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Increasing Music Preference Through Guided Self-Framing: A Comparison of Historical and Imaginative Approaches

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While accompanying or contextualizing information ("framing") is often included alongside music, prior research on the impact of framing on music preference has produced heterogeneous results. Most of these studies have examined historical framing, although a small subset has suggested that imaginative framing may have an understudied potential to increase preference. In such studies the participants are encouraged to freely use their imagination while listening. The present work directly compared these 2 approaches to framing to examine which has greater positive impact on preference. One hundred and fifty-two participants were exposed to 5 varied music excerpts (Pop/Rock and Classical), with participants placed into 1 of 3 conditions. Those in the historical condition were supplied with initial historical framing and were encouraged to freely search online for information related to the piece while listening to it (hence guided self-framing), whereas those in the imaginative condition were encouraged to freely use their imagination while listening. Those in a third, "unrelated" control condition were encouraged to choose an online game (selected from a provided list) while listening. Bayesian modeling was used to examine preference ratings by piece and condition. Historical framing led to higher preference than the control for 4 of 5 pieces, while imaginative framing led to higher preference than the control for 2 pieces. Additionally, those receiving historical framing rated preference higher for pieces that had a greater amount of information readily available online. Thus, historical framing most benefited preference, although we discuss limitations and future directions for research on guided self-framing.

Keywords: music preference, framing context, program notes, historical, imagination

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Do we like music more if we know something about it? Many circumstances involving music listening are accompanied by related information, such as program notes for performances of classical music, album liner notes, and interviews or commentaries. We henceforth term this engagement with accompanying or contextualizing information as "framing." The widespread practice of providing such framing for music listening would suggest that its presence should have an impact or benefit to our aesthetic experience, although prior empirical investigations have provided mixed results (for reviews, see Chmiel & Schubert, 2019a, 2020). To further complicate this matter various types of framing exist, as will be detailed below. This provokes another equally misunderstood and rarely researched question of whether any particular type of framing privileges positive impact on music preference?

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In this paper we aim to compare the extent to which multiple types of framing are able to positively or negatively impact preference for a variety of music stimuli. We use the term "preference" as an umbrella term intended to encompass aesthetic responses such as appreciation, enjoyment, liking, and so on. Thus, our use of the term preference can be seen to include both aesthetic responses (i.e., personal responses) as well as affective responses (mood and emotion-based responses); for further discussion see Hargreaves (1986), and Hargreaves and North (2010).

Historical and Valenced Framing

We begin this work by defining the two most commonly studied types of framing considered in music preference research. The first type, *historical framing*, refers to accompanying historical information presented alongside a work; for a detailed discussion and review of historical framing and music preference see Chmiel and Schubert (2019a). Examples of historical framing include program notes highlighting specific circumstances and people surrounding or impacting on the creation of the work, and details regarding compositional aspects. At times historical framing will also contain analytical aspects such as suggested elements to listen for or to help facilitate understanding. As historical framing can be manipulated in terms of the amount but also the type of framing that is provided,

prior studies can be grouped into three general categories: identifying information; program notes; and guided analysis.

The first category refers to studies manipulating the presence of identifying framing elements, such as supplying listeners with the title of the work or the name of the artist, composer, or performer (e.g., Anglada-Tort et al., 2019; Damon, 1933; Taylor & Dean, 2021). While identifying information does not always strictly contain historical details (e.g., when only a title is supplied) it can help the listener understand the work, so we still regard this as an approach to framing. The second category refers to more extended framing, such as supplying listeners with a program note containing historical and/or compositional details (e.g., Halpern, 1992; Margulis, 2010; Margulis et al., 2015). The third category refers to studies manipulating the presence of guided analysis, such as providing focused listening classes or music analysis classes to participants (e.g., Bradley, 1972; Prince, 1974).

Typically, these studies examine the hypothesis that by increasing the listener's understanding of the historical details surrounding a work, preference for that work will also be increased. This is in line with a number of theoretical frameworks concerning the impact of historical framing, with one highly-cited example being the Psychohistorical framework for the science of art appreciation, proposed by Bullot and Reber (2013a). Specifically, Bullot and Reber propose that a respondent to a work from any artistic medium—be it music, film, visual art, poetry, and so on—has an individual level of *art-historical sensitivity*. This sensitivity refers to the respondent's ability to understand the work from a historically-informed standpoint. As the respondent's understanding of a work increases, so too does their level of sensitivity. Thus, sensitivity can be increased through methods such as training, subsequent exposures, or the provision of framing. Increasing sensitivity levels are hypothesized to lead to increasing impact on their aesthetic response to the work, although this impact will not necessarily be positive[1] (Bullot & Reber, 2013b, 2017).

The second type of framing for music preference is *valenced framing*. Valenced framing refers to manipulation of the purported quality or prestige of a work, in either a positive or negative manner[2]. Empirical studies examining valenced framing and preference have labeled identical musical excerpts as performances by different artists with a varying associated skill level, such as labels of student performers versus world-renowned performers (Anglada-Tort & Müllensiefen, 2017; Aydogan et al., 2018; Duerksen, 1972; Kroger & Margulis, 2017). Other studies have presented identical excerpts that are incorrectly labeled as separate human performances, or as human-created compositions versus computer-created compositions (Schubert et al., 2017; Steinbeis & Koelsch, 2009; Ziv & Moran, 2006). Similarly, Kiernan et al. (2021) examined the impact of valenced historical biographies for the musical works of Zelenka, although the target variable was self-reported emotional responses rather than preference; they observed increased negative emotions accompanying the negatively valenced biography. In an alternative approach to examining valence and music preference, Taylor and Dean (2021) asked participants to rate their own perceptions of valence for each stimulus they listened to.

Two recent literature reviews have, respectively, examined the impact of historical framing (Chmiel & Schubert, 2019a) and valenced framing (Chmiel & Schubert, 2020) on music preference, and have highlighted the heterogeneity of reported results. In the first review, 50% of the ten examined studies provided no evidence of higher preference ratings alongside historical framing, whereas 30% of these studies contained significantly higher preference ratings alongside historical framing. The remaining 20% of studies provided mixed results within the same experiment, and so were inconclusive. The literature review on valenced framing also produced heterogenous results, although a substantially larger percentage of the 12 reviewed studies (50%, in comparison to the above 30%) provided evidence of significantly higher preference ratings when framing valence was positive rather than neutral or negative. Additionally, 16.7% of these studies provided no evidence of higher preference ratings alongside positively valenced framing, and 33.3% of studies contained mixed or inconclusive results.

One implication of these findings is that some framing types produce more of a positive impact on music preference than others, with current findings specifically favoring valenced framing over historical framing. However, as there is a dearth of research directly comparing the impact of different types of framing on preference, more concrete conclusions cannot yet be made. Given the variability of results in the literature, we decided to trial a novel but ecologically plausible approach to historical framing (as will be detailed below). Therefore the focus of this paper turns away from valenced framing, and toward the less-studied aspect of imaginative framing, although subsequent comparisons between historical and valenced framing, using novel approaches such as will be proposed here, are recommended.

Imaginative Framing

Encouraging the use of imagination while listening to music is a less-studied form of framing. To our knowledge only three previous studies have examined preference alongside this type of framing (Chmiel & Schubert, 2020; Damon, 1933; Zalanowski, 1986), although these have produced promising results. Across two experiments Chmiel and Schubert (2020) exposed participants to music alongside historical information that was either positively or negatively valenced (which constitutes a mix of historical and valenced framing). Additionally, participants in a third framing condition were encouraged to freely imagine a story or use mental imagery to accompany their listening experiences. In both experiments imaginative framing produced a significant, positive impact on preference compared to the control condition.

Similarly, Zalanowski (1986) examined enjoyment ratings for participants receiving either no framing, program notes, or one of two imaginative framing conditions. Zalanowski used two classical music pieces—with one composed by Berlioz and the second by Schubert—with differing conditions for each piece. For the Berlioz piece, participants were asked to either pay attention while listening (the control condition), to freely form mental imagery (hence "free imagery" condition), or were provided with a program note describing the story related to this piece and specifically

[1] E.g., if a respondent were to discover that the creator of a work publicly supported social values that strongly contradict their own values, this framing may lead to a decrease in preference for the work.

[2] A distinction must be made between valence as described here, and the oft-studied valence of emotions (see, e.g. Russell, 1980). We use the term valence simply to denote positive versus negative aspects of framing, and this does not relate to specific moods or emotions.

asked to mentally form the images suggested by that story (hence "directed program imagery" condition). Zalanowski reported that the free imagery condition produced significantly higher ratings of enjoyment than the directed program imagery condition.

For the second piece the control and free imagery conditions from the first piece were retained, although the directed program imagery condition was replaced with two separate historical conditions in which participants received either a "descriptive" or "analytical" program note, and were not asked to mentally form imagery. Zalanowski reported no significant differences in enjoyment between any of the conditions for the Schubert piece. Thus, while this study contained overall mixed results that are characteristic of research in this area, the potential positive impact of imaginative framing on music preference is demonstrated by responses to the Berlioz piece.

Finally, early research regarding framing and music preference by Damon (1933) examined the impact of two types of program notes on three excerpts of classical music. The program notes contained either historical details of the pieces, or discussed story-like details relating to the music. While this approach did not strictly ask participants to form mental imagery while listening, we can surmise that many of Damon's participants may have taken this step after reading the story-like program notes. Damon did not provide inferential analysis of these data, although a subsequent reanalysis by Chmiel and Schubert (2019a) indicated that participants receiving story-like program notes produced significantly higher enjoyment ratings for two of the three pieces. For the remaining piece there was no significant difference in ratings between conditions. Thus, in concert with Zalanowski (1986) the overall findings of Damon's study are varied, yet still indicate that in certain cases imaginative or story-like framing is able to significantly enhance music preference.

Self-Framing

The studies by Chmiel and Schubert (2020) and Zalanowski (1986) both allowed participants in the imaginative conditions a certain amount of freedom in how the participant engaged with framing. Henceforth, we refer to such an approach as "self-framing." Self-framing means that the participant self-directs what specific information they acquire or engage with to frame their knowledge of the music. By developing an experimental design that controls the framing approach taken (valenced, historical, imaginative, and so on) the framing is not completely self-directed. The researchers are to some extent guiding the framing by indicating the general approach to be taken, and hence this is more correctly a "guided self-framing" process. In the present study we will henceforth use the term self-framing, although the authors acknowledge that further distinction between these two aspects of self-framing is possible.

As discussed, imaginative self-framing has tended to produce a significant, positive impact on preference, although this was not always the case, such as with the Schubert piece within Zalanowski's study. This observation gave us the impetus to examine more closely whether there is an optimal self-framing approach for increasing preference for music, and the extent to which various pieces or types of music may differ in this regard. We decided, therefore, to examine more closely on one hand the little-studied, but potentially useful imaginative self-framing approach, and on the other hand the oft-studied historical approach to framing, which has tended to produce mixed findings.

From a methodological point of view, managing imaginative self-framing is straightforward, with the process based on the way the individual wishes to engage with the music. However, the historical approach to self-framing is more complex because to allow the participant the freedom to use whatever information they wish will be limited to the amount of information available (e.g.,via searching the Internet or a provided database). This in turn leads to other methodological considerations. If a large amount of information is available about a piece of music or a musician, it will be easier for the listener to find relevant information, and vice versa (which may also impact on their assessment of the esteem of the piece). Therefore, the amount of readily available historical information for a specific work or artist is likely to impact on historical self-framing, and so this variable (amount of information available) needs to be considered.

The Use of Popular Music and Classical Music in Framing

Based on the literature reviews by Chmiel and Schubert (2019a, 2020) we also conclude that the majority of existing studies on framing have used examples of Western classical music (for example, Aydogan et al., 2018; Chapman & Williams, 1976; experiment 2; Damon, 1933; Duerksen, 1972; Fischinger et al., 2020; Kroger & Margulis, 2017; Margulis, 2010; Prince, 1974; Radocy, 1976; Rigg, 1948; Zalanowski, 1986; Ziv & Moran, 2006) or music from a related style such as Western concert band repertoire (e.g., Cavitt, 1997, 2002; Silvey, 2009). However, as the vast majority of these studies used undergraduate or school-aged participants this is unlikely to represent the types of music that these participants would typically listen to, which may impact the validity of findings. The inclusion of exclusively classical music may be relevant for select studies focusing on participants drawn from music-based institutions, although this was not the case for any of the studies listed above.

Following from this, a small subset of studies have used popular music to examine the effects of framing, such as in Anglada-Tort et al. (2019), although often these popular examples make up a small subset of the stimuli used (e.g., Halpern, 1992). Additionally, at times the popular music chosen was released decades earlier, meaning that the stimuli are not likely to be representative of the music typically listened to by undergraduate participants (e.g., Anglada-Tort & Müllensiefen, 2017). Thus, the inclusion of current, popular forms of music constitutes an understudied aspect of framing that we aim to address in part in the present work.

Aims and Hypotheses

In this paper we aim to examine what positive impact, if any, different types of framing can have on music preference. We investigate four hypotheses:

H1: Historical self-framing will have a positive impact on music preference compared with an unrelated control[3];

[3] By this, we refer to a control that contains no framing whatsoever; see the Method section for further detail.

H2: Imaginative self-framing will have a positive impact on music preference compared with an unrelated control;

H3: Imaginative self-framing will have a stronger positive impact on music preference than historical self-framing will;

H4: Historical self-framing will have a stronger positive impact on preference of music that has a high amount of relevant information readily available online, compared to music that has a low amount of relevant information readily available online.

Method

Participants

One hundred and fifty-two participants were recruited from an undergraduate elective course containing a mixture of music and nonmusic students. Participants received course credit for taking part in the study. The sample contained 89 females (58.6%) and 63 males (41.4%), with participant age ranging from 18 to 49 years ($M = 21.3$, $SD = 3.8$). Two other options were provided for gender ("Other" and "Prefer not to say") although no participants used these options. Participants were asked to record (1) the number of years in which they had played any instrument or practised voice, and (2) the number of years in which they had received any music lessons or formal music training. Recorded values for years of playing ranged from 0 to 30 ($M = 6.9$, $SD = 6.2$), and for years of training ranged from 0 to 16 ($M = 4.9$, $SD = 4.8$). Based on guidelines proposed by Zhang and Schubert (2019), participants that responded with 7 or more years for either question were categorized as "trained" ($n = 77$; 50.7%), whereas those who responded with 6 or less years for both questions were categorized as "untrained" ($n = 75$; 49.3%). This variable is henceforth referred to as "musicianship."

Participants were split into one of three framing conditions (historical, imaginative, and unrelated; each condition is detailed below in the "Procedures" section). Fifty-three (34.9%) participants were placed into the historical condition, 50 (32.9%) participants were placed into the imaginative condition, and 49 (32.2%) participants were placed into the unrelated condition.

Materials

Five short excerpts were used, intentionally taken from a range of genres and time periods, although broadly fitting into two categories of either Pop/Rock or Classical music. The label of "Pop" refers to the conventions of Western popular music, rather than to the piece being commercially released; the piece *Red ribbon* was not released commercially, whereas the piece *Happy* was. Excerpt details, durations, and categorizations are listed in Table 1. Each excerpt was a shortened version of the original stimulus, with duration ranging from 1m52s to 2m28s to allow playing the excerpts while providing sufficient time for each participant to complete their tasks in the allotted time of the experimental session. Each excerpt began at the starting point of the piece, and a fade out was applied five seconds before the end of the excerpt. The five stimuli included here are not able to entirely represent the genre they were classified as. However, this was not our intention; instead we aimed to explore framing for varying genres, including some that have seen little prior examination with framing.

Additionally, each stimulus was classified according to the amount of relevant information that was readily available online for that stimulus, and so could potentially be discovered by the participant. Two categories of information availability were formed—"Low information" and "High information"—according to the following principles, based on a priori likely-search strategies. The amount of relevant information that was readily available online for each stimulus was examined with a series of searches of related terms using *Google* search engine several days prior to the experiment. Example search strings and the number of resulting web pages (e.g., blog posts, music reviews, artist biographies, and so on) that were relevant to that stimulus are listed in Table 1. Ten online searches were performed for each stimulus, and the relevance of the pages, up to a maximum of fifty pages for each stimulus, were checked by the researchers. Three of the stimuli produced two, six, and eleven relevant online web pages, respectively, and were labeled "Low information" availability. The two remaining stimuli each produced over 50 relevant online web pages and were labeled "High information" availability.

Procedures

Participants were drawn from a convenience sample of six undergraduate classes within an introductory music psychology course; the experiment occurred in the first week of the course meaning that participants had not yet examined related theoretical concepts. Two classes were randomly assigned to each of the three conditions listed above (i.e., 2 x historical; 2 x imaginative; 2 x unrelated) with procedures being identical between two classes receiving the same condition. The chosen classes contained approximately the same number of participants (see *Participants* section), although as listed in Supplementary Table 1 there was some small variation in gender proportions and musicianship balance between conditions. Each class was exposed to the entire set of five excerpts. The excerpt order was randomized between conditions, although classes within the same condition received stimuli in the same order as each other to ensure that the procedures for these within-condition classes did not change variables other than those of interest. Responses were made on either a personal device (a laptop or tablet), or a supplied desktop computer. Participants provided their demographic information using an online survey created with *Key Survey* (Key Survey, Inc., Braintree, MA, U.S.A.).

Each of the three conditions received a different type of instruction for framing of the stimuli, detailed below in the section *Framing details* and also in the Supplementary Material. Framing and music occurred in a sequence in which framing for a piece was presented first, which was immediately followed by listening to that piece. After listening finished, a time period of five minutes was allowed to give participants time to fill in their survey responses and to complete a "five-minute task" detailed below. Following this 5-minute period, framing for the next piece in the sequence began.

Participants used the online survey to provide responses for four variables: preference, complexity, familiarity and unusualness[4]. Each variable was recorded on an 11-point scale (0–10), with

[4] For detailed discussion on the variable "unusualness", see Chmiel and Schubert (2018, 2019b).

Table 1
This Table Contains The Details of the Stimuli Used

Piece title	Information level-Genre	Stimulus details	Excerpt duration	Example of search text string	Resulting relevant pages
Red ribbon	Low-Pop/Rock	Bright Young Things. (2010). Red ribbon [Sound recording]. On *The great Lonesome*. Soulmate Records.	2:21	"bright young things red ribbon music Australia"	2
Happy	High-Pop/Rock	Williams, P. (2013). Happy [Sound recording]. On *Girl*. I am other.	2:09	"pharrell williams song happy music 2013"	>50
Megalon	Low-Pop/Rock	Godswounds. (2014). Megalon [Sound recording]. On *Death to the babyboomers*. Sonichimaera.	1:52	"godswounds band megalon music Australia"	6
Tallawarra	Low-Classical	Peterson, J. (2000). Tallawarra [Sound recording]. On *Works by various Australian composers*. Australian Music Unit, ABC Classic FM.	2:10	"john peterson tallawarra classical music Australia"	11
Etwas bewegte	High-Classical	Webern, A. (1909). Etwas bewegte achtel and Bewegt, from Six pieces for large orchestra, Op. 6 [Sound recording]. On *Schoenberg, Webern, Berg: Orchestral works*. Warner Classics.	2:28	"anton webern six pieces for large orchestra atonal music"	>50

Note. The information level refers to a "Low" or "High" amount of information readily available online, based on the number of relevant pages for each stimulus following 10 online searches using Google shortly before the testing period. An example of an online search text string is provided for each stimulus; see method section for further detail. The genre refers to either Pop/Rock or Classical. Stimuli were shortened so they would fit within the allotted time period. However, due to their short duration of approximately one minute each, both movements by Webern were combined into one continuous excerpt; participants were informed of this before listening. This was the only excerpt not to feature a fade out, being the only "complete" works used. We use the piece title *Etwas bewegte* to refer to both of these movements collectively.

rating scales worded as "I like this piece"; "The music sounds complex"; This piece is highly familiar"; "The piece is unusual." Participants used response guides "Strongly Agree (10)"; "Strongly Disagree (0)"; "Neither Agree Nor Disagree (5)." Participants were expected to use their own understanding of terminology for each variable. Together, the three collative variables complexity, familiarity, and unusualness were collected to ensure that varied stimuli were used.

Framing Details

The framing instructions were displayed on a large screen that all participants in the class could see, and were also read out by the instructor before each stimulus was played. Participants received the same type of instructions for all five stimuli in their given condition. Furthermore, in the five minutes following each stimulus all participants completed a "five-minute task", which was different for each condition. Participants in all conditions were able to record their responses for the four variables at any point from the beginning of listening until the end of the five-minute task, and these responses could be made in any order and changed at any point up to the conclusion of the five-minute task. For all five-minute tasks, the instructor was able to monitor each participant's screen from a distance to ensure that all participants were taking part. The instructor was present to answer any questions or fix any technical issues, but aimed to let participants proceed with as little disturbance as possible.

For the historical condition the instructions began with a vignette containing background information for each piece (see Supplementary Material, Section A for vignettes as well as instructions for the five-minute task for this condition). Following the vignette, for the five-minute task participants in this condition were asked to perform an online search for additional information relating to that piece. This online search could occur at any time during music listening, and also during the five-minute task. The purpose of the five-minute task was to match the self-framing aspect of the historical condition as closely as possible to the self-framing of the imaginative condition. Participants were invited to enter this self-discovered information in an open-response text box in the survey, although supplying this information was not mandatory for submission of the survey page. We made the decision not to force participants to provide historical information so that the experience of creating an historical listening experience was as close as possible to a free imagery condition as possible. Furthermore, by not forcing responses we were able to ensure that the required stimuli could be played, framing discovered online, and variables responded to by participants in the allotted time for each session.

Participants in the imaginative and unrelated conditions did not receive background information via vignettes and were not informed of identifying details such as the title, artist, or year of production for each piece. Instead, participants in the imaginative condition were asked to imagine a story, scenes, imagery, or anything of the like to accompany the music they heard (see Supplementary Material, Section B). For the five-minute task participants in the imaginative condition were invited to enter any information relating to their imaginative experience in an open-response text box, although as above this was not mandatory for submission of the survey; this approach was intended to mimic the sequence of the historical condition as closely as possible.

Participants in the unrelated condition were asked to play an online game or puzzle from a provided list (see Supplementary Material, Section C) while they were listening, and to continue playing this game as their five-minute task that followed listening. This condition was designed to mimic mere exposure via incidental listening (see, Schellenberg et al., 2008; Szpunar et al., 2004). The unrelated condition could be considered an "active control", as participants are engaged while listening although not in a way that contains framing (active control is in contrast to a "passive control", as exemplified by the "pay attention" condition used by Zalanowski, 1986). Participants in the unrelated condition were able to note which game they had played in the open-ended response box, although as with the other conditions this was not

mandatory for submission of the survey. For a summary of the three framing conditions, see Supplementary Table 2.

Ethics

Prospective participants all agreed to participate and completed a written consent form. This study received ethics approval (UNSW Human Ethics Approval HC13015).

Results and Discussion

The data were analyzed in R using the brms package (Bürkner, 2017, 2018), which is a front end for the Bayesian inference and Markov chain Monte Carlo (MCMC) sampler Stan (Carpenter et al., 2017). Maximal random effects structures were used such that the effects of all within-piece predictors (the intercept, condition, musicianship, and gender) were allowed to vary between pieces, and the effects of all within-participant predictors (the intercept, information, and genre) were allowed to vary between participants. All effects were given weakly informative priors[5] in order to shrink toward zero any effects that may be only weakly evidenced by the data. The strength of evidence for each directional hypothesis was obtained from Bayesian evidence ratios, which are the posterior odds of the effect being in the direction specified in the hypothesis. Given the four hypotheses in this study are directional, we consider an evidence ratio greater than 19 to be strong, which is loosely analogous to a one-tailed *p*-value below .05 (Makowski et al., 2019). The use of maximal random effects structures and weakly informative priors (centred on zero effect) reduce the chance of incorrectly obtaining strong evidence for an effect (Barr et al., 2013; Gelman et al., 2012).

It is important to reiterate that the preference ratings were provided by participants during or directly after listening to each musical piece, and during the same time period participants also gave ratings for the three collative variables familiarity, unusualness, and complexity. These are post-treatment variables (i.e., they may be differentially influenced by the three framing conditions), and so controlling for them by including them as predictors might bias our inferences for the framing condition (Angrist & Pischke, 2009; Gelman et al., 2020). Because it is of interest to estimate correlations between the three collative ratings and preference, we use a multivariate model with four dependent variables: preference, and the three collative variables complexity, familiarity, and unusualness. This allows us to obtain the residual correlations between preference, familiarity, unusualness, and complexity—being the correlations beyond that explained by the independent variables in the model—without biasing our inferences related to the effect of the predictors on familiarity.

We report results from two separate models. Model 1 investigates the effect of framing condition. The effect of condition varies, as a random effect, by piece; the intercept varies by piece and by participant. This allows us to report the population-level effect of framing (averaged over every piece) as well as the group-level effect of framing for each piece. Model 2 shows the extent to which the effect of framing changes by the genre classification of the piece and, for the historical framing condition, the level of available information for that piece. Model 2 has an interaction between framing condition and genre, and a nested interaction between the historical framing condition and information. The effects of genre, information, and the intercept vary, as random effects, by participant.

In both models, the multilevel formulations mean that the effect of each framing condition is shrunk (partially pooled) toward its mean over the differing pieces (in model 1), and the effects of information level and genre are shrunk toward their means over the different participants (in model 2). This shrinkage causes the estimates and their contrasts to be more accurate (Davis-Stober et al., 2018) and more conservative than if they were estimated without taking account of the multilevel nature of the data (Gelman et al., 2012).

Alternative models with additional predictors (gender, musicianship, or both) were also fitted. PSIS-LOO, being a fast approximation of leave-one-out cross-validation (Vehtari et al., 2017), showed that including these variables led to poorer fits of out-of-sample data (Supplementary Table 8), and so they were not examined in further detail. Descriptive statistics for each piece, split by condition, musicianship and gender, and other Bayesian-related analyses are reported in the Supplementary Material, Section D. Additionally, descriptive statistics for the collative variables are reported in the Supplementary Material, Section E.

Model 1

Model 1 has the following R-style formula: $\sim 1 + \text{Condition} + (1 + \text{Condition} \mid \text{Piece}) + (1 \mid \text{Participant})$ – see also the Syntax provided in the Supplementary Material. The model is multivariate, so these predictors simultaneously model preference, familiarity, unusualness, and complexity, allowing us to compute their effects on each of these four dependent variables, as well as the dependent variables' residual correlations. As shown in Figure 1 and the "All pieces collapsed" section in Supplementary Table 4, there is no detectable population-level effect of framing condition averaged across every piece of music tested. However, for many of the individual pieces, the different framing conditions are strongly evidenced as producing different preference ratings (see Figure 2 and the "Hypothesis by piece" section in Supplementary Table 4).

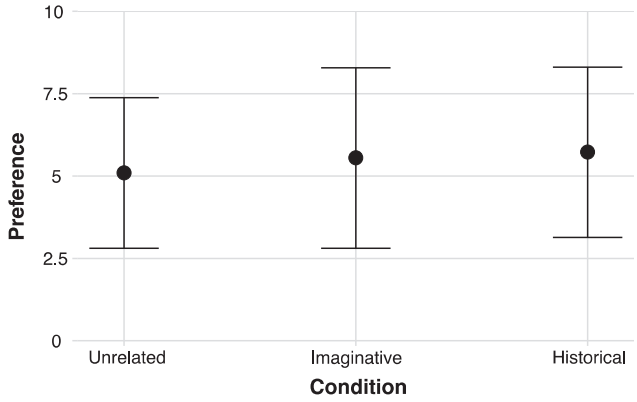
For *Red ribbon* there was strong evidence that all three conditions result in different preferences: lowest preference for the unrelated condition, higher preference for the historical condition, and highest preference for the imaginative condition. For *Happy* there are some similarities: the unrelated condition results in lower preference ratings than both the historical and imaginative conditions, although the effects of the latter two conditions are not distinguishable. For *Etwas bewegte* there was strong evidence that the historical condition was rated higher than the unrelated condition, although again the effects of the historical and imaginative conditions were not distinguishable from each other. Similarly, for *Tallawarra* there was moderate to strong evidence (evidence ratio of 18) that the historical condition was rated higher than the unrelated condition, but only weak to moderate evidence (evidence ratio of 8.15) that the historical condition produced higher preference than the imaginative condition.

In contrast to this, differences in preference ratings by condition for *Megalon* occur in the opposite direction to those for *Red*

[5] With a normal distribution of $M = 0$, $SD = 3$; N.B. that SD of the ratings were approximately 3.

Figure 1

Effects of Framing Conditions on Preference Ratings, Collapsed Across the Five Pieces



Note. Error bars are 95% Bayesian credibility intervals.

ribbon: the unrelated condition results in highest preferences, the historical condition has lower preference, while the imaginative condition has the lowest preference. Strong evidence was observed for each of these comparisons for *Megalon*. To summarize model 1, four pieces (all except *Megalon*) supported H1, and two out of five pieces (*Red ribbon* and *Happy*) supported H2, whereas one piece (*Megalon*) provided strong evidence for an effect that is counter to both H1 and H2. Overall this analysis shows that the lack of any obvious framing-based differences in ratings across all pieces (Figure 1 and the "All pieces collapsed" section of Supplementary Table 4) is due to the diverse effects of framing between the pieces; for example, the effects of *Red ribbon* and *Megalon* essentially cancel each other out.

The data do not support H3. Only one piece (*Red ribbon*) produced higher preference ratings for the imaginative condition compared to the historical condition, whereas for *Happy* these two conditions produced almost identical mean values of preference. For the remaining three pieces the historical condition produced higher preference than the imaginative condition.

The residual correlations for model 1 are shown in Supplementary Table 5. These indicate that—beyond the correlations implied by model 1's predictors—there is strong evidence for a moderate positive correlation between preference and familiarity, a small negative correlation between familiarity and unusualness, and a moderate positive correlation between familiarity and complexity. Supplementary Table 6 provides the cross-validated *R*-squared values for the four dependent variables. The model's fit for the ratings of preference, unusualness, and complexity, are broadly similar, although for familiarity the model performs substantially better. This can be explained by the large difference in familiarity between pieces, particularly exemplified by *Happy* (see Supplementary Figure 1).

Our examination of mean ratings for the collative variables by piece (see Supplementary Figure 1) suggests that, as was our intention, a varied selection of pieces within the two genres were selected. At times this led to significant differences in ratings for collative variables between pieces. We also examined each collative variable split by piece as well as condition, as can be seen in Supplementary Figure 2. In the figure, *Megalon* shows the largest discrepancy between conditions for all three collative variables. Similarly, *Red ribbon* shows significant differences between conditions for all three collative variables, and *Etwas bewegte* shows significant differences between conditions for complexity. Further examination of the collative variables and framing is beyond the scope of this paper, although we note that for some pieces the collative variables appear to hold a relationship with preference. It is possible that these are confounding variables that future approaches will need to account for.

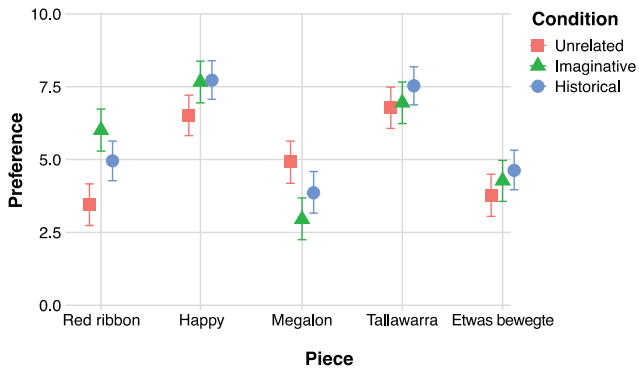
Model 2

Model 2 has the following R-style formula: ~ Condition * Genre + Historical:Information + (Genre + Historical:Information | Participant) – see also the Syntax provided in the Supplementary Material. As with model 1, this is a multivariate model with four dependent variables: preference, familiarity, unusualness, and complexity. The variable called "Historical" in this syntax is a binary indicator, which is 1 when the condition is Historical and otherwise 0; including this variable as an interaction with Information, allows us to "nest" Information (Low or High) within the historical condition, thereby ensuring it has no effect in the other two framing conditions (unrelated and imaginative). Condition is between-participants so it cannot be included as a random effect varying by participant, yet both Genre and Information are within-participant (at least for those who received historical framing) and so are included as effects varying by participant.

Figure 3 shows the effects of framing conditioned on the amount of information available for each piece (Low or High, with this being relevant only in the historical condition), and by two groupings of music genre (Pop/Rock and Classical). As confirmed by the Bayesian hypothesis tests in Supplementary Table 7, we have strong evidence (evidence ratio of 35) in favor of a positive effect of High information, in the historical condition. We also have moderate to strong evidence (evidence ratio of 15.5) that Classical music was preferred to Pop/Rock in the historical condition; there is no evidence for an effect of Genre in the other two conditions (unrelated and imaginative). PSIS-LOO comparison showed that this model performed significantly better than models with either Information or Genre removed (Supplementary Table 9).

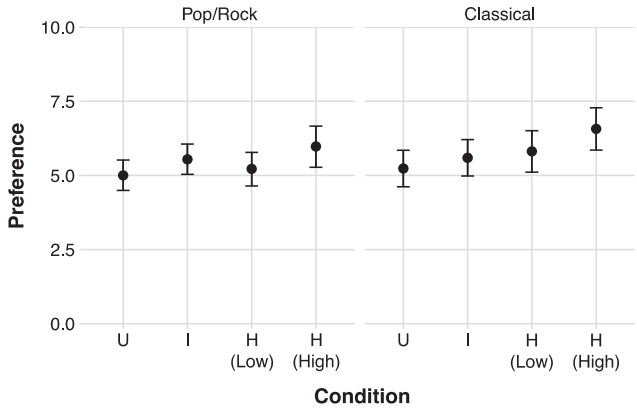
Figure 2

The Effect of Framing Condition on Preference Ratings for Each of the Five Pieces



Note. Error bars are 95% Bayesian credibility intervals. See the online article for the color version of this figure.

Figure 3
The Effect of Framing Condition on Preference



Note. The H (historical) condition is split into Low and High information pieces, and the overall data are also split by the genres Pop/Rock and Classical. N.b. that the High/Low information did not impact those in the I (imaginative) and U (unrelated) conditions; to account for this, within model 2 Information was nested within only the historical framing condition. The error bars are 95% Bayesian credibility intervals.

Overall, the findings from both models indicate that the impact of framing is largely dependent on piece, and possibly also on genre, although it is not yet clear how reproducible these differences are. Regardless, some trends can be observed and these are most evident when interpreting the results with reference to Figures 2 and 3, and particularly in terms of genre. For the two Classical pieces (*Tallawarra* and *Etwas bewegte*) the historical condition was consistently associated with the highest mean preference scores of all conditions. Indeed, for all pieces except *Megalon*, historical self-framing produced higher preference ratings than the control condition. Furthermore, when historical information could easily be located by the participant ("High information") mean preference was also relatively higher regardless of the genre (see Figure 3 in particular).

For the popular music pieces *Happy* and *Red ribbon* no trends could be identified other than preference for the unrelated condition being lowest. Yet the eclectic results across these two pieces were no longer consistent when *Megalon* (a piece that could arguably be classified as popular, although contained different instrumentation to the other two popular examples) was treated as a third member of the broader "Pop/Rock" genre category. In brief, counter to H3, historical framing appears to have a greater positive impact on music preference than imaginative framing does, particularly when more historical information is available. It could be that having access to historical information helps the listener to make the experience more enriching, and also aids in comprehension of the music (as proposed by Belke et al., 2010). However, there are some important caveats to this interpretation.

For *Happy*, preference ratings occurred at a relatively high level for all conditions. This could be interpreted as a ceiling effect, meaning that all framing conditions were only able to produce marginal improvements. Additionally, as *Happy* also received very high levels of familiarity ratings we can infer that framing for this piece is likely interacting with previous exposures to the piece. For example, it is possible that while framing was having a positive impact on preference, this was also interacting with decreasing preference for some participants who were past the optimal point of exposure (according to the inverted-U model of preference; see Berlyne, 1960, 1971; Chmiel & Schubert, 2017). Hence, exposure may be an overriding factor for this piece, with framing having a more subtle effect. This interpretation is somewhat supported in the greater spread of means for each framing condition for the other pieces.

We also need to be cognizant of the nature of the framing tasks. It is possible that the imaginative framing task was not as successful for *Megalon* as it was for other pieces, and that for this piece there was little interesting historical information available for participants to find. This could explain why the framing conditions produced lower mean ratings of preference than the control condition for this piece; a different imaginative task, for example, may have produced different results. This interpretation reminds us of the nascent state of imaginative framing in particular, and that a wider range of approaches for imaginative framing are required to properly interrogate its impact in a more nuanced way. Our study is therefore necessarily exploratory in some respects, and more systematic control of each of the framing conditions (historical and imaginative) is needed to better understand their subtleties, such as how they interact with genre and familiarity/exposure.

Conclusion

This paper examined two types of guided self-framing—historical and imaginative—against an incidental listening control (unrelated) condition that accompanied music listening for five varied excerpts. Music preference for each condition was the variable of interest. The inclusion of historical self-framing was a novel approach, as to the best knowledge of the authors self-framing for music has previously only been used with imaginative tasks. Our inclusion of this condition stemmed from the desire to match the historical and imaginative conditions as closely as possible, to allow direct comparison.

Four hypotheses were formulated: H1, that the historical condition would produce higher preference than the unrelated condition; H2, that the imaginative condition would produce higher preference than the unrelated condition; H3, that the imaginative condition would produce higher preference than the historical condition; and H4, that historical self-framing would be more effective at increasing preference for pieces with a "High" level of readily available online information than for pieces with a "Low" level of such information. Four of the five pieces produced increased preference for historical framing in comparison to the control, providing strong support for H1. In contrast only two of the five pieces supported H2, although one of these comparisons (for the piece *Red ribbon*) produced the strongest Bayesian evidence ratio observed in this paper. Together these findings indicate that both historical framing and imaginative framing were able to significantly enhance music preference, although at times no effect or a negative effect on preference was instead observed.

As imaginative framing was not able to enhance preference as frequently as historical framing was able to, we reject H3. The present data suggest that imaginative framing had greater potential to enhance preference for popular music (particularly regarding *Red ribbon*) compared to classical music, but our small sample of stimuli for each genre means that further investigation is needed.

H4 was also supported, with examination of preference ratings for those in the historical condition showing higher ratings for the pieces that had a high level of available information when compared to those with a low level of available information. In contrast to the four pieces supporting H1 and H2, for the fifth piece (*Megalon*) we found that the control condition produced substantially higher preference than either of the framing conditions. We attribute this anomalous finding to a combination of the unusualness of the piece, the lack of availability of historical information to aid the listeners in the historical framing condition, and possibly also due to stylistic differences between this piece and the others that were used.

While the present paper has provided an important insight into the potential benefits of framing, the findings also highlight the need for further study containing additional stimuli, as well as greater musical diversity, to better understand the complexities at hand. We also recommend that future work should aim to implement novel strategies that allow greater control on the availability of information related to each piece. This may constitute an alternative approach to the open-ended web-based searches that were performed here. One such solution might concern the use of an information database that is made available to participants, which would allow clear tracking of what information is interacted with as well as more control over the framing information presented. We also recommend further consideration of how to best present the various types of self-framing instructions, and additional control for collative variables such as existing familiarity with the music. We were unable to definitively ascertain if these variables somehow interacted with the framing conditions, suggesting another fruitful area for future study.

In summary, the method of self-framing proposed here has been demonstrated to significantly impact (either positively or negatively) preference for music that is heard under several circumstances (regarding genre, existing familiarity, and availability of information in particular). The data at hand suggest that historical framing is the most likely candidate to enhance preference, although the subtleties and reproducibility of this notion are not yet fully understood. This has implications for how music is presented and promoted, as well as helping to build psychological models of preference for music and the arts.

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