways. *Nominal authenticity* refers to the authorship of an artwork (Dutton, 1983), and how closely a music performance or composition realizes the author's intention and conforms to an artistic tradition. Deviations from nominal authenticity tend to be associated with reduced levels of appreciation (Newman & Bloom, 2012), with cases of musical plagiarism or lip-synched performances representing extreme cases. *Expressive authenticity* describes the degree to which a musical work or performance exhibits sincerity, passion, and integrity of expression (Dutton, 2003). Because any assessment of expressive authenticity requires an awareness of the causal agent performing the act of expressive communication, it is a form of source sensitivity; the quest for authenticity, according to Barker and Taylor (2007), was influential enough to shape the sound of pop music across the twentieth century.

Contextual Knowledge Enhances Experiences of Live Music

Contextualizing a music experience can also impact appreciation. Program notes with rich descriptions of the source domain often accompany classical and other music performances. This information can be challenging to assimilate in the short term for untrained listeners (Margulis, 2010), but as contextual information is processed over longer periods of time, it becomes easier to listen to music with this understanding in mind. Ultimately, the sounded music becomes merged with contextual understanding, resulting in a deeper and more communicative experience (Cone, 1977). Similarly, explanatory information panels in art museum galleries significantly impact upon appreciation, enhancing enjoyment for most visitors (Temme, 1992), and deepening appreciation for the artworks (Swami, 2013).

Margulis et al. (2017) played people expressively ambiguous excerpts paired with information purported to describe the composer's intention in writing the excerpt. Descriptions alleged that the composer wrote the music for a positively-valenced purpose (e.g., to celebrate the wedding of a friend); a negatively-valenced purpose (e.g., to mourn the loss of a friend); or a neutral purpose (e.g., to fulfill a commission). The valence of the creative intention influenced how happy or sad the music sounded and also impacted enjoyment of the excerpts. Excerpts were liked more if listeners thought they had been composed for a positive reason. Similarly, Anglada-Tort et al. (2019) found that adding titles increased aesthetic appreciation of musical excerpts, and that this effect was further modulated by the title's valence, such that excerpts paired with negative titles were the least liked. Finally, Kiernan et al. (2021) presented negative, neutral, or no biographical information about the composer Jan Dismas Zelenka (1679–1745) before playing his music to 179 participants. Presenting biographical information influenced emotional responses, memories, associations, and mental images. For example, participants who read the negative biography of Zelenka tended to use negatively valenced language to describe their emotional responses to the music. Comparable effects of contextual information have been reported for the appreciation of visual art (e.g., Bordens, 2010; Cupchik et al., 1994; Kirk et al., 2009; Specht, 2010).

Source Sensitivity Is Integral to Cultural Transmission of Music

Source sensitivity is not merely an additional type of valued artistic knowledge, but inherent to skill transmission, including transmission by imitation, pedagogy, apprentice learning (Csibra & Gergely, 2009; Sterelny, 2012), and cooperation (Heyes, 2018; Laland, 2017; Tomasello, 2009, 2014; Tomasello et al., 1993). These processes of learning cannot occur without the learner's ability to develop source sensitivity. Take, for example, the ability to learn how to produce music of a particular style and historical category (e.g., the classical style, Hindustani classical music, *qawwali* devotional singing, or experimental *musique concrète*). An apprentice must have access to a set of sources that possess and can transfer expertise in the target musical style (Davies, 1994; Walton, 1970). Thus, learning about a particular tradition of music necessarily entails exposure to the people, places, and systems associated with that learning process, situating music within the context of these sources.

This linkage between source sensitivity and cultural practices is also reflected in the phenomenology of music experience. Individuals can be moved by music that is historically linked with specific cultural identities and geographical locations. Such associations and

emotions (e.g., nostalgia or yearning) can be particularly potent for individuals who have been dislocated from their homeland, such as refugees who are thrust into an unfamiliar and often unwelcoming society.

Source Knowledge Informs Ethical Aspects of Music Appreciation

The acquisition of source knowledge has ethical implications (Higgins, 2011). Both laypersons and experts use source knowledge to integrate ethical judgments into their evaluation of music and other artworks (Gaut, 2007). This approach to art criticism—called *ethicism*—holds that artworks are appraised with ethical considerations in mind. For example, if music arises within exploitative or abusive circumstances, it may feel wrong to appreciate the results of that labor. Cases where a composer or performer are accused of crimes or serious ethical violations, such as R. Kelly, Richard Wagner, James Levine, or Michael Jackson, raise challenges for those who enjoy their music, forcing them to reckon with how tightly linked source circumstances are with the music itself. If a person knows that a jury found him guilty of sexual abuse of children, the song R. Kelly wrote for Aaliyah "Age Ain't Nothing But a Number" may be difficult to separate from this fact. Similarly, listeners aware of Richard Wagner's anti-Semitism can perceive Jewish stereotypes in some of his operas, notable in the depiction of Klingsor in *Parsifal*.

Historical contexts of music analysis and pedagogy should also be scrutinized, because such an examination may uncover normative practices that sustain certain hegemonic perspectives while excluding others (Ewell, 2020). For example, one of the most dominant traditions of music analysis, Schenkerian analysis, emphasizes the hierarchical structure of music, and this analysis shapes the way music is understood in Western formal music pedagogy (Schenker, 1935/1979, see also, Narmour, 1977). However, it has been suggested that Schenker's hierarchical approach to music cannot be dissociated from his vociferous racist views (Ewell, 2020, Section 4), given that Schenkerian analysis is well suited to Western tonal music in the classical tradition, and poorly suited to many other musical forms. Such discussions highlight the ethical implications of pedagogical and scholarly norms, and the need to question dominant traditions of musical understanding.

Ethical considerations are also relevant to music and entertainment law. The creation of original songs is a primary source of income for musicians, so public appreciation of those songs and the monetary value of that appreciation should be directed to the creators of the music. Intellectual property rights exist to ensure that songs created by one artist are not plagiarized or appropriated without authorization. To enforce copyright laws, processes exist to evaluate the degree of similarity in musical pieces that differ in superficial ways (Müllensiefen & Pendich, 2009). Cases of copyright infringement are not just the domain of lawyers and musicians; they are headline news and part of the way consumers understand and appreciate musicians and their works.

Psychological Functions of Source Sensitivity

The above evidence demonstrates that people attend closely to musical sources on multiple levels of analysis, in different contexts, and with real-world implications for experience, professional practice, pedagogy, and marketing. These implications raise important questions for future research. What steps can adjudicators take to minimize unwanted biases caused by source sensitivity? Do certain qualities of a music performance predict high or low estimations of authenticity? To what extent do musicians' ethical choices impact upon short- and long-term appreciation of their music? Do individuals with hearing loss develop enhanced source sensitivity, for example, attending closely to gestures and bodily movements in performance? The mental processes (*explanans*) of music appreciation take a diverse range of inputs to generate source knowledge, ranging from the bodily movements used to play instruments to historical and sociopolitical information. Are there common mental processes and brain areas that connect these different levels of source sensitivity?

More research is also needed on the degree of interaction between the forms of appreciation, and the conditions under which one form dominates over others. Do they compete for attention or coexist without constraint? Are there developmental trajectories in the forms of appreciation that dominate—for example, is source sensitivity more central during early adolescence when individuals seek role models? Such questions underscore the application of research into source sensitivity for the music industry.

Source sensitivity has both formal and informal functions. Formal functions include the scholarly study of music. When a musicologist analyzes the context of a work of music to provide a historical or cultural understanding, their explanations and insights can be understood as a scholarly form of source sensitivity (Bullot & Reber, 2013a; Keil, 2006; Keil & Wilson, 2000). Their analysis may function as the basis for the creation and dissemination of new knowledge, to enhance their professional rank and esteem in the field, and to nurture their own and others' appreciation of the work.

There are also functions of source knowledge acquired in informal contexts. An adolescent who identifies strongly with a particular band may acquire source knowledge that is no less detailed than that acquired by an academic scholar, even if the strategies and motivations for acquiring this knowledge differ. The acquisition of source knowledge in informal contexts likely functions to optimize or augment *attention*, *memory*, *prediction*, and *social identity*.

First, source knowledge often functions to direct attention to important features of the music that might otherwise go unnoticed, amplifying comprehension of the music and its emotive impact. An individual with detailed knowledge of studio production techniques may draw on this knowledge to attend to production elements in a popular song, amplifying their emotive impact. An Indigenous Australian knowledgeable of Songlines can use that understanding to navigate and learn from country by attending to properties of the song (such as melodic contour and rhythm) that carry cultural and geographical information in relation to country (Burarrwaŋa et al., 2019; Neale & Kelly, 2020).

Second, source knowledge functions to provide additional input into mental representations of music, making them more elaborate and distinct. The capacity to distinguish a musical work from other similar works not only enhances the recognition and retrieval of the music, but has artistic value (Benjamin, 1936/2008; Bullot & Reber, 2013a). Third, acquiring source knowledge may derive from a general biological function to optimize the prediction of environmental events (Huron, 2006). Understanding the

environment leads to successful prediction, which is adaptive. Reward systems may function to optimize the prediction of all sensory input, regardless of whether they are artworks (Brown et al., 2012). Fourth, valuing the causal sources and contexts of music may function to nurture a social identity to which an individual feels affiliated (social bonding) and affirmed (Connell & Gibson, 2003; Jenkins, 1996/2008; MacDonald et al., 2002; Sarrazin, 2013; Tajfel, 1979).

Investigating Forms of Appreciation in Conjunction

Research is needed to understand how the three forms of appreciation interact, vary in salience under different conditions, and influence each other. In this final section, we consider the dynamic interrelationships between the three forms of appreciation, and offer predictions for future research.

Relative Salience of Form of Music Appreciation

The relative salience of the three forms of appreciation will depend on goals and circumstances, and within empirical research, it will vary according to task demands (Chmiel & Schubert, 2019). Forms of appreciation may also depend on processing fluency: how readily perceptual input can be assimilated into existing schemata (Berlyne, 1971; Bullot, 2020; Bullot & Reber, 2013a, 2013b; Christensen et al., 2020). When individuals can readily assimilate perceptual input, they may incorporate their experience into existing structural knowledge of music, reducing the motivation to consider nonstructural aspects of the stimulus. Conversely, when the stimulus features of music are not easily assimilated or expected, then a process may be triggered whereby nonstructural aspects of music are consulted (see also, Windsor & de Bézenac, 2012). Accommodation is the mechanism by which violations of expectation lead to learning. When stimulus characteristics are difficult to assimilate, we consider the *sources* of a stimulus in order to assist in our understanding of the situation, and we do this at multiple levels of abstraction, from attending to the facial expressions of musicians as part of perceptual experience, to accessing source sensitivity as part of conceptual understanding.

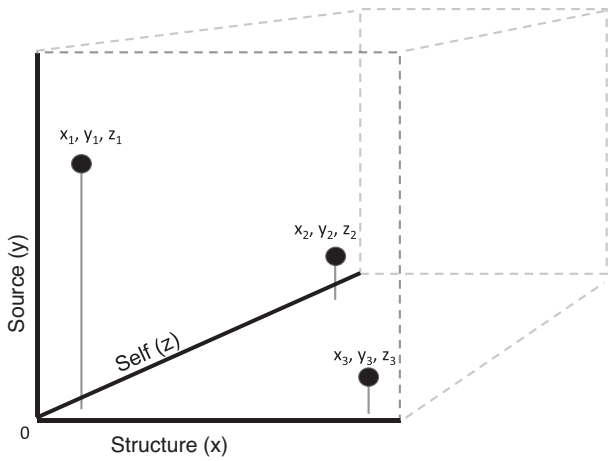
How would one evaluate the possibility that fluency influences the salience of source sensitivity? We predict that when music is distinctive and disfluent—such that it does not fit readily into our generic schema of music—there should be a greater tendency to consider the source of the music. In Western contexts one might ask: Who composed this music? What were the sociopolitical, creative, and historical contexts that motivated such an unusual composition? A related finding is that disfluent sounds trigger abstract thinking (Hansen & Melzner, 2014). Listeners encountering unfamiliar music may devote extra attentional resources to thinking about who might have written the music and why.

Personal circumstances may also influence the relative salience of the three categories of music appreciation. For example, at developmental stages when individuals seek *role models* to aid in their development of personal identity, greater emphasis should be placed on source information about admired musicians, and greater interaction between source knowledge and self-oriented appreciation of music. Indeed, adolescents often invest significant resources into learning everything about their favorite bands and genres. K-pop fans, for example, describe band members' personalities as one of the key appeals of the genre, and fans of Justin Bieber often talk about his songs in the context of his conversion to Christianity. People report higher valuation for, recognition of, and more personal memories associated with music from their adolescence (Krumhansl & Zupnick, 2013). Some aspects of this *reminiscence bump* may arise from the increased contextualization that can occur for music experiences sustained during this time. At later stages of the lifespan, when reminiscence and biographical memory take on special significance (decline in memory for contextual information), greater weight may be placed on personal associations of music.

It is an empirical question whether there are appreciation *traits*, whereby individuals have tendencies to appreciate music in certain ways. Research is also needed to track how appreciation depends on the salience of structure, self, and source across the dynamic context of music listening. Although it is beyond the scope of the present review to ascertain the experimental productivity of such a new methodology, in principle it should be possible to measure the relative salience of the three categories of appreciation for any given stimulus, and plot the outcome within a *Music Appreciation Space*, illustrated in Figure 2. Numerous measurement strategies are plausible, ranging from direct ratings of the salience of each dimension of appreciation while listening, to content analyses of the associations or imagery reported (e.g., whether about musical structure, personal memories, musician characteristics, etc.).

As a starting point, the proposed space assumes that each dimension makes a positive contribution to appreciation, but it is an empirical question whether music experiences may sometimes involve suppression of one or more dimensions of appreciation (e.g., reduced sense of identity during high-absorption or trance-state music experience). More generally, the geometry of the appreciation space (e.g., cubic, spherical, an octant within a space) will depend on the method of data collection: whether independent measures are obtained for the three types of appreciation, or free responses are classified and displayed as proportions (e.g., appreciative comments). Thus, the space is not intended to be prescriptive, but rather a starting point for empirical exploration.

Figure 2
Music Appreciation Space



The figure depicts three hypothetical positions within the space, representing experiences that are weighted heavily on one of the three categories of appreciation: structure, self, and source. As the three dimensions of appreciation reflect superordinate categories, there are many different contexts that might lead an individual to experience one form of appreciation over others, whether listening to music with friends, dancing at a club, composing music, or performing in a quartet. Thus, a challenge for future research is to explicate the most common contexts associated with each form. For example, a musicologist may focus on a deep understanding of the historical, political, and social contexts of music, while fans of music may enjoy reading autobiographies by individual musicians. Conversely, a person who has just broken up with their long-time spouse may have a deeply personal response to a sad song, while a composer might appreciate a new piece of music for its innovative harmonic structure and internal logic, and a person dancing to music may have an embodied appreciation for the rhythmic structure or *groove* of the music (Janata et al., 2012).

For any music experience, the salience and perceived significance of each dimension will vary as a function of psychological and contextual factors, which include individual circumstances, alertness and mood, listening goals, expertise, role in the experience (listener or participant), capacity to access each dimension of appreciation, and conventions distinctive of the work's genre. Such differences in appreciation can be systematically compared, whether between two experiences by the same individual, different musical pieces or artists, or changes in the nature of appreciation following training or increased familiarity. Whether such a comparison is optimally estimated as the Euclidean distance between points within the space, $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$, or by non-Euclidean estimates is unknown, and an empirical matter for future research.

Activation of the three forms of appreciation will also depend on contextual and personal factors that vary across individuals and cultural groups (Bullot, 2019; Davies, 1994; Levinson, 1997, 2011). In a live musical event, mental representations of musical structure emerge concurrently with the listening experience, with multiple timescales of past information and knowledge continuously affecting music processing. Personal associations may be triggered by the music, but their emergence is contingent on prior autobiographical associations with that work. Consequently, the occurrence of personal associations is dependent on a range of priming processes (McNamara, 2005; Rhodes & Tremewan, 1993; Tulving & Schacter, 1990), episodic encodings (Tulving, 1983; Tulving & Thomson, 1971), and historically-defined autobiographical periods (Brown et al., 2012).

Information about musical sources can be brought to mind during a listening experience. However, source sensitivity can also contribute to music appreciation outside of an immediate music experience, shown in Figure 1 by direct connections between musical contexts and the appreciation of these sources that bypass the experience of an actual musical event. For example, a fan of a particular subgenre who spends the evening scouring the internet for the latest news and band information may carry out their exploration while simulating or imagining the kind of aesthetic transport they experience while listening to the music. Thus, the pursuit of source information is an extension of direct music experience. The presence of self-oriented and source appreciation also influences perceptual experience by directing attention to certain sounded properties of the music over others. For example, if a bluegrass devotee learns on the internet forum *Banjo Hangout* about a particular finger position employed by a favorite artist, she might attend to that movement at the next live performance, hearing the sounds produced by it in a concrete, defined way that previously eluded her. This perceptual shift, in turn, impacts appreciation.

Interactions Between Forms of Appreciation

Source sensitivity interacts with structural and personal understandings of music. First, general mechanisms of auditory cognition provide input into both structural *and* source understandings of music. Mechanisms of *auditory scene analysis* function to identify sequences of acoustic information that should be grouped together (e.g., notes of a melody), and represented as emanating from the same sound *source*, such as a particular musical instrument or singer (Bregman, 1990). Thus, source sensitivity is inherent to the way musical structure is perceived and remembered, and the ease of auditory scene analysis may have aesthetic implications (Bonin et al., 2016; Huron, 2016; see also, Reber et al., 2004).

Second, self-oriented and source appreciation both involve attending carefully to the *contexts* in which music experiences occur, and differ only in the nature of that contextual understanding (e.g., Johnson & Raye, 1981; Johnson et al., 1993). Quite possibly, both forms of contextual understanding derive from psychological process of *epistemic vigilance* that scrutinize all forms of communication for its veracity and authenticity (Mahr & Csibra, 2018; Sperber et al., 2010).

Third, structural or expressive features within sounded music may provide clues about sources. For example, a person might recognize the late Glenn Gould's characteristic expressive actions in a piano performance; an understanding of Gould's personal history, in turn, will influence both the appreciation of the music and how the listener attends to the rest of the piece. The music is perceived first, and this perception elicits a source representation that, in turn, affects the way a person attends to subsequent features of the music. For sung pieces of music, voice recognition provides a more obvious means by which sounded music can trigger networks for person identification (Belin, 2006; González et al., 2011; Latinus & Belin, 2011).

Fourth, an individual may have direct access to source information as they listen to music, for example, while watching a concert. This concurrent source information influences how the sounded music is perceived, interpreted, and appreciated. Listeners attend closely to facial expressions and body movements of performers, which mirror structural attributes of the music (Thompson & Russo, 2007). Some movements are needed to produce musical sounds; others are ancillary gestures that communicate expressive intentions or highlight musical structure. By aligning gestures and facial expressions to musical structure, the association between the music and the source of that music is strengthened and affirmed.

Fifth, an individual may gain access to source information before hearing the music, and their understanding of this source can bias personal and structural forms of appreciation (Seeley, 2020). For example, knowing that the upbeat song "Home is Where You're Happy" was composed and performed by cult leader Charles Manson may influence a person's attitude toward the music prior to hearing it, diminishing any personal associations they may have made with the song, and even how they perceive the song's structural features.

Finally, forms of appreciation compete for attention. In cases where one form dominates at the expense of others, such competition would be depicted in Figure 2 by high values on one dimension and low values on other dimensions. In rare cases, such competition could result in profound suppression of one or more dimensions, which could be depicted as a negative value on those dimensions. For example, high absorption in a perceptual experience of music could lead to a trance or flow state in which there is a loss of self-consciousness (Sadlo, 2016). Conversely, if a musicologist attends to a historical antecedent for a piece of music, representations of the musical structure may be restricted or actively suppressed.

Conclusion

This article describes a novel framework that considers three forms of appreciation, identifies the inputs and outputs of appreciation, proposes contexts and processes that increase the salience of each category, and makes predictions for future research on the diverse contexts of appreciation. Importantly, identifying three categories of appreciation in no way diminishes or overlooks the vast range of *contexts* of music appreciation, but groups them into psychologically meaningful and distinctive superordinate categories. In this way, the music appreciation framework markedly improves upon models that focus on transient pleasure in explaining the varieties of differentiation and context-specificity in appreciation. Multiple forms of music appreciation—structural, self, source—collectively permit subtle shades of differentiation between music experiences, giving each experience a unique character rather than merely a difference in the amount of "pleasure." This uniqueness of experience, instead of eluding the science of the arts (see, e.g., Chatterjee, 2013; Chatterjee & Vartanian, 2016), is a central phenomenon that our framework explains.

The distinction between source sensitivity and self-oriented appreciation of music is reminiscent of dual-process models that distinguish *knowing* from *remembering* (Wixted & Mickes, 2010). Source sensitivity can occur independently of personal memories, even if the knowledge was originally acquired from first-hand experience. Personal associations with music, in contrast, typically depend on autobiographic memories of music experiences. Whether source sensitivity and self-oriented appreciation of music reflect distinct or shared neural processes is currently unknown. However, they are conceptually distinct as an output of *reality monitoring* (Johnson et al., 1993; Johnson & Raye, 1981), which permits individuals to distinguish their own mental and emotional states (personal recollections) from those arising from an external source (e.g., biographical information about a musician). Without such monitoring, delusions and source confabulations would result (Bullot & Égré, 2010; Frith et al., 1998; Langdon & Bayne, 2010).

The three forms of appreciation interact. Personal responses to music are typically dependent on the formation of a structural representation and its association with autobiographical circumstances. Structural representations and source understandings also interact: musical structure can be used to infer plausible contextual and causal factors, and vice versa. For example, music that is novel or unexpected may imply a cultural or historical context within which innovation and creativity were valued, or that the music originated from an unfamiliar culture. Ultimately, information about musical sources is typically integrated with structural and personal understandings of music to form a merged and coherent appreciation of the music. The greater the degree of input from different forms of appreciation, the more differentiated and unique the phenomenal experience of music will be.

Conversely, source sensitivity can bias structural representations. A clash between a slightly flat B and a slightly sharp B might may be experienced as an error when heard from the stage of the Royal Philharmonic, but as an intentional friction when heard within a grunge performance at a club. This distinction can rise beyond the level of the interpretive to the level of the perceptual, since framing it one way or the other can foreground particular granularities within the sound. Similarly, knowing that a piece of music was produced by Brian Eno may encourage a listener to focus on musical attributes and decisions within the purview of a producer, or that typify other songs produced by Brian Eno. More generally, understanding authorial intention(s) behind a musician's artwork can guide attentional processes when listening to music (Davies, 2013; Farrell, 2017; Stecker, 2003). Understanding intentions can make certain musical features more prominent in a structural representation than others, with potential moral, legal, and political implications (Harrop & Bullot, 2020; Stecker, 2008).

Source and self-oriented appreciation also overlap. A listener may be aware that a song was motivated by the peace movement of the 1960s and 1970s and was first performed at Woodstock in 1969. She also may have been at that concert, and the peace movement might have personal significance to her. Her personal experiences of the music are intertwined with an understanding of the historical and causal context of the music, and her experience of the music is influenced both by her personal memories and by abstract knowledge distinctive of her own source sensitivity—forces that together may have an especially powerful impact on the experience of music.

More generally, many forms of music are strongly associated with a sense of place that, in turn, is tied to personal identity (Connell & Gibson, 2003). The connection between music and place emerges because, in order to succeed, musicians must communicate with audiences that are geographically localized, and hence may draw upon musical styles associated with that location. In this way, music is a cultural expression that is bound up with geographical locations and identities. Indeed, many approaches to music analysis emphasize the location and origins of musical scenes, and include cartographies of production and diffusion whereby musical forms are represented in maps. Varieties of music such as South American panpipe, Spanish Flamenco, Australian Indigenous Hip-Hop, or North Indian Hindustani music signal broad geographical associations. Even individual musicians have geographical connotations, whether Édith Piaf (France), Beyoncé (USA), Khaled (Algeria), Kylie Minogue (Australia), Paul McCartney (England), Youssou N'Dour (Senegal), or Ravi Shankar (India). Cities such as Nashville, Seattle, New York, and New Orleans also have identifiable musical *sounds*. In addition, numerous works of experimental and electroacoustic music, radio art and drama, and sound art invite audience members to reflect on the place of production or performance of the work (LaBelle, 2006), as illustrated in Luc Ferrari's *musique concrète*, John Cage's *4′33″* (Cage, 1960; Davies, 1997), Mary and Alvin Lucier's *I Am Sitting in a Room*, Brian Eno's situated ambient music, and numerous works of acoustic ecology (Schafer, 1977). Globalization has complicated, but not eliminated, the links between music, place and cultural identity (White, 2011).

The degree to which accurate and detailed source sensitivity is sought will depend on the goals, training, and experience of the

listener, as well the quality of information that is available. Source sensitivity can be specified to differing degrees and with different degrees of confidence. Sometimes an initial lack of source knowledge can enhance a sense of curiosity and wonder during a music experience. For example, if a friend takes you to a new place to hear a type of music you haven't encountered before, both the fact that your friend likes it and the fact that you're getting to know a new venue and a new community of listeners can shape what you hear and how it feels.

Decades of research has presented musical excerpts to listeners as if in a vacuum. Yet listeners' assumptions about the source of these materials color fundamental aspects of their experience. If one is asked to make loudness estimates of music, they vary depending on whether those excerpts are extreme metal or easy listening genres. Similarly, chord changes that would be surprising in the context of baroque music may be expected in the context of reggae music (Huron, 2006). Programs of research on music should seek to understand the influence and interaction of all forms of appreciation; not merely those that stem from the perception of musical structure. Far from an abstract stimulus, music is deeply interwoven in people's lives and their understanding of themselves and the world around them. Taking these interactions seriously is an important next step for the psychology of music appreciation.

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