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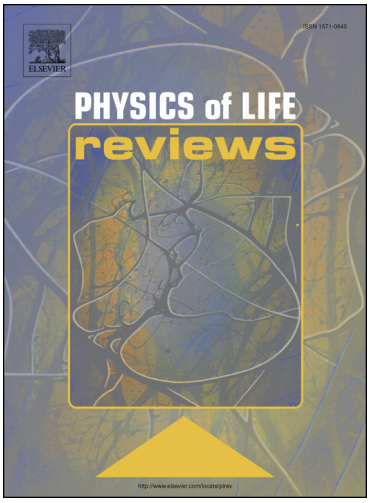

An Integrative Review of the Enjoyment of Sadness Associated with Music

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Highlights

- We identify biological, psycho-social, and cultural levels of explanation for the paradoxical enjoyment of negative emotions in the specific context of music listening.
- Our contribution offers an integrative account of the phenomenon where each level of explanation is understood as contributing to the phenomenon in a specific yet interconnected fashion.
- We put forward a restricted yet cascading model that predicts restricted hedonic shifts at each level, which may bring about a transformation that seemingly turns a nominally negative emotion into intense pleasure.
- We assess the mechanisms and evidence at each level and conclude that there is insufficient evidence at the biological level, some positive evidence at the psycho-social level, and ample cases at the cultural level to support the integrated model.
- We pinpoint several conflicting assumptions and observations that have led the research astray, and suggest a number of key topics for establishing the drivers and constraints involved in deriving pleasure out of music-related sadness.

An Integrative Review of the Enjoyment of Sadness Associated with Music

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Abstract

The recent surge of interest towards the paradoxical pleasure produced by sad music has generated a handful of theories and an array of empirical explorations on the topic. However, none of these have attempted to weigh the existing evidence in a systematic fashion. The present work puts forward an integrative framework laid out over three levels of explanation – biological, psycho-social, and cultural – to compare and integrate the existing findings in a meaningful way. First, we review the evidence pertinent to experiences of pleasure associated with sad music from the fields of neuroscience, psychophysiology, and endocrinology. Then, the psychological and interpersonal mechanisms underlying the recognition and induction of sadness in the context of music are combined with putative explanations ranging from social surrogacy and nostalgia to feelings of being moved. Finally, we address the cultural aspects of the paradox – the extent to which it is embedded in the Western notion of music as an aesthetic, contemplative object – by synthesising findings from history, ethnography, and empirical studies. Furthermore, we complement these explanations by considering the particularly significant life meanings that sadness portrayed in art can evoke in some perceivers. Our central claim is that one cannot attribute the enjoyment of sadness fully to any one of these levels, but to a chain

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of functionalities afforded by each level. Each explanatory level has several putative explanations and its own shift towards positive valence, but none of them deliver the full transformation from a highly negative experience to a fully enjoyable experience alone. The current evidence within this framework ranges from weak to non-existent at the biological level, moderate at the psychological level, and suggestive at the cultural level. We propose a series of focussed topics for future investigation that would allow to deconstruct the drivers and constraints of the processes leading to pleasurable music-related sadness.

Keywords: music, emotions, sadness, pleasure, valence shift, enjoyment

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1. Introduction

The paradoxical nature of enjoying nominally negative emotions such as sadness in the context of the arts and fiction has been widely acknowledged by philosophers from Aristotle to Schopenhauer. However, only the last decade has provided empirical evidence of this paradox in action in the domains of psychology [1, 2] and neuroscience [3], and started to expose the ways in which people derive profound enjoyment from tragic films [4], literature [5], and sad music [6].

Central to this paradox are the functional aspects of emotions, such as sadness as an outcome of significant personal loss that results in behavioural withdrawal and anhedonia [7, 8]. Fiction and music may be able to operate the very machinery responsible for real-life emotions such as sadness, but since it is detached from the actual consequences, the process can lead to a dramatically different outcome. Music that induces sadness but is nevertheless intensely enjoyed provides a striking example of this phenomenon. It is not just the fact that most cultures have a distinct category for sad music [9], and that listeners frequently report everyday experiences of sadness induced by sad music [10], but these experiences are commonly described to be highly enjoyable [11].

Despite the growing interest and empirical work, frameworks that would offer an explanation for this intricate paradox are still rare. Recently, Menninghaus and his colleagues [12] put forward a novel theory that purports to account for the appeal of negative emotions in all arts. However, their proposal mainly operates on the level of culture and generic psychological principles, and does not delineate the emotions themselves or the actual mechanisms involved. Our review takes a closer look at the appeal of negative emotions associated with music while simultaneously paying closer attention to the functions and mechanisms potentially involved in these paradoxical experiences. We also regard the enjoyment of music-induced sadness as a complex behaviour linked at biological, psycho-socical, and cultural levels. This distinction into three levels bears resemblance with the three broad theoretical approaches to the psychol-

ogy of emotion – evolutionary theories, cognitive appraisal theories, and social constructionist theories – which all provide different paradigms for research [13]. Each of these levels can be differentiated in terms of a number of key concepts such as the focus, valence shift, functions, and the type and quality of evidence, all of which we will consider in the following sections.

Before embarking further into the proposed explanations for pleasurable sadness induced by music, we will introduce five premises that are relevant for all explanations concerning music-induced emotions.

(i) Our philosophical stance to emotions is a nonessentialist perspective that questions the existence of fixed universal types of emotions, and considers emotions as complex, constructed experiences [14, 15]. Moreover, we embrace an integrative approach to emotions, where we acknowledge the necessity of looking at the issue across multiple levels (biological, psychological, social, and cultural). This does not, however, mean that we have an instrumentalist account of emotions, where any theory could be right. Our stance could be labelled as scientific realism, where the explanations at different levels can be subjected to empirical evidence [16].

(ii) Emotions expressed by music may be different from the emotions the same music induces [17], our main focus of interest. For instance, sadness expressed by music is associated with a consistent set of affective cues [18], which may convey the emotion even across cultures [19] and to young children [20]. The actual experiences induced by music expressing sadness, however, may not always be aligned with the expressed emotional content [21]. These deviations are explained by distinct emotion induction mechanisms and construction of meaning, explained in the third premise.

(iii) There are multiple emotion induction mechanisms that music capitalises on [22]. Mechanisms such as *episodic memories*, *emotional contagion*, and *evaluative conditioning* have been offered to account for music-induced sadness in particular [23]. A later update to the mechanisms also includes aesthetic judgement (which has been taken to explain the enjoyment of sad music as well; [24]). We will discuss aesthetic judgement and the concept of beauty in the context

of sad music in section 4.4. The mechanisms also have a direct impact on the issue of familiarity; unfamiliar music may induce emotions through *emotional contagion*, for example; a mechanism that capitalises on the affective cues of the music. However, *evaluative conditioning* and *episodic memory* are both capable of generating emotional experiences that are in direct conflict with music's affective cues, such as feelings of sadness induced by a cheerful-sounding song that reminds one of a close friend who recently passed away [25]. Even without these key mechanisms, listeners may construct meanings that lead to emotional experiences.

(iv) Music-induced sadness is not an emotional monolith, but better characterised as a spectrum of emotions, ranging from (a) highly pleasurable experiences to (b) feelings of comfort and relaxation, and even to (c) high-intensity negative emotions such as grief [6, 11]. These three types of experiences identified in recent studies will most likely require distinct explanations, and this holds the key to solving the paradox. In other words, the paradox only exists for the pleasurable and comforting aspects of sadness.

(v) Emotions are contextualised and culture specific to some extent. Despite the fact that there are common embodied aspects of emotions, people's experiences of emotion vary across cultures, for example in *how* and *what* emotions should be experienced [26, 27]. In music, emotions often take the form of mood regulation. The pleasure derived from sad music is no different; experiences driven by sad music are known to be more prevalent in specific situations, are related to pursuing self-regulatory goals [28], and commonly take place in solitary situations [10] and in particularly poignant circumstances [6].

If we acknowledge these five premises as a firm starting point, we can more easily assess the explanations of enjoyable sadness that go beyond these well-known premises and offer unique explanations for the paradox.

1.1. Past overviews

The paradox of enjoyable sadness in the context of music has gathered attention from thinkers and writers throughout history (Aristotle, Hume, Kant),

and possibly for that reason, philosophers have offered perhaps the most balanced discussion of the phenomenon during the last two decades [29, 30, 31]. Some of the recent explanations of the enjoyment of sadness in music utilise the route opened by the philosophers, which basically defaults to a lack of real-world appraisals and consequences. For instance, Schubert [32] postulated that sad music is experienced as enjoyable simply due to the aesthetic, safe context. Taruffi and Koelsch [23] expanded this explanation by bringing in the role of memories and deliberate savouring of emotions, whereas Juslin [33] also evoked the same rationale by explaining that sad music may combine two independent mechanisms, contagion of negative emotion and the aesthetic judgment mechanism that leads to an overall pleasurable response. Sachs and his colleagues [34] interpreted the paradox from the perspective of adjusting homeostatic imbalances. According to this interpretation, sad music enables the listener to "disengage from the distressing situation and focus instead on the beauty of the music" [34, p. 8]. While all these four explanations capitalise on the lack of real-world consequences of music, they fail to specify why sadness would be special, and why other negative emotions such as fear or disgust do not produce similar effects in the context of music.

Huron [35] has offered an interesting conjecture that is indeed specific to sadness. It assumes that listening to sad music is sometimes enough to trigger an endocrine response (prolactin release) relevant for alleviating the mental pain related to the experience of loss. This response is experienced as consoling and positive when the real-life consequences of loss are absent, as is the case with music. Although some evidence exists showing that hormone levels associated with such functions are modulated by emotion induction [36], the conjecture has not yet been empirically corroborated in the context of music.

Expanding the realm of explanations to account for the functions of music listening, Van den Tol and Edwards [37, 28] have explained the appeal of listening to sad music in terms of distinct mood regulation strategies such as seeking connection, retrieving memories, validating or re-experiencing affects, and providing solace. However, these do not go beyond the starting premises (iv and

v), and fail to identify the strategies as inherently related to the generation of pleasure. Nevertheless, this work highlights an interesting aspect of the puzzle by observing that listeners often feel displeasure due to painful memories whilst listening to music, but this affect is *transformed* into positive emotion (nostalgia, relief) afterwards. The identification of this "cathartic" experience has long roots in philosophy (Smuts, 2009), but empirical evidence suggests that venting or cathartic processing is less efficient than distraction as a strategy for elevating mood after induced sadness [38]. Finally, it has been suggested that sad music may be experienced as pleasurable due to it's power to overcome cognitive dissonance often associated with negative emotions. Although this hypothesis has not yet been directly tested in the context of sad music, the mitigation of cognitive dissonance could be one of the potential evolutionary benefits conferred by music [39].

In other fields of art, a number of creative explanations have been offered. The enjoyment of tragedy in films has been linked with beauty and portrayal of human perseverance [40], insights into human plight and existence [41, 42, 43], and re-appraisal of one's experience from different perspectives, some of which may differ from one's own emotional response (often called *meta-appraisals* [44] or *metacognitive self-reflection* [45]). It has been assumed that most of these explanations – with the exception of beauty – cannot be easily applied to the enjoyment of musical sadness, since they rely on narrative and propositional content that is often absent from music (except in operas, song cycles, and in music that has lyrics). However, recent work investigating the effects of music on mind-wandering and Default Mode Network activation has revealed that listening to sad music elicits more self-reflection and meta-awareness than listening to happy music [46], which suggests that even instrumental music can facilitate meta-appraisal and related processes.

Recent theorising by Menninghaus and colleagues [47] has generated an accessible framework to explain the construct of "being moved", which is applicable to the enjoyment of music-induced sadness. We will return to the concept of "being moved" later in section 3.1. More recently, Menninghaus and col-

leagues have proposed a Distancing-Embracing model to explain the enjoyment of negative emotions in the arts [12]. The first component in the model, psychological distance, is more or less the same argument as expressed previously by philosophers (i.e., the lack of real-world consequences, and art being regarded as separate from the normal world of actions). Distance in itself, we argue, cannot be a key factor, since greater immersion and intensity of felt (negative) emotion actually lead to stronger enjoyment in the context of the arts (for a more detailed critique on the model, see [48]). The other key component, the embracing factor, offers at least five different routes for transforming the induced negative emotions into pleasure via the interplay of positive and negative emotion, meaning construction, aesthetic virtues, genre scripts, and mixed emotions. While we find these broad distinctions useful, a major limitation in the model is the omission of the underlying mechanisms of emotion induction. Any account of the enjoyment of negative emotions in the context of the arts is incomplete without considering how the arts are able to evoke negative emotions in the first place. Furthermore, the pleasure derived from different negative emotions such sadness and fear may rely on fundamentally different mechanisms. In this review, we will attempt to complement the insights offered by the Distancing-Embracing model by explicitly addressing the processes omitted in the model.

1.2. Organisation of the present review

This review is organised according to the broad levels of attention and explanation – biological, psycho-social, and cultural. Although the recent years have observed a rapid growth in psychological explanations and tentative signs of biological accounts, cultural explanations have dominated the topic ever since the Greeks documented the cultural manifestations of pleasurable sadness [30]. We argue here that what is needed is an integrative account where each level of explanation is understood as contributing to the phenomenon in a specific yet interconnected fashion; one cannot attribute the enjoyment of sadness in the context of music fully to cultural explanations, unless these are, in turn, operationally carried out by the psychosocial mechanisms requiring learning and

interpersonal chains of communication. These mechanisms are subsequently driven by a chain of biological reactions originally serving adaptive purposes. In the past, the attempts to explain enjoyable sadness have been carried out at a single level, but so far consistent linking and critical evaluation of the levels has been missing. Connecting cultural, psycho-social and physical manifestations of this phenomenon will allow us to highlight the key issues and specificities at each level, and help to bridge some of the currently isolated explanations. Such an integrative account will also be helpful in linking findings from music listening with wider fields of inquiry.

In order to clarify the crucial distinctions between the three levels of explanation, we define a set of concepts relevant to different functional properties of sadness at the different levels. With *focus* and *function*, we refer to the nature of sadness, which has a different focus and function at different levels; At *biological level*, this refers to adaptive mechanisms and responses related to coping with loss at the level of an individual, that may lead to pleasure if certain conditions are met. The *psycho-social level* refers to interpersonal processes that can either serve to restore homeostasis (mood regulation) or have certain inherently pleasurable qualities (e.g. simulation of actions and emotions, or being moved). This level necessarily includes the machinery for recognising sadness in the music. The *cultural level* refers to culturally constructed, collective understanding of sadness, where music has the potential to enrich the meaning of loss in different ways. The fundamental changes involved in turning the sadness into pleasure can be described in terms of the pleasure–pain dimension. We call such changes *hedonic shifts* and postulate that the three explanatory levels take up different ranges in the hedonic continuum.

2. Biological foundations

A biological account of emotions – consisting of physiological, neural and endocrine levels – is currently far from being understood in detail [49]. However, a great deal of the main components involved in emotions within each level is

known and connected to the functional architecture of emotions. If we are to make progress in explaining why musical sadness may be able to generate feelings of pleasure, we need to consider what happens at these levels when we experience sadness, and why we have such mechanisms in the first place and what function have they served in our phylogenetic development.

2.1. Evolutionary framework

A modern darwinian view of emotions stresses how certain states confer advantages in particular situations, and how natural selection shaped these into sub-types of emotions complete with regulation programmes adapted to particular situations [50], including that this selection has operated at the levels of individual, group, and culture. Most basic emotions are assumed to be innate and universal [51], and even evident to a degree in animals [52, 53], although the accumulated evidence about the nature of distinct emotions is not convincing at the level of physiological signature or neural areas [54]. In the present work, we do not assume that strictly an innate and triggered system for sadness induction would be the only possibility since our interpretation aligns more closely with the constructionist account. However, characterising the functional nature of such an emotion will nevertheless provide valuable insights into the mechanisms involved.

Sadness as an emotion has conferred an adaptive value by promoting behaviours and cognitive strategies suitable for compensation and recovery after irrevocable and real loss [7], first and foremost to the individual, but also to maintain group attachment [55], and to signal others either of surrender in case of crying [56] or just provide cues to others about one's mood state. In experiencing sadness, the configuration of these tendencies are low physiological arousal and reflective and critical information processing, often dubbed as "depressive realism" [57]. This reflective state is beneficial for the individual for coping with the loss, to consider the options in a realistic fashion. It also has social implications, if sadness – or particularly grief which is distinct from sadness – is perceived as social signal that directs social attention and solicits support

from others [58]. To express biological sadness in our key terms, focussed on real-world implications to the individual, and negatively loaded in its hedonic value.

How could these physiological and cognitive elements of sadness be linked with the putative pleasure derived from sad experiences, which is sharply in contrast with the nature of any loss? The evolutionary perspective values both negative and positive emotions and regards the mind as a modular system, possibly allowing the modules operate independently and serving other purposes than what they were originally intended for [59]. For understanding the enjoyment of sadness, the modularity and redirection of the function are vital distinctions, since they allow the possible mechanisms to be considered either as by-products [60], or as decoupled cognition using a more positive account by evolutionary psychologists [61]. The latter account has also been explained by means of *simulation*. According to simulation theory [62], fictional events are able to operate the very same cognitive and biological machinery involving in non-fictional emotion by means of simulation. More importantly, it has been proposed that we enjoy fiction – especially fiction involving complex or potentially distressing scenarios – because engaging in it is beneficial for us: Immersing ourselves in fictional scenarios and putting ourselves in the shoes of fictional agents enables us to simulate the experience of different types of events, emotions, and behaviours [63]. Not only does this simulation make us more prepared for various challenging scenarios in the real world, but it also enhances our empathy and theory of mind skills [63, 64]. Futhermore, based on the most recent evidence from neuroscience, it has been proposed that all emotions – not just those experienced in a fictional context – would be based on prediction and simulation, and that with the help of information from interoceptive and sensory input, as well as past experiences, brain creates experiences that can be conceptualised as emotions [65, 66, 67]. Although this account shifts the attention already to a higher levels of explanation, it demonstrates that the basic machinery inherent rewards of engaging in such activities may be important building blocks of how the paradox might easily arise. What separates

this account from a by-product is that the fiction-driven, simulated emotional experiences are assumed to have evolutionary relevance, even to be intrinsically rewarding [61].

We shall first look at the biological correlates of sadness at the level of functions and neuroendocrine markers and then briefly describe how sadness has been characterised as psychophysiological and neural activation patterns.

2.2. A biological systems account

A closer look at the biochemical correlates of sadness is necessary to carve out a full argument of their role in real and fictional loss. In our map of concepts, biological account of sadness places the emotion as a reaction to non-fictional loss, which has serious implications to the goals of an individual, and the response itself leads to negative affect (hedonic value). When we look at the processes in detail, the experience of sadness is associated with separate patterns of peripheral and nervous system activations including the endocrine activity that are consistent with the functional purposes of sadness described earlier. We call these adaptive, stress and consoling reactions.

In the *adaptive reaction*, the purpose of the system is to conserve energy by inducing a state of withdrawal by anergia and anhedonia. Such withdrawal is achieved through decreased serotonic and dopaminergic activity, and HPA dysregulation [68, 69]. The stress reaction to sadness is similar in purpose, and refers to changes in the immune response, particularly to the heightened inflammatory responses [70, 71], which are all associated with negative mood states.

The *consoling reaction* refers to the anxiolytic effects of prolactin and oxytocin, which are known to be associated with crying, feelings of social support, and negative moods. Both oxytocin and prolactin inhibit the sympathetic and HPA activity during stress, influence cardiovascular dynamics [72], reduce stress responsiveness on neuronal and behavioural levels [73], and are known to produce feelings of calmness, well-being, and consolation [74]. The consoling effects of prolactin have been well documented in crying [75] and nursing [76]. Oxytocin

has similarly been reported to facilitate positive emotions, trust, and feelings of social support [77] despite the acknowledged measurement problems associated with these measures [78].

With respect to music-induced sadness, stress and adaptive reactions to sadness are unlikely to lead to increases in enjoyment, since the logic and the evidence is on the contrary [70]. Only the consoling reaction has the potential of generating pleasure in this context, since the complex endocrine response involved in consoling reaction is associated with strong positive emotions (reviewed in [73]). This is, of course, what Huron's theory [35] about prolactin and the pleasure induced by sad music is all about.

Unfortunately the evidence to date concerning biochemical markers of music-induced emotions is scattered, and does not address these assumptions directly (see [79] for a review). Gerra and others [80] observed changes in a host of endocrine measures when participants were listening to techno music vs. classical music, whereas Evers and Suhr [81] recorded changes in serotonin levels after exposure to pleasant or unpleasant music, but found no differences in prolactin or ACTH (adrenocorticotropic hormone). Choir singing has been demonstrated to modify neuroendocrine measures (TNF-alpha, prolactin, cortisol, and oxytocin), although whether these are emotion-related reactions or merely variations induced by the activity levels within the tasks, is still unknown [82]. Finally, Nilsson [83] has demonstrated that a music intervention increased the levels of oxytocin and subjective relaxation in comparison to a control group in patients recovering from open-heart surgery.

Based on these studies, however, one may only conclude that music itself is sufficient to modulate variety of hormones but none of these studies have provided any evidence of these within the context of sadness. Studies using other forms of fiction such as unpleasant and pleasant pictures (Codispoti et al., 2003) and films [36] have obtained tentative support for a selective pattern of prolactin and cortisol measures associated with mood changes induced by the manipulations. Also NK cell activity and immunoglobulins are known to be influenced by negative and positive mood manipulations [84, 70]. One can assume that

music would be able to generate a similar pattern of distinct reactions since it is at least equally potent manipulator of emotions and moods [85].

In an analogous fashion, peripheral physiological (e.g., heart-rate variability, galvanic skin response, respiratory rate, temperature, and facial EMG) indicators of moods and emotions have been predominantly studied in the context of films inducing happy and sad emotions [86] or neutral, fearful and sad emotions [87] or variants of these. Music has also been used as an emotion inducer [88, 89] in studies involving psychophysiology. Unfortunately, many of these studies have distinguished the emotions based on their arousal (sadness is a low arousal emotion whereas happiness is high arousal). Nevertheless, certain indicators such as skin conductance response, temperature, and respiration rate have been observed to differentiate neutral and sad emotions ([87, 33], although such nuances have not been explored within music yet.

To summarise, hormonal and physiological responses to experiences induced by sad music currently do not exist despite a host of studies exploring the responses to sadness and music in general. If we take the findings from other topics of study (films and pictures), at least an assumption can be made that the low-level physiological mechanisms measurable from hormones and physiology could be associated with music-induced sadness, but unless these reactions can be theoretically strongly connected to functional aspects of the process such as the adaptive or consoling reaction, the contribution of such signature to the understanding of the topic is marginal. It is also worth noting that the postulated endocrine mechanism proposes a positive hedonic shift (from a very negative experience to a bearable but still a negative experience, see Figure 1) but fails to explain how this shift would explain fully pleasurable experiences.

2.3. Neural correlates of music-induced sadness and pleasure

Neuroimaging studies suggest that music-induced emotions rely on some of the same networks thought to underlie everyday emotions [90]. With regard to music-induced sadness, functional magnetic resonance imaging (fMRI) studies have reported increased activation in the amygdala [91], hippocampus [91],

parahippocampal gyrus [92, 93], anterior cingulate [92, 93] and various frontal regions [92, 94] as a response to musical stimuli deemed as expressing or evoking sadness. It is noteworthy, however, that the activation of these areas is not consistently replicated across studies. In fact, some of the above-cited studies show no overlap in the brain regions they implicate in music-induced sadness [91, 92]. Moreover, some of the areas associated with music-induced sadness, such as the amygdala and hippocampus, have also been linked to other music-induced emotions such joy and happiness [90]. It also bears mentioning that some studies have failed to find any significant differences between activation patterns during listening to neutral and sad musical excerpts [95, 96]. Therefore, on a close inspection of the literature, it is evident that neuroimaging studies have not yet revealed reliable and specific neural correlates of music-induced sadness.

Meta-analyses of neuroimaging studies [97, 98] show that identifying distinct neural substrates for different emotion categories has proven difficult not only with regard to music-induced emotions but also more broadly in the cognitive neuroscience of emotion. Based on this evidence, it has been argued that discrete emotion categories such as sadness and happiness do not map onto specific brain areas [98] and that the search for such correlates is thereby fundamentally misguided. While this may be true, several more prosaic explanations related to methodological differences can also be offered for the discrepant findings regarding the neural correlates of music-induced sadness. As outlined in the previous sections, music-induced sadness comprises of a spectrum of emotional experiences ([11], premise iii) ranging from genuinely unpleasant affective states to more pleasurable ones while in neuroimaging studies subjects typically simply rate their emotional response to musical excerpts on a sad-happy continuum. This almost certainly leaves much inter-individual variation in emotional experience and the underlying neural activation unaccounted for and might help to explain why results from neuroimaging studies looking at the "same" emotional experience of music-induced sadness do not converge. A related issue is that neuroimaging studies on music-induced emotions have not typically taken into account individual differences that might influence emotional responses

to music (e.g. empathy, see section 3.1.). More generally, there are inherent limitations in the current neuroimaging and the associated analysis techniques that may explain why the neural correlates of specific emotional states have remained elusive [99]. Pattern analysis of fMRI data [100] shows promise as a tool for disentangling neural networks for different music-induced emotions including sadness and for investigating whether the "neural signatures" of sadness generalize across music listening and conditions that elicit genuine, unpleasant sadness [101, 102].

Music-induced pleasure has been repeatedly linked to activation of the striatal dopaminergic system including the nucleus accumbens and the caudate [103, 104, 105, 106, 91]. These results suggest that similarly to pleasure derived from other rewarding stimuli (e.g. food and sex), music-induced pleasure is mediated by dopamine release. Perhaps the most direct evidence to date for the involvement of striatal dopaminergic activity in music-induced pleasure was reported by Salimpoor et al. [107]. They employed ligand-based PET scanning as a measure of dopamine binding and found compelling evidence for heightened dopamine release in the nucleus accumbens and the caudate while subjects listened to self-selected pleasurable, chill-inducing music. Importantly, the activation of striatal nuclei has been reported not only for self-selected familiar music [103, 107] or music that expresses and induces (arguably) unambiguously positive emotion such as joy [91, 92], but also for unfamiliar music that induced more "complex" but still pleasant emotional responses. In one of the few studies that have explored the neural underpinnings of music-induced emotions other than the broad categories of happiness, sadness etc., Trost et al. [92] linked activation of the ventral striatum to a mixed music-induced emotional response characterized by both joy and sadness (termed nostalgia by the authors) suggesting that music that listeners deem as sadness-inducing can evoke activity of the striatal reward system.

Neuroimaging studies on the neural correlates of music-induced emotions have tended to shy away from functional explanations on why music engages the neural systems outlined above. As a notable exception, the activation of the

dopaminergic reward system during listening to pleasurable music (presumably including pleasurable sad music) has been suggested to be driven by the degree to which musical events match implicit predictions about how music unfolds in time [108], akin to the musical expectancy mechanism proposed by Juslin and Västfjäll [22] and the ideas of Huron [109] and Meyer [110]. Based on neuroimaging evidence suggesting that music can engage the putative human mirror neuron system, others [111] have discussed the possibility that affective responses to music might be supported by simulation of the emotion conveyed by the music (this idea and other similar ones are discussed in more detail in section 3.1). The following sections outline several additional psychological phenomena that have been identified as possible mediators of pleasure derived form sad music including the experience of beauty (see section 3.1), being moved (see section 3.1.), nostalgia and the attribution of social surrogacy (see section 3.2) or meaning to music (see section 4.3). However, there is thus far practically no evidence on how these mechanisms are implement in the brain during sad music listening although initial steps towards mapping neural basis of some of them have been taken in the context of both music [112] and other art forms [113]. For example, when investigating the pleasure evoked by auditorily presented poems, Wassiliwizky and colleagues [114] have found temporal correspondences between chills (and preceding activity in the nucleus accumbens) and physiological markers of negative affect (corrugator activity), suggesting that peak aesthetic pleasure can co-occur with the experience of negative emotions.

3. Psycho-social explanations

The psycho-social level of explanation covers a broad range of topics and mechanisms relevant for emotions and music. Here we first focus on the principles that are necessary for bringing music into an interpersonal context, building on the notion of simulation described in the evolutionary section. These elements are broadened by an account of empathy and how it links with the enjoyment of sad music through a specific type of experience that can generally be

termed "being moved". The second theme focusses on socio-emotional benefits of music listening with an emphasis on music's ability to provide company and comfort.

3.1. Empathy, embodiment, and 'being moved'

Music is imbued with connotations of human emotional expression on multiple levels; it emulates the expressive qualities of human vocal communication and movement [115, 116], and conveys a sense of agency; both as intentional sounds organized and produced by a human agent [117], as well as in the form of a "virtual person" [118] or an imaginary persona inhabiting the music [119]. Therefore, it has been proposed that there could be some embodied, empathic basis for musical understanding and meaning-making processes. For instance, certain sounds produced by the singing voice or specific musical instruments might correspond to affect vocalisations characteristic of emotion-related physiological changes. This physiological state theory [120] has received support from a range of emotion recognition studies in music [121, 18] and speech [122, 123]. In the context of sad expression, descending melodies, soft timbres, and slow tempo would convey the meaning of lamentation by mimicking the sounds and melodic lines of the grieving human voice. The mimetic hypothesis, proposed by Cox [124, 125], ties together embodied knowledge about emotional states and dynamics of tension and release in music, suggesting the emotional meaning of a piece of music would be partly the result of mimetic participation. Thus, it is entirely plausible that listeners would — at least in some occasions — respond to music as they would to the observed experiences of another person — with empathy.

Empathy can be broadly defined as a process by which we can come to understand and feel what another person is experiencing. An instance of empathy can involve "automatic", non-conscious processes such as emotional contagion, as well as more conscious, reflective processes such as mentalizing and perspective-taking [126, 127]. Importantly, both types of processes have been proposed to be involved in the emotional responses evoked by music [22, 128, 129]. In fact,

it has even been proposed that Theory of Mind (ToM), the ability to infer the emotional and mental states of others; to "understand each other as ourselves" [130, p. 148], may have been fundamental to the emergence of music [130, 131] and culture in general [132]. Furthermore, a capacity – as well as the motivation – for shared intentionality is also essential for successful interaction and joint action [132]). Although it may be more apparent how shared intentionality and affective and temporal alignment (i.e., entrainment and empathy) facilitate — and are involved in — music-making as a form of joint action, similar processes may also take place in the context of music listening.

Experimental evidence from multiple studies supports this view, showing that empathy and emotional contagion contribute to emotional responses evoked by music listening – particularly in the case of sad music – by intensifying emotional reactions that match the emotional expression of the music [133, 134, 135]. This empathic responding can occur on multiple levels, ranging from preconscious, internal mimicry of the emotionally expressive acoustic and gestural cues [111] to imaginative perspective-taking and mentalizing evoked by the process of music listening [119, 128], enabling listeners to explore and simulate emotional experiences in a safe and controlled setting. Deliberate perspective-taking and narrative imagery have both been shown to mediate and intensify the emotions induced by music (including sadness; [134, 135] even at the level of psychophysiology [135]. Furthermore, stronger empathy appears to be consistently associated with more intense music-induced sadness, and greater enjoyment of sad music [136, 134, 137].

But why should stronger experienced sadness lead to more enjoyment? Similar findings have been obtained with sad films [40, 4], and it may be this pattern of findings is related to a broader phenomenon concerning sadness portrayed in — and elicited by — fictional stimuli. Using a set of 38 sad film clips to investigate the enjoyment of fiction-induced sadness, Hanich and colleagues [4] discovered that the positive relationship between felt sadness and enjoyment was almost entirely mediated by feelings of "being moved". Moreover, Hanich and colleagues found that portrayals of prosocial behaviour appeared to play an

important role in the feelings of being moved, further hinting at the significant role of empathy in the enjoyment of sad fictional stimuli. A similar pattern of relationships emerges when emotional responses to sad music are explored: Vuoskoski and Eerola [138] discovered that the initial positive relationship between music-induced sadness and liking was fully mediated by feelings of being moved. Furthermore, listeners who had a more empathic disposition appeared to experience stronger feelings of being moved. Interestingly, a recent meta-analysis by Zickfeld and colleagues [139] established that there is a consistent positive relationship between trait Empathic concern [140] and feelings of being moved and sadness evoked by films and other stimuli. In fact, Zickfeld and colleagues go as far as to suggest that empathic concern and being moved might both be part of the same construct; a positively valenced pro-social emotion that is elicited by the sudden intensification of communal sharing relationships. In similar lines, Menninghaus and colleagues [47] postulate that feelings of being moved may serve the function of activating the value of social bonds and prompting prosocial behaviour.

Since strong positive correlations between felt sadness and being moved were observed by both Hanich and colleagues [4] and Vuoskoski and Eerola [138], it is possible that felt sadness contributes to the enjoyment of artistic and fictional stimuli by intensifying feelings of being moved. Hanich and colleagues postulate that sadness – being a nominally negative emotion – intensifies feelings of being moved more effectively than positive emotions (such as joy) due to the higher intensity and memorability associated with negative vs. positive emotions [141, 142]. Given that expressions of sadness and grief are likely to elicit social support and helping in others, it is also fathomable that listening to sad music may evoke a pro-social emotion akin to empathic concern or being moved – especially in those with a strong disposition to respond to others' experiences with empathy. Thus, the pleasure of being moved is far from being purely *hedonistic*; it is strongly intertwined with interpersonal aspects (see section 4.4 for a discussion on *being moved* in the context of aesthetic appreciation and beauty).

3.2. Mood regulation via social surrogacy and nostalgia

Outside fiction, experiencing negative emotions is known to increase the amount of social interaction and sharing of emotions [143], and negative emotions are willingly shared, even though the act of sharing is thought to reactivate the aversive aspects of the emotion (cf. [144], p. 74). The function of engaging in these activities is assumed to be related to the understanding and comfort, feelings of belonging, and emotional support such sharing entails [145], in other words, to mood regulation and specifically to mood improvement. In this section, we review the situational and social reasons for listening and deriving pleasure from sad music, and broaden the scope beyond the hedonic to eudaimonic aspects of sad music. Here we assume that mood regulation aims to convert a negative hedonic experience to a mildly positive one, and that such a *hedonic shift* crosses the boundary between negative and positive valence (see Figure 1).

Listening to sad music seems to fulfill the criteria for mood regulation. Although retrospective recall reports suggest that people engage in listening to sad music in diverse situations [146, 6]. The most consistent triggers of such episodes are autobiographical memories and significant situations in life (breakup, death, etc.) when people have distinct needs to regulate their moods. In laboratory studies, it has been also observed that people choose music that is congruous with their mood; when in negative mood, sad music is actually preferred over happy music [147, 148], and even more specifically, listeners tend to choose sad music after interpersonal over noninterpersonal losses [149]. Interestingly, when some time has passed after a negative mood induction people are more inclined to choose uplifting music in order to repair their mood [150]. One suggested reason for this shift is that listening to sad music provides the opportunity to sort out one's feelings and thoughts. Indeed, a small-scale empirical study seems to suggest that people, who listened to sad music for that purpose, reported feeling more positive [28].

How do such mood repair strategies actually work in this context? There are multiple, overlapping proposals that emphasise either the act of bringing

company to the listener (*social surrogacy*) or providing a platform for reflection via memories (*nostalgia*). Some aspects of these two proposals are consistent with the more generic musical mood regulation strategy of solace [151, 152], which is used by listeners who are sad and troubled to feel understood and comforted. This strategy emphasises the listener's attention on the lyrics which can give voice to feelings or experiences that one might not be able to express oneself [152]. Further, lyrics that resonate with the listener's personal experience contribute to the personal meaning and comforting effect of a song [153, 154].

Music listening seems to provide a sort of social connection, a *social surrogacy*, where the listeners enjoy the mere presence of a virtual person represented by the music. As the simple presence of another person who is in the same mood can help to cope with negativity [155], Lee, Andrade, and Palmer [156] suggest that sad music might provide comfort simply by signalling a mood-congruent other. Indeed, music has been described as having friend-like characteristics [152, 157]. Qualitative investigations of engagement with sad music suggest that sad music can be experienced as an imaginary friend who provides support and empathy after the experience of a social loss [156, 28]. Sometimes the social surrogacy has been described as an *emotional communion* [158], where a listener feels that the music establishes connection with the feelings of the composer as well as other listeners. Also, the concepts of transportation and identification are relevant for social surrogacy. Song lyrics might provide a means of being transported into another space/a narrative [159] or give the listener an opportunity for social connection with the singer through identification [160]. Transportation as well as identification are supposed to allow listeners to enjoy to forget about themselves [161], but we have little evidence to date whether the social surrogacy would be able to produce strong pleasure instead of mere slight positive shift in mood in the context of sad music.

Memories that people retrieve by listening to sad-sounding music often include foregone times. *Nostalgia* is known to be associated with mixed emotions or positive emotions depending on the situation [162]. The argument goes that sad mood can motivate people to listen to music associated with sadness as

a means to retrieve nostalgic memories. Such reflective revisiting of memories may enhance the mood, especially if the memories are related to pivotal and meaningful life moments [163], which bolster social bonds and generate positive affect [2]. By eliciting nostalgic memories, listening to sad music may also induce feelings of connectedness to loved ones [37]. As music is such a powerful trigger for personal memories, it might help replenishing feelings of connection and belonging simply by eliciting memories of a positive social relationship or interaction [164].

To recapitulate, sad music seems to be associated with different goals of mood regulation. Even though pleasure is not explicitly mentioned as the goal of the regulation, at least two broad strategies described above are assumed to lead to a positive emotional state such as feeling emotionally supported or being in a better mood, which might pave the way for or even constitute itself as pleasurable experiences. In other words, the mood regulation strategies describe a clear hedonic shift from negative to positive, although we assume that both are fairly mild compared to actual negative loss or the full pleasure obtainable through music listening, since the mood regulation is such a precise functional strategy (see Figure 1). The evidence for the two highlighted conjectures, social surrogacy and nostalgia is still rather scarce in studies of sadness and music. However, the strategies may be congruent with each other if the time-scale of the process is defined more clearly in future studies. It is also clear that social surrogacy and nostalgia are bound in the moral and cultural values of the society that require dedicated attention.

4. Cultural perspectives on enjoyment of sad music

As stated in the beginning (premise v), the social reality with its rules, practices, values, and cultural scripts shape the experienced emotions [26, 13]. Thus, individuals raised in a certain culture have specific cultural competence for understanding the scripts of their environment, which then again shape the social reality in which the person is living and experiencing emotions. Musical

traditions can be seen as part of cultural transmission of knowledge, a.k.a. *cultural ratcheting* [131], which can take a form of narratives that situate entities of human experience meaningfully to their environment [165]. Narrative forms allow for complex organisation and understanding of experienced events in both personal and larger sociocultural level, which enables one to understand what self is, what it means to remember one's past, and how these concepts relate to one's social environment [166]. Cultural context affects on the content and style of any of these narratives (for cross-cultural differences in autobiographical remembering, see [167]). This kind of cultural variation is particularly apparent in the case of cultural artifacts — such as music.

4.1. Musical traditions and learned codes for sadness

In the Western world, the purpose of music has been considered to be to both convey some affective meaning and induce affective responses in the listener at least since the 16th century [168]. Thus, well-articulated rules and cultural ideals for composition have guided their ways of expressing these affects during the past 500 years or so [169, 31]. For instance, embodied affective meanings and bodily movements were important part of music theory in Baroque era, when the whole doctrine of the affections (*Affektenlehre*) was created for imitating and summoning both positive and negative emotional reactions in the listener [31]. While some of these musical codes might still be accessible to listeners of the present day, certain "topoi" might be lost, as they refer also to their contemporary musical traditions (e.g., different styles of dance; cf., [170]), which do not exist in our present-day cultural practices. Although it has been suggested that the most important musical cues for the expression of sadness in Western music (low pitch range, slow tempi, and minor mode – see e.g., [171]) might have universal, embodied basis, and reflect the effect of emotions on our vocal output (see [172, 173, 19]), not all meanings have such clear mappings, but require learning. For instance, Nieminen and others [174] found that children start to associate conventional "sad musical features" (such as minor mode) with sadness not prior than at the age of eight (see also [20]).

Furthermore, conceptual knowledge about emotions keep changing and developing through both individual's personal life history and its reflection, and interaction with the social reality, as people negotiate, share, and reproduce existing meanings as well as give new meanings to old expressive cues within a (music) culture. By continually reflecting and refining their ways of musical expression, musicians have done their share of cultural ratcheting [131], which has led to our present understanding of what sad-sounding music sounds like – and what do the emotions associated with it generally mean. This is a generic principle acknowledged widely even to influence the types of emotions different cultures promote [175]. Thus, listeners experienced with a certain music culture are better in recognizing a specific sad musical expression of that tradition [19], and emotionally reacting to it, than the listeners not familiar with the music culture – in fact, when it comes to a foreign musical tradition, the sad expression might not be recognised at all [176, 177]. For example, Western listeners may be more inclined to believe that listening to music is to give us powerful but private emotional experiences because of the lore in our culture, whereas in other cultures, these emotional responses might be completely different and are embedded in social activities, as Robinson [31] has proposed. Thus, although the Western concept of music-induced sadness is often related to solitude and privacy [10, 178], this does not necessarily apply to listeners with other kind of conceptual knowledge about music or sadness [176]. We do not have enough evidence relating to the differences in sadness and music across cultures, but there are well-documented differences in cultural expressions of sympathy [179], and anger and shame [180].

Most cultures have specific musical traditions for expressing sadness and other negative emotions. For instance, musical *laments*, which express grief both verbally and non-verbally (e.g., vocal gestures similar to crying), exist in several cultures [181, 177, 182, 183], but also other forms of expression that do not seem as obvious for a Western listener can be related to sadness [176]. In the Western context, music has a visible role in death rituals, such as funerals, but they are not the only occasions where sad music is being played – in fact,

the pleasant kind of sadness is hardly ever experienced in relation to funeral music [11].

Thus, in addition to bereavement, in the Western music culture, this cathartic form of musical expression coexists with a more abstract, *aesthetic* expression of sadness, which does not need to have any clear connection to personal loss, nor does it need to be listened to for solely comforting purposes. For instance, in a recent qualitative study [11], a dominant proportion of participants described not only their aesthetic appreciation of sad music, but also associated sadness with aesthetically appealing qualities. In these descriptions, sadness had little to do with pain or suffering, and was associated with positive or even desirable concepts such as beauty, honour, and righteousness – clashing with the psychological concept of sadness as a negative emotion. The question of *why* this cultural ratcheting has kept mingling sadness with pleasure throughout history is of course rather impossible to answer, but we can nevertheless articulate the cultural practices associated with music and sadness in the Western culture in more detail.

4.2. Sad music as a form of cultural narrative for tragedy

There has been a long tradition of associating noble qualities with sadness and tragedy within Western cultures: Aristotle believed tragedy was superior to other forms of art, and it was seen as "the very measure of depth and maturity" by the post-Hegelians [184]. Sadness has not always been considered as something that should be avoided, but, conversely, as an indicator of great sophistication, religious devotion, providing even a certain degree of enjoyment, as was the case in 19th century Europe and the United States [8, 185]. Furthermore, these honourable qualities have been an important part of the concept of sadness throughout human history: the existence of misery, and feelings of melancholia, grief and other dysphoric emotions have been seen as signs of virtue, creativity, and intelligence in different times and in different cultures [186]. From a cultural-historical perspective it is no wonder that artists, for their part, have expressed these highly valued features of human life in multiple

ways, and created different kinds of cultural narratives for tragedy in different forms of arts.

Tragic art draws from the existing repertoire of cultural narratives that also define the meaning-making parameters of individuals' lives [187]. Fiction provides its own repertoire for meaningful information, or *conceptual knowledge* [65], about sadness and tragedy. Thus, tragic art is more than only something "very, very sad", because there are moral and normative aspects involved in cultural narratives for tragedy [184]. It provides us the means to have rich emotional experiences, which may be psychologically rewarding in its own right [63], but it also offers culturally constructed meanings for concepts such as human existence and mortality.

4.3. Musical sadness and reflection on the meaningfulness of human life

Tragic art can give *value* to sadness and pain, or even create an illusion about the noble nature of human suffering [188]. Hence, it offers contextual motivation for the existence of negative emotions, which can then be experienced as being more than just personal pain – it provides conceptual knowledge about sadness being socially valuable and thus attractive – even pleasurable – in certain contexts [11]. To express this in terms of the hedonic shift, we assume that the starting point of the cultural level of explanation is usually already positive (on the hedonic continuum); we usually engage with art objects voluntarily, and assume an aesthetic mode of listening. For this reason, the hedonic shift – if successful – can be assumed to move from mildly positive to very positive (see Figure 1).

It might be that the unique quality of music as a cultural narrative for tragedy lies in its ambiguous nature that is, as Nussbaum [189] proposes, both general and particular at the same time; the listener is free to interpret musical cues for sadness, and reflect on their own experiences in a very particular or general level. Instrumental music in particular generates unspecific musical landscapes that afford many different kinds of interpretations, from which the listener may conceptualise their personal emotional experiences. However,

even with accompanying text, music may add the kind of conceptual input to the experience that text alone cannot produce – thus, two songs with the same lyrics produce different emotional expressions due to the two composers" unique styles of organising their musical material [189]. Nonetheless, musical expression gives special *meaning* to the emotional states it portrays; it is not just pointless sadness, but there is some reason or meaning to it [188]. Such experiences fall under *eudaemonia*, which refers to life satisfaction, contentment and feeling good [190, 191], not dissimilar to the Chinese discourse of *savoring* that includes negative experiences [192]. Eudaemonia is a departure from *hedonic concerns* by focussing on insight and meaningfulness of human life. Oliver and Raney [193] found evidence that these two different goals in the pursuit of happiness evoked by fiction elicit different types of affective responses, and they are related to people's preferences in media entertainment: individuals with higher hedonic motivations were more likely to prefer entertainment eliciting pleasurable, "fun" affect, whereas individuals with eudaimonic motivations preferred entertainment eliciting more ambiguous or even negative affect. They suggested that eudaimonic motivations are related to "truth"-seeking — even at the expense of hedonic pleasure. Thus, sad music may provide meaningful conceptual information – or act as an "affective sandbox", as Livingstone and Thompson [131] suggest – for some listeners by portraying more sombre human themes such as mortality and personal loss. Such contrasts, in turn, are also known to be related to experiences of being moved [4], discussed earlier. Menninghaus and others [47] have proposed that there is "special relevance and meaningfulness often attributed to feelings of being moved" and that these are primarily due to the combination of the special antecedent focus of these feelings (usually relating to significant relationships and/or critical life events), as well as the cognitive appraisals for their compatibility with social norms and (self-)ideals. Direct evidence supporting the role of musical sadness as an instrument for reflecting on the meaningfulness of the human condition does not exist yet. However, the observations made in the context of studies involving feelings of being moved, which suggested a link between the intensity of being moved and sadness [40, 4],

could be loosely interpreted to support this notion.

4.4. Aesthetic appreciation and beauty

Aesthetic appreciation is intrinsically embedded in culture and historical tradition, and overlooking the centrality of these contextual factors has not typically yielded useful insights. For instance, Juslin [24] and others [34] have proposed that the enjoyment of music-induced sadness could be explained simply in terms of pleasure drawn from aesthetic appreciation or, in other words, the "beauty" of sad music. Specifically, Juslin suggests that "It is not that the sadness per se is a source of pleasure, it only happens to occur together with a percept of beauty" [24, p. 258]. In similar lines, Menninghaus and colleagues [12] outline "Aesthetic virtues" (i.e., the aesthetically appealing use of the media of representation) as one of the central components of their Distancing-Embracing model. But what exactly makes sad music "beautiful," and could sadness itself not be an important contributor in the concept of beauty? Indeed, there is a long tradition of associating beauty with tragedy, sorrow, and ruin in Western art: From the medieval troubadour tales of unattainable love to lyrical romantic portrayals of "beautiful death" in the 19th century operas and "death songs", the transience and the dark sides of human life have been the building blocks of the concept of beauty throughout history [185]. More recently, empirical investigations have shown that perceived sadness and beauty tend to be highly correlated in such diverse stimuli as film music excerpts [194] and poems (where patterns of poetic diction have been manipulated; [195]).

The concept of "beauty" is undeniably central to the aesthetic appreciation of music [196, 197], although aesthetic experiences comprise other components as well. Despite being a salient descriptor of aesthetic appreciation for most listeners [196], the scientific definition of "beauty" is notoriously difficult, and the constituents of musical "beauty" are not yet well understood [197]. However, current views of musical 'beauty' emphasize the interaction between the perceiver and the object: beauty is considered to emerge from a relationship between the listener and the music (conceptualised as perceptual fluency or

processing dynamics [198]), rather than any 'objective' features of the musical material or 'subjective' features of the listener alone [24]. Furthermore, recent findings as well as past discussions [199] suggest that there may be a significant emotional component that contributes to the association between beauty and sadness. Vuoskoski and Eerola [48] aimed to elucidate the interconnections of sadness, beauty, and liking in a systematically selected set of film music examples. They found that the initial positive correlation between sadness and beauty was fully mediated by movingness, and that movingness – rather than beauty – also mediated the relationship between sadness and liking (see subsection 3.1 for a discussion on empathy and being moved). "Being moved" has been conceptualised both as an interpersonally significant emotion that activates (and is activated by) pro-social behaviour and the value of social bonds [47, 139], as well as a pleasurable aesthetic emotion [200] often accompanied by chills or frissons [201, 202]. This dual nature of "being moved" suggests that percepts of beauty must conform with with prosocial norms and ideals, and that, in order to be experienced as beautiful, music may have to be perceived as conveying prosocial intentions [203]. However, more exploratory empirical research is undoubtedly needed to better understand both phenomena in the context of music listening.

Although the degree of conceptual overlap between "liking" and "perceived beauty" remains unclear, it appears that feelings of "being moved" contribute to both phenomena, and mediate their association to felt sadness in the context of music listening [48]. In light of these findings, it appears that Juslin's assertion (that music-induced sadness is pleasurable only because it happens to co-occur with a percept of beauty) is limited, as feelings of sadness actually appear to contribute to perceived beauty and liking by intensifying feelings of being moved. It could also be argued that those listeners who enjoy listening to sad music have learned conceptual knowledge about the "beauty" and the social value of sadness as an emotion, which, together with pleasant musical features, may contribute to an experience of "being moved" by music.

To summarise, musical emotions are always experienced in a particular cul-

tural context, in which the social rules, scripts, and concepts of that culture shape these experiences. In the Western context, there are historically constructed concepts for sadness that highlight the socially valuable and aesthetically appealing aspects of that specific emotion. These concepts are being used in creating and maintaining cultural narratives, which, in turn, can be used in creating personal meanings for human existence and other cultural concepts, such as beauty or tragedy.

5. Summary and discussion

5.1. Benefits of an integrated framework

The aim of the present work was to provide an integrative account of the elements involved in the enjoyment of sadness associated with music. Our main argument is that past research has tended to consider only one particular level of explanation at a time, and taken concepts and notions from the other levels as given. A critical look at the explanations provided by biological, psychological, social, and cultural levels clarifies the paradoxes and confusions related to the extant findings, and provides us with more precise conceptual tools for future research. For instance, the notion of consolation through sad music has different meanings at different levels that are not necessarily consistent with each other. At the biological level, this term has been used in conjunction with homeostasis and specific responses (e.g. prolactin, oxytocin) that are involved in mitigating the impact of loss. At the psycho-social level, consolation still refers to mood regulation, but it emphasises interpersonal processes and is explained through social surrogacy and shared emotions. Currently we have no evidence to suggest that mood regulation through music would be able to utilise the specific biological consolation mechanism. Consolation at the cultural level is associated with acts of consoling (cultural traditions representing, for example, rhetoric oration at funerals), but these acts have diverse meanings and qualities that are embedded in history and culture. One could argue that common ritualised symbolic acts (such as Chopin's Piano Sonata No. 2 in B♭ minor, a well known funeral

march) stems from biological and psychological elements that initially operate at the individual level, and that the cultural symbols provide shared, agreed representations of loss and consolation that allow the community to collectively participate in the putative consoling process. However, since the current evidence within the levels is limited at best, such linking between the levels of explanation is not only premature, but can also lead to dubious analogies or misattributions across the levels.

5.2. Current state of evidence

Our approach paints a sombre picture of the current understanding of the enjoyment of sad music. There are several gaps and limitations in our knowledge of the key issues. At the biological level, we simply do not understand the complexity of the hormonal and neural systems in conjunction with emotions and their functions in order to make strong inferences from the few existing observations. The neural evidence is mainly limited to areas involved in experiencing pleasure while listening to music, but the evidence concerning a more precise signature of enjoyable sadness may not even be a meaningful target to pursue, since the direct indicators (neural, hormonal, psychophysiological) will most likely reflect lower levels of representation (e.g., core affects) and not higher-level meanings. However, direct links to functional mechanisms – such as the specific hormonal consolation response – could at least provide valuable evidence for the claim that such low-level homeostatic functions are involved in the process.

The empirical evidence for the different explanations offered within the psycho-social level are still patchy. Empathy has repeatedly been linked with pleasure associated with fictional tragedy [204, 4] and sad music [48], and the notion of being moved seems to be a crucial proxy for conceptualising those experiences that encapsulate the most enjoyable aspects of sadness. The other promising, tentative explanation at this level relates to the intriguing notion of music being able to function as a substitute for another, sympathetic being, which in itself provides company and comfort. Both processes deserve more

	Biological	**Psycho-social**	**Cultural**
Focus	Individual	Interpersonal	Collective
Mechanisms	Homeostasis	Mood regulation, empathy, memories, social surrogates	Shared meanings via learning and cultural ratcheting
Valence shift	[- -] to [-]	[-] to [+]	[+] to [++]
Measures	Neural, hormonal, physiological	Behaviours, self-reports (e.g., pleasure, being moved), narratives	Historical and ethnographic evidence
Evidence	Non-existent, or pertaining only to actual sadness or music-induced pleasure	Positive evidence for mood repair. No evidence for social surrogacy and nostalgia, yet. Indirect evidence for empathy	Some supporting evidence in recent Western history and self-reports
Caveats	Functional roles and physical correlates of biological systems not fully understood	Mood regulation points to mood change, not pleasure. Mainly correlational evidence linking trait empathy and pleasure. Lack of research emphasis on social context	Lack of cross-cultural perspectives and only a few historical analogies

Table 1: Summary of key mechanisms, hedonic shift, and evidence across the three explanatory levels with respect to pleasure associated with sad music.

attention in the future, and require analytical breakdown of their components.

When we traverse the levels of explanations, we also cross disciplinary boundaries and epistemologies that come with the disciplines. The concept of "evidence" in biological sciences is not the same as in social sciences, and the term requires yet another reading in humanities. Thus, our interpretation of the evidence in the cultural level suggests that music and sadness have been coupled together in contemporary Western culture, and that such couplings are undeniably cultural conventions that may not have direct counterparts in other cultures or times. This challenges the notion of universal recognition of sad music, but it does not necessarily invalidate the explanations provided at the different levels — provided that they can be achieved with a diverse set of musical cues. However, most cultures do have specific music associated with funerals (e.g., laments, music for mourning), and the rudimentary musical cues of sadness such as slow tempo and dark timbre might directly reflect the physiological state associated with sadness. However, we are doubtful that such universal uses of music in mourning rituals would have direct links to deriving pleasure from the music. Instead, we surmise that the contemplative and aesthetic mode of music listening might be a particularly Western-oriented concept, and it may be the act of simulation and empathic engagement with a virtual agent that contributes to enjoyability of the experience. If this turns out to be true, the paradox of pleasurable sadness is also a profoundly Western construct, which has direct implications for the universal relevance of the explanations.

5.3. Key processes involved: Simulation and hedonic shift

Our review has provided some tantalising analogies and conceptual similarities. We adopted a constructionist account of emotions, which has simulation as the core mechanism. Simulation, interestingly, is also at the centre of the only explanation specifically geared towards the pleasure generated by music-induced sadness [35]. This conjecture claims that music allows us to simulate the feelings of loss so effectively that it triggers a defensive response that serves to alleviate mental pain. In the absence of actual loss, this response produces a pleasurable

feeling. At the psycho-social level, the process of simulation was fleshed out in more detail with regard to Theory of Mind, music as a virtual person, the physiological-state theory for decoding the mapping of expressed of emotions, and aspects of empathy. Simulation remains a core process even though the object of simulation is not a sentient being but rather the emotional expression conveyed by music. This expression can take various forms in different situations; music acting as an empathic friend; providing comfort through meaning, familiarity and lyrics; reminding of nostalgic memories; or merely providing conceptual knowledge about sadness by imitating it in a particularly moving manner. The available empirical evidence frames aspects of empathy as the moderating variable in experiences involving pleasurable sadness and feelings of being moved. However, closer dissection of the types of empathic engagement and the process of separating contagious and reflective aspects of empathy is critical. Finally, all cultural explanations also rely on our ability to simulate fictional and imaginary worlds that are based on shared assumptions requiring culture-specific competence. The pleasure at this level is not chiefly derived from a particular chemical response or interpersonal comfort, but from our reflections and meta-cognitive appraisals of the rich cultural meanings associated with the experience.

One of the central missing pieces of evidence is the actual process and timescale of the transformation of sadness as a negative emotion to something that is experienced as positive. Most of the putative explanations offered at each level imply a dramatic transformation from negative to a positive hedonic state, but without qualifying this in any way. We want to limit and specify such a process by framing it as a *hedonic shift*. In this, a nominally negative emotional expression, act, or experience, shifts towards positive valence in terms of the core affect; the hedonic dimension. This approach differs somewhat from accounts offering a "mixed emotions" explanation to the sadness paradox [24, 12], where the overall experience becomes pleasurable due to a more positive concomitant emotion. We view "mixed emotions" as conceptual acts, existing mainly at the conscious, experiential level [14], and instead focus on delineating the changes in

the underlying core affect. The proposed hedonic shift is gradual and limited in range with regard to each level and explanation. For instance, at the biological level, the comfort response is triggered by a very negative hedonic state (real loss), and provides merely a shift from purely negative to slightly less negative [35]. As such, it does not really claim to explain the pleasure derived from such an experience (although the affective state induced by sad music is hardly comparable to actual loss in its hedonic tone). The hedonic shifts postulated at the psycho-social level relate mainly to mood regulation processes (e.g., social surrogacy and nostalgia), where the starting point is typically a negative hedonic state, albeit milder than the one triggering the comfort response. As the goal of these mood regulation processes is to repair negative mood, the comfort derived through surrogacy or nostalgia shifts the hedonic state to a mildly positive one at best. Indeed, the literature exploring the uses of sad music in mood regulation suggests that such processes are unlikely to lead to strong experiences of pleasure [28]. At the cultural level, the starting point is not loss or negative mood but engagement with art, which can be considered at least neutral or more likely slightly positive. Again, the hedonic shift is assumed to be fairly limited, but when made from such a positive starting point, the reflective engagement with negative expression allows the listener to embark on a journey that makes her realise how fortunate she actually is (according to the eudaemonic explanation), or experience the feelings of being moved, both of which are often reported as highly pleasurable. We have summarised these limited one-directional hedonic shifts in Figure 1.

The three uppermost hedonic shifts illustrate the approximate change predicted in an optimal case for each explanation (hormonal comfort response at the biological level, mood regulation at the psycho-social, and being moved or reflecting meaning at the cultural level). While we do not have precise locations for the start and end points on the hedonic continuum, the diagram highlights how the shift on each level has a restricted range. Acknowledging this alleviates pressure from the expectation that a particular process at a specific level could somehow convert a nominally negative emotion into something akin to

rapture and intense pleasure. The integrated summary at the bottom attempts to sketch the ways in which such experiences are nevertheless possible within the framework; the appeal of sad music may lie in capitalising on multiple levels of explanation; music *exploits* the narratives and meanings embedded in culture, which in turn exploit the sense of social connection and empathy in the listener, and – tentatively – some of these processes could have their roots in primitive neural and chemical functionality aimed to mitigate the experience of genuine loss, which in turn might *enhance* the hedonic shift.

Even though we have outlined the different processes at the three levels separately, one could also make an argument that there are hierarchical relationships between the levels where the higher levels could be seen as stylised conventions of the instances at the lower levels; mood regulation with mood-congruent (negative) music initially amplifies the negative mood and capitalises on the proposed biological mechanism aimed to restore homeostasis, for example. These individualised instances of self-regulation with the use of music (as social surrogates or to evoke nostalgic memories, or both) can be interpreted as having been encoded as cultural scripts and narratives at the cultural level, which allow groups of people to share similar experiences. One cannot attribute the enjoyment of sadness fully to any one of these levels, but to the chain of functionalities afforded by each level. We currently do not have enough analytical evidence to assess the validity of the links between the levels, but at least this present account acknowledges the limits of the various explanations with respect to pleasure, and advances a more narrow set of cascading accounts.

5.4. Future directions

Although the evidence itself is not yet convincing – particularly with regard to the actual pleasure induced by sad music – the framework of separate levels and interconnected themes provides a roadmap for future explorations on the topic. The most crucial gaps in our understanding lie in the biological mechanisms and the possible transitions from functional, mood regulatory acts to cultural symbols. At the moment, the biochemical explanations are mere

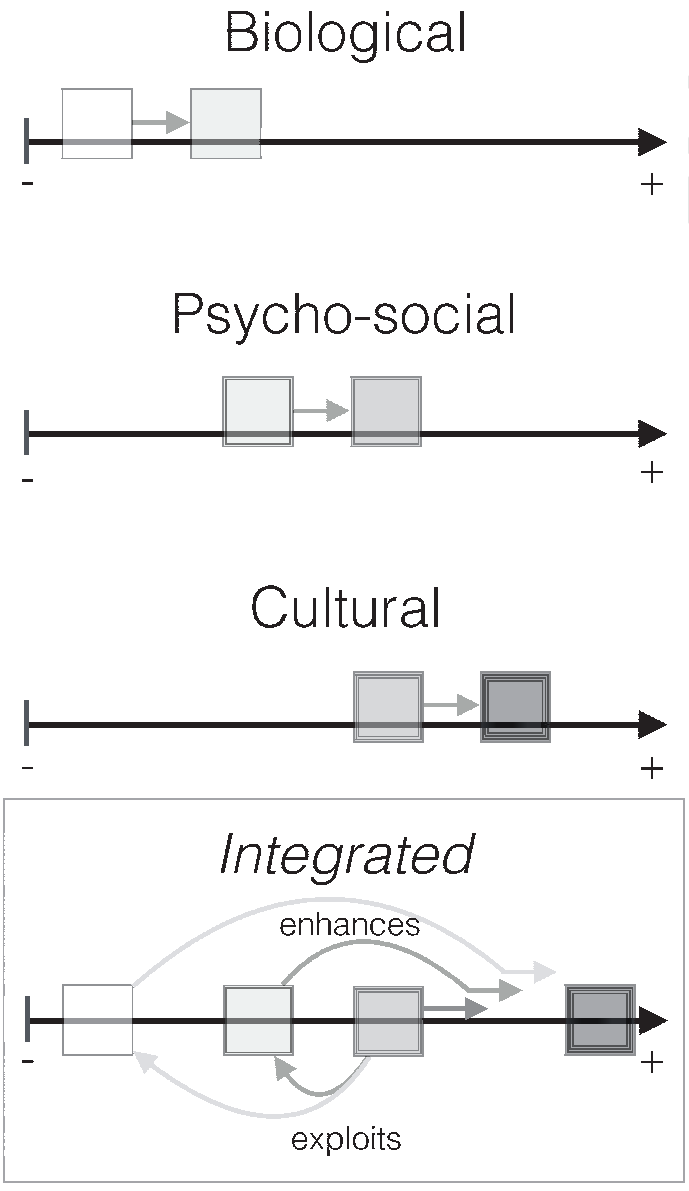

Figure 1: Hedonic shift at different levels and integrated account of the shifts.

conjectures that rely on a few endocrine markers to index complicated emotional processes, which probably will turn out to be a drastic oversimplification [205]. Unfortunately, most of the evidence associated with the topic at the biological level concerns comparisons (e.g. happy-sad, low-high arousal or stress) that cannot reveal insights into the hedonic shifts involved. Provided that the required techniques become affordable and reliable, probing the biological responses involved in experiences of pleasure associated with sad music may prove to be useful. One recent study by Wassiliwizky and others [114] has provided an example of how one could trace the physiological and experiential aspects of pleasure (chills) and negative affect simultaneously.

On the psycho-social level, it is unclear whether the mood regulation processes — including social surrogacy and emotion sharing — can lead to highly pleasurable experiences at all. It may turn out that while these documented effects are tangible and important positive shifts in mood, they should not be considered as highly pleasurable — at least in the typical situations of functional music use. Finally, we highlighted the possibility that the entire topic of music-induced pleasurable sadness is a highly culturally specific, Western notion, and only meaningful and tractable in a cultural context that puts high value on aesthetic contemplation. This is an open empirical question for cross-cultural study, but existing accounts of contemplative emotions suggest that such notions may not be unique (e.g., Chinese *savouring* of negative emotions, [192]; positive values of suffering in buddhist cultures, [206]).

In conclusion, the paradox of enjoying sad music is not so much a paradox, but an ill-defined problem. By separating the levels of explanation, the types of experiences involved, the plausible yet restricted hedonic shifts, and the competing accounts of how a sad emotion may have rewarding qualities, the enigma finally becomes tractable. However, the real challenge still remains: We do not yet know which of levels and explanations are actually necessary in order to explain these experiences, and whether they are dependent on each other. Furthermore, we remain uncertain regarding the extent to which these explanations are (or are not) specific to music. Causal research designs utilising

a wide array of methods and approaches (such as narrative recall studies, mood manipulations, laboratory experiments collecting biological markers of hedonic states, and cross-cultural comparisons, for example) are needed to tease these processes apart. Finally, exposing the pivotal elements involved in the enjoyment of music-related sadness may reveal something fundamental about the awe-inspiring, moving experiences sometimes evoked by nature and social situations [207], and is likely to provide insights into how other forms of art exert their fascinating power on all of us.

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