Note

Citation

Steffens, J., & Anglada-Tort, M. (2023). The effect of visual recognition on listener choices when searching for music in playlists. *Psychology of Aesthetics, Creativity, and the Arts*, *19*(4), 587–596. https://doi.org/10.1037/aca0000562

The effect of visual recognition on listener choices when searching for music in playlists

Jochen Steffens[1, 2] and Manuel Anglada-Tort[2, 3]

[1]Department of Media, Düsseldorf University of Applied Sciences

[2]Audio Communication Group, Technische Universität Berlin

[3]Computational Auditory Perception Group, Max Planck Institute for Empirical Aesthetics

Abstract

With so many options available, how do listeners search for and choose music effectively? Here we examine the role of a simple cognitive heuristic: choosing based on recognition. In two experiments, participants were presented with multiple musical choices and asked to choose their favorite songs. We manipulated visual recognition by presenting songs either with recognizable titles (names previously learned in a familiarization task) or completely novel ones. In line with the Recognition Heuristic (Goldstein & Gigerenzer, 2002), Experiment 1 tested whether listeners rely on visual recognition in a compensatory fashion. Participants had to choose one of a pair of songs presented with familiar/novel titles and social information about the quality of the song (positive, neutral, and negative). Results revealed that visual recognition only was a significant driver of choice when participants selected music based on visual information. However, participants' choices were largely influenced by social information. This suggests the use of a cue integration strategy in which listeners weigh all available cues and combine them according to their utility to choose the optimal option. In Experiment 2, we tested the main effect of visual recognition in a more complex decision-making situation, where participants had to choose their favorite songs from a playlist with 10 choice options. Participants' choices were significantly influenced by the recognition of song title, even when they were allowed to listen to all music options. This suggests that visual recognition may be more influential in multi-choice situations due to the higher demands of the task. We discuss these findings in terms of the implications of recognition effects on listening behavior and aesthetic preferences, audio streaming services, and the music industry.

Introduction

Listening to music is easier than ever before. As a result, music listening has become one of the most prominent activities in everyday life (Greenberg & Rentfrow, 2017) and a multi-billion dollar industry (ifpi, 2021). Due to the dramatic increase of audio streaming services in recent years - Spotify, Apple Music, YouTube – listeners now have access to millions of songs almost instantly, as well as a myriad of user- and computer-generated playlists, confronting them with a seemingly endless range of musical choices. For artists and labels, the decisions of streaming users are crucial, as royalties depend on click counts which have become an essential element of monetization after the steady decrease in record sales since the late 1990s (Routley, 2018). This raises the questions of (1) how listeners manage to choose music effectively from this vast amount of choices, and (2) which psychological mechanisms may influence music preferential choice in such situations (Anglada-Tort, Masters, Steffens, North, & Müllensiefen, 2022).

Research in the field of Music Information Retrieval (MIR) has begun to look into how listeners behave when searching and choosing music in playlists, in particular in the context of music recommendation algorithms (e.g., Barrington, Oda, & Lanckriet, 2009; Fields, 2011). A playlist can be defined as 'a collection of songs grouped together under a particular principle' (Barrington et al., 2009), or as 'a set of songs meant to be listened to as a group, usually with an explicit order' (Fields, Lamere, & Hornby, 2010). Factors influencing music decisions in playlists include listeners' preference for music, song familiarity, song coherence, and music diversity (Fields, 2011). The order of songs in a playlist can also have an impact, including song transitions, the overall structure of a playlist, and the occurrence of serendipity (Mooij & Verhaegh, 1997; Fields, 2011). Moreover, findings by Barrington et al. (2009) suggest that the visibility of song and artist names can have a positive influence on playlist evaluations and decreased decision time compared to choosing songs from a playlist where no such contextual information is available.

However, little is known about the precise cognitive mechanisms underlying decision-making when listeners search for and choose music in playlists. Research on the

intersection between music and behavioral economics shows that when making judgments and decisions, listeners are constrained by the information available to them (e.g., artist's descriptions, song titles, or popularity ratings) and their mental resources, such as memory and emotion (Anglada-Tort et al., 2022). Consequently, listeners use information selectively and rely on cognitive heuristics to simplify complex situations into easier-to-calculate operations. For example, in line with processing fluency (Reber et al., 2004), songs with more repetitive lyrics are perceived as more familiar and found to have an increased likelihood of being commercially successful (Nunes et al., 2015). This cognitive bias favouring easy-to-process stimuli can even affect listeners when the manipulation is minimal. Anglada-Tort, Steffens, and Müllensiefen (2019) found that music preferences were significantly more positive when songs were presented with fluent titles (easy-to-pronounce) compared to disfluent ones (difficult-to-pronounce). Social influence is another important cognitive bias affecting listener choices, where the behavior of an individual is influenced by the behavior of others (Berlin, Bernard, & Fürst, 2015; Berns, Capra, Moore, & Noussair, 2010; Dewan & Ramaprasad, 2012; Dewan, Ho, & Ramaprasad, 2017). Such social influences have been found to underline key popularity dynamics in the music market (Salganik et al., 2006).

The role of visual recognition on listener choice

Among all potential cognitive mechanisms underlying listener choices when searching for music in playlists, this paper focuses on the role of visual recognition. As humans, we develop preferences for things simply by becoming familiar with them. This is known as the mere exposure effect (Zajonc, 1968) and has been supported by decades of research in psychology and marketing. For example, studies have shown that people prefer stimuli they have previously seen, even if they were not aware of seeing them (see Bornstein, 1989, for a review). In decision-making situations, the recognition heuristic has been proposed as a simple mechanism by which familiarity guides choice (Goldstein & Gigerenzer, 2002; Pachur, Todd, Gigerenzer, Schooler, & Goldstein, 2011). The recognition heuristic proposes that recognized options will be chosen over unrecognized ones if recognition is predictive of the decision criterion, regardless of any other available relevant information (Goldstein & Gigerenzer, 2002). Thus, this heuristic only applies

usefully in domains in which knowledge is limited, and some (but not all) options in the choice set are unrecognized.

Since knowledge and time are often limited when searching for music in playlists, we expect listeners to rely on recognition cues. In particular, we expect that songs with recognizable titles will enter the mental awareness set and, in turn, pass on to the consideration set more readily than songs paired with novel titles (see also Shocker, Ben-Akiva, Boccara, & Nedungadi, 1991). However, listeners do not always use the same searching behavior when choosing music in playlists. Listeners may sometimes search for music only based on visual information (e.g., title and artist name), whereas on other occasions they may (pre-) listen to the music as well. It seems plausible that in the presence of the music, the influence of contextual factors, such as visual recognition, may vanish or at least be diminished. On the other hand, there is evidence from consumer research showing preferences for highly recognized brands even when participants are allowed to consume each product in the choice set before making a decision (Hoyer & Brown, 1990; Macdonald & Sharp, 2000). Thus, we hypothesized:

> H_1: The familiarity (recognition) of song titles presented with music will be a significant determinant of listener choice, although the magnitude of its effect will decrease in the presence of music (Experiment 1 and 2).

A core assumption of the recognition heuristic is that people use it in a non-compensatory fashion (Goldstein & Gigerenzer, 2002). That is, 'no other information about the recognized object is searched for and, therefore no other information can reverse the choice determined by recognition' (p. 82). This assumption is key to understanding how recognition may affect listener choice. For example, using a non-compensatory strategy would indicate that listeners ignore some of the relevant information and only use one cue (i.e., recognition) to determine a decision, supporting previous research on the recognition heuristic in inferential choice (Goldstein & Gigerenzer, 2002). In contrast, using a compensatory strategy would indicate that listeners consider all available cues and combine them according to their usefulness in

pointing to one choice option over another, supporting the cue integration framework (Oeusoonthornwattana & Shanks, 2010). The non-compensatory principle of the recognition heuristic has been challenged in several studies, showing that additional cues can indeed influence or even exceed the effect of recognition (see Pachur, Bröder, & Marewski, 2008, for a review). This is particularly true in preferential choice, where consumers combine the recognition of brand products with additional information presented with the brands (Oeusoonthornwattana & Shanks, 2010; Thoma & Williams, 2013). In the context of listening behavior, many factors may be combined with visual recognition, such as properties of the music itself (e.g., listeners' preferences for certain music genres or styles), associations with the title and artist name (e.g., affective responses, semantics, prestige), or social cues presented with each song (e.g., popularity ratings given by other listeners). We thus hypothesized:

> $H_{2:}$ When choosing music in playlists, visual recognition will influence choice in a compensatory manner; that is, participants will consider all available cues and combine them to determine their decisions (Experiment 1).

Finally, previous research on the role of recognition in preferential choice is limited in that it requires participants to make a decision involving only two options, such as measuring consumer choice between pairs of brands in a 2-alternative-choice (2AFC) task (Oeusoonthornwattana & Shanks, 2010; Thoma & Williams, 2013). Thus, it remains unclear whether the results observed in 2AFC paradigms generalize to more complex situations where multiple options are available in the choice set. Here, we investigated whether recognition effects extend to more complex situations where listeners are faced with multiple-choice options. Specifically, we hypothesized:

> $H_{3:}$ The familiarity (recognition) of song titles will influence listener choice both in simple situations with two-choice options (Experiment 1) and more complex situations with multiple-choice options (Experiment 2).

To address the hypotheses presented above, we adapted the paradigm from Thoma and Williams (2013) to musical choices in playlists. In Experiment 1, we investigated the non-compensatory use of the recognition heuristic by presenting each song in the pair with additional social information – i.e., either positive, neutral, or negative ratings. In Experiment 2, we examined a similar choosing situation where participants were presented with a playlist with 10 choice options and had to choose their favorite five. In both experiments, song title recognition was manipulated within the experimental design by familiarizing participants with a list of Spanish song titles prior to the main choosing task, providing a set of previously learned titles and a set of completely novel ones to pair with the music. To investigate the role of visual recognition in the presence and absence of music, we compared participants' choices in two playlist conditions: a *visual-only* (where participants selected music only based on their song title) and a *visual-and-auditory* condition (where they could also listen to the music).

Experiment 1

Methods

Participants

A total of 107 participants (52 female, 55 male) with an average age of 42.7 years (*SD* =11.3) took part in the experiment and was included in the final analysis. The study was distributed via Amazon Mechanical Turk and conducted online using *Qualtrics*. Participants were compensated with 1.50$ for taking part in the experiment which lasted about 10-15 minutes on average. The majority were English native speakers (98.1%), whereas two participants were German and Polish Native speakers, respectively. None of the participants of the final sample spoke Spanish.

Design

The experiment used a within-participants design measuring preferential choice in a two-alternative forced-choice task, using an adaption of the paradigm described in Thoma and Williams (2013). The independent variables were the recognition of the titles (learned vs. novel) and additional social information presented with each song (positive, neutral, and negative), as indicated by five-, three-, and one-star popularity ratings, respectively.

In addition, we examined participants' choices in two playlist conditions: a *visual-only* condition (where they could only choose music based on verbal cues – i.e., song titles) and a *visual-and-auditory* condition (where they could also listen to the music).

Using a Latin Square design, we made pairs of novel songs (unfamiliar to participants, see *materials*) where one song in the pair was always presented with a previously learned title and the other song with a novel one. We then created three types of critical pairs: control, positive, and negative. For the neutral control pairs, both the learned and the novel song titles were presented with three stars (out of a possible five) underneath the song title. For the positive pairs, the learned song title was presented with five stars and the novel one with one star (low-rated). In the negative pairs, the learned song title was presented with one star (low-rated) and the novel song title with five stars (high-rated). Participants were told that the popularity ratings were determined by the ratings of previous listeners.

Materials

The song titles consisted of Spanish titles obtained from actual Spotify playlists. The decision to use Spanish titles was made to ensure that all titles were novel to our non-Spanish speaking participants. To reduce potential confounding effects associated with the linguistic properties of the titles, these were selected according to the following criteria: (i) all titles had to be matched in word count and length and thus only included titles consisting of one word and 5-9 characters matching the average orthographic word length in Spanish (M = 7.9, SD =2.2)), as reported by Marian, Bartolotti, Chabal, and Shook (2012), (ii) highly frequent words in Spanish (those with a relative frequency of more than 5,000) were excluded, and (iii) the orthographic similarity (OS) between the Spanish words and their English and German translations had to be low, i.e., only including words with an OS value smaller than 0.3. To retrieve these linguistic variables from the Spanish titles, we used the NIM stimulus search engine for psycholinguists (Guasch, Boada, Ferré, & Sánchez-Casas, 2013). Based on these criteria, we selected 24 music titles. The titles were randomly divided into two blocks (A and B). In block A, one set of titles remained novel (1-12), whereas the other set (13-24) was included in the learning phase and, therefore, was learned by participants through a familiarization process. In block B,

the order was reversed, i.e., the first set of titles was learned (1-12) and the other set novel (13-24; see Appendix for the list of Spanish titles used in the two test versions and conditions in Experiment 1).

For the music stimuli, we used 30-second excerpts of 15 non-vocal dance/electronica tracks that had been evaluated previously by 62-116 participants regarding their familiarity, liking, and musical expression (Lepa, Herzog, Steffens, Schoenrock, & Egermann, 2020) . To avoid the recognition of single tracks and associated popularity effects, we only selected songs with low familiarity scores (with a mean value of 1.8, on a scale of 1-6, *SD* = 0.6). To control for music liking, we selected music excerpts with similar liking ratings, with an average score of 3-4, on a scale of 1-6 (*SD* = 0.3). An overview of the songs used is also presented in the Appendix.

Procedure

Before starting the experiment, a declaration of consent was issued, in which the voluntary nature of participation and the possibility of quitting the study at any time was explained. Then participants reported on the sociodemographic variables age, gender, nationality, country of residence, and language skills. Participants were then randomly assigned to one of two test blocks (A: 51 participants; B: 56 participants).

Learning phase. The first part of the experiment consisted of a learning phase in which participants were familiarized with a set of song titles to build the 2AFC task. In particular, participants were instructed to memorize eight Spanish words displayed on the screen. To enhance the learning effect, they were asked to write the words twice in a text box to the right. When the learning phase was completed, participants were presented with a memory test. Specifically, they were presented with the eight Spanish names side-by-side with four new (and henceforth unknown) ones, in random order, and they had to indicate whether they had seen the words in the previous section or not.

Choosing phase. Using a 2AFC paradigm, participants were presented with four pairs of songs in each playlist condition (*visual-only* and *visual-and-auditory*), resulting in a total

of eight trials. In each condition, two of the pairs were neutral, one positive, and one negative. The order of the pairs within each condition and the order of the two conditions was randomized for each participant. In each trial, participants were instructed to consider the two options in the choice set and to choose their favorite one to create a playlist.

Results and Discussion

Participants who reported speaking Spanish were excluded afterwards (n = 4). No further participants were excluded since they all passed a pre-defined threshold of 10 out of 12 correct responses in the learning phase, resulting in a final sample of 107 participants included in the subsequent analysis.

Effect of title recognition and star ratings on choice

In line with the analytic strategy used in Oeusoonthornwattana & Shanks (2010) and Thoma & Williams (2013), to test the main effect of title recognition on musical choice, we calculated participants' mean choice proportions in the three types of critical pairs of popularity ratings (positive, negative, and neutral) and the two playlist conditions separately (see Figure 1, for the general means in each condition across participants).

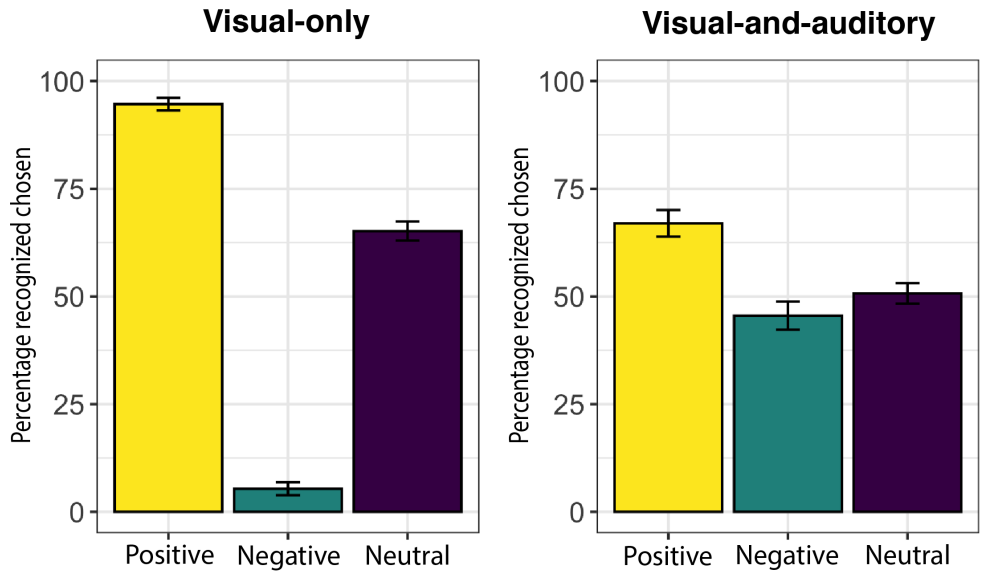


Figure 1: Mean choice proportion of the recognized titles and 95% confidence intervals in the different types of critical pairs of popularity ratings and playlist conditions. Note. Positive: The learned song title was presented with five stars whereas the novel one with one star. Negative: the learned song title was presented with one star whereas the novel one with five stars. Neutral: both titles in the pair were presented with three stars.

Visual-only condition: First, to test whether participants relied on title recognition to choose music in the visual-only condition, we examined whether recognized items in the neutral condition were chosen more often than chance (50%) using a one-sample t-test. Results confirmed that the proportion (64.5%) was significantly higher than chance, t (106) = 4.54, p <.001, supporting our first hypothesis (H_1). To test for a compensatory choice strategy (H_2), an analysis of variance (ANOVA) was conducted with mean choice proportions in each of the three types of critical pairs as repeated measures (see Figure 1 - left). Since the sphericity assumption was violated (χ^2 (2) = .886, p = .002), degrees of freedom were adjusted utilizing the Greenhouse-Geisser estimates of sphericity (□= .898). The results revealed a significant main effect of popularity ratings, F(1.8, 190.3) = 357.1, p < .001, R^2 = .69, indicating that participants chose music presented with recognized titles significantly more often when they were presented with five stars (positive) than when they were presented with three stars (neutral) or one star (negative). Posthoc Bonferroni-corrected pairwise comparisons confirmed that mean choice

proportions in all conditions significantly differed from each other. That is, the mean choice proportion of recognized titles was significantly higher in the positive (96.3%) than in the neutral (64.5%, t[106] = -9.0, p < .001) and negative (3.7%, t[106] = - 26.21, p < .001) condition.

Visual-and-auditory condition: To test whether participants relied on title recognition in the presence of music, we performed another one-sample t-test to examine whether that mean choice proportions in the neutral condition (51.9%) were above chance (50%). This time, the results indicated that title recognition did not significantly influence participants' choices, t (106) = .39, p = .70, rejecting H1. Furthermore, an ANOVA was computed to test for the effect of popularity ratings on mean choice proportions. Again, the sphericity assumption was violated (χ^2 (2) = 0.907, p = .006), so degrees of freedom were adjusted utilizing the Greenhouse-Geisser estimates of sphericity (□= .915). The ANOVA again revealed a significant main effect of popularity ratings, F (1.83, 193.9) = 8.1, p = .047, R^2 = .05. Also note that the effect size is much smaller compared to the visual-only condition, indicating that social information effects decrease in the presence of the criterion being judged, but are not completely suppressed. Posthoc Bonferroni-corrected pairwise comparisons further confirmed that the mean proportion of choices was significantly higher in the positive (69.2%) than in the neutral (51.2%, t [106] = -2.8, p = .014) and negative condition (45.8%, t [106] = -3.8, p < .001). The difference between the neutral and negative pairs, however, was not significant, t (106) = 1.0, p = .96.

Taken together, the results of Experiment 1 show that participants only relied on the recognition of song titles when they chose music based on visual information, partially confirming Hypothesis 1. In the presence of music, the influence of visual recognition on participants' choices was non-significant. This is most clear when looking at the mean choice proportion of the recognized titles in the neutral condition, where both songs in the pair were presented with neutral popularity ratings. Social information presented with the music had a large impact on participant choices both in the absence and presence of music, either increasing or suppressing the effect of visual recognition. This suggests that recognition cues are used in a compensatory rather than non-compensatory fashion (H_1).

Experiment 2

Experiment 1 revealed under which circumstances listeners rely on title recognition when choosing music in 2AFC situations. Experiment 2 aimed at extending this paradigm by looking at the effects of title recognition in a playlist with multiple choice options. In particular, we adapted the materials used in Experiment 1 and created playlists of ten novel songs where half were paired with previously learned Spanish titles and the other half with completely novel ones.

Methods

Participants

A total of 99 participants (35 female, 63 male, one divers) with an average age of 33.7 years (*SD* = 9.3) took part in the experiment and was included in the final analysis. The study was advertised via social media channels and university email lists and conducted online using *LimeSurvey software*. The experiment lasted about 10-15 minutes on average. The majority of the test subjects were German native speakers (92.9%), whereas the remaining 7.1% were English native speakers. None of the participants spoke Spanish.

Design, materials, and procedure

The main difference between Experiment 1 and 2 was the number of choice options in the playlist. That is, Experiment 2 applied a within-participants design measuring participants' choices in a 10-alternative-forced choice task, resembling a common choosing situation in a music playlist. In two playlist conditions, participants were presented with a set of ten songs randomly paired with five recognizable titles and five new ones, with the condition that the same song and title could not be repeated twice for a given participant. In both conditions, they were to consider all options in the playlist and choose their favorite five songs to create a playlist. In the *visual-only* condition, participants had to choose their five favorite songs based only on visual cues (i.e., song title), whereas, in the *visual-and-auditory* condition, participants did so after also listening to the underlying pieces.

The music stimuli and titles were the same as used in Experiment 1. We also used the same blocking strategy with two blocks (A and B) across participants (about half of the participants were randomly allocated to block A [N = 43] and the other half to block B [N = 56]). In line with Experiment 1, this experiment consisted of a learning phase with a memory test and a choosing phase.

Results and Discussion

Seven participants who reported less than four titles (40%) correctly in the recognition phase were excluded, resulting in 99 participants being included in the final analysis.

Figure 2A shows the overall mean choice proportion of music clips paired with learned and novel titles in the two playlists. Visual recognition significantly influenced participant choices in the two playlist conditions, but the effect was about three times larger in size when participants chose music only based on visual cues (their titles). In the *visual-only* condition, the mean choice proportion of music paired with learned titles was 62% and the mean choice proportion of music paired with novel titles was 38%. In the *visual-and-auditory* condition, the mean choice proportion of music paired with learned and novel titles was 54% and 46%, respectively. Figure 2B shows the same results at the title level, indicating that visual recognition effects were generally consistent across all song titles.

To test the main hypotheses regarding the effect of title recognition on music choices (H_1), we computed an ANOVA where the mean choice proportion per participant was the dependent variable and title recognition (learned vs novel), choosing condition (visual-only vs visual-and-auditory) and their interaction were the independent variables. The ANOVA revealed a main effect of title recognition on choice proportions, $F(1, 392) = 53.20$, $p < .001$, $\eta^2 = .115$. It further revealed a significant interaction between title recognition and choosing condition, $F(1, 392) = 15.83$, $p < .001$, $\eta^2 = .034$, whereby the main effect of choosing condition was not significant, $F(1, 392) = 0.00$, $p > .99$. Figure 2 reveals a much larger influence of recognition when listeners chose music only based on

verbal rather than both verbal and music cues. This also becomes obvious when analyzing the two choosing conditions separately, $R^2_{\text{visual-only}} = .202$, $R^2_{\text{visual-and-auditory}} = .037$.

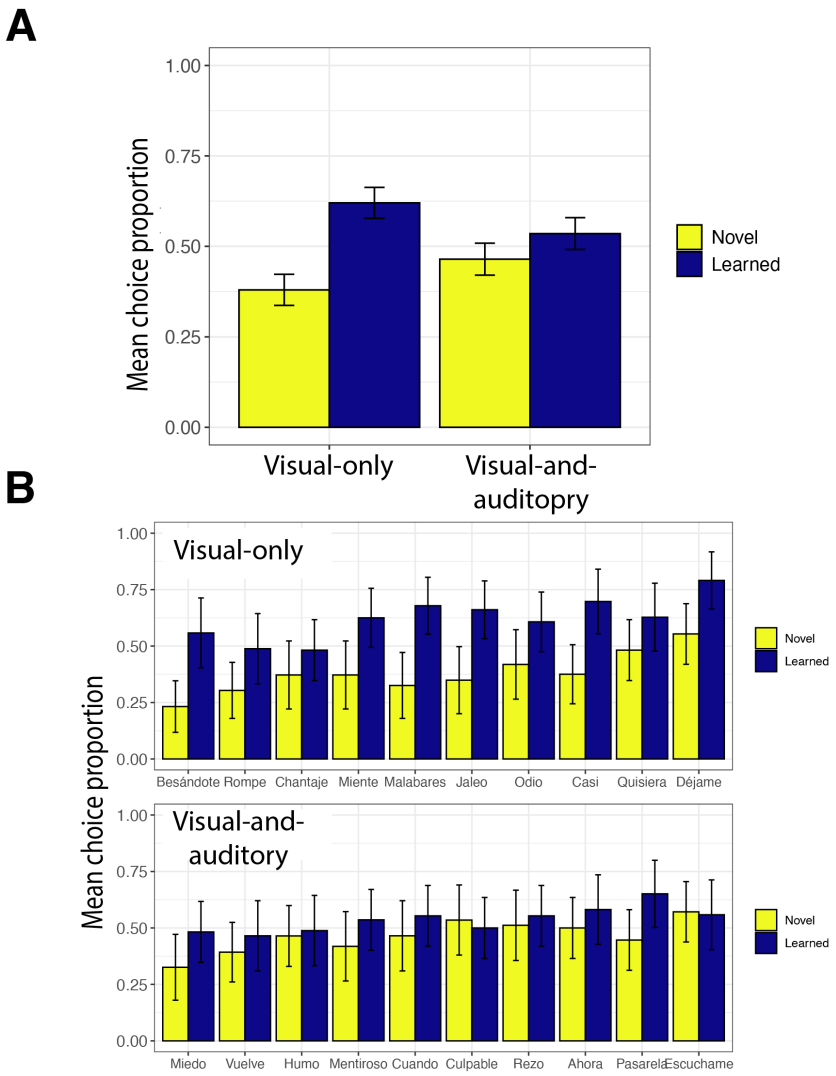


Figure 2: (A)Mean choice proportion of music and 95% confidence intervals when paired with learned and novel titles in both playlist conditions. (B) Results of the two choosing conditions across song titles.

Overall, Experiment 2 extended the results obtained in Experiment 1 (2AFC task) in a more complex task with multiple-choice options (playlists with 10 songs). This time, title recognition influenced participant choices in both playlist conditions, where participants chose music significantly more often when it was presented with previously learned titles

rather than novel ones. The presence of the criterion being judged (the music) significantly reduced the effect of title recognition but it did not suppress it completely.

General Discussion

The drastic increase in audio streaming services observed in recent years provides listeners with a vast variety of songs almost instantly. Despite this, little is known about how listeners make efficient decisions when searching for music in such large digital collections. We conducted two experiments to examine listener choices in a simple decision task with two choice options (Experiment 1) and a more complex situation with 10 options instead (Experiment 2). In both conditions, the familiarity (recognition) of song titles presented with music was a significant determinant of listener choice (Hypothesis 1). However, in Experiment 1 this effect was only significant when participants chose music based on visual information, whereas in Experiment 2 title recognition also influenced participants when they were allowed to listen to the actual music (although the magnitude of the effect decreased drastically). Specifically, allowing participants to listen to the music decreased the influence of title recognition by 13.3% in Experiment 1 (neutral condition) and by 8% in Experiment 2. Interestingly, in Experiment 1 we also found that the presence of music decreased significantly the influence of popularity ratings (an absolute decrease of 42.1% in negative ratings, and an absolute decrease of 27.1% in positive ratings). These results show that the effect of contextual factors on playlist choice behavior is significantly more influential when participants choose music without listening to it. Although this is not surprising, it has important implications for audio streaming services, where listeners often choose music only based on visual information.

Our second hypothesis focused on testing whether title recognition influenced listener choice in a non-compensatory fashion (meaning that additional information is ignored), directly testing the use of the Recognition Heuristic (Goldstein & Gigerenzer, 2002). We found that participants combined title recognition with additional social information presented with the music (Experiment 1). These results are therefore less consistent with the recognition heuristic (Goldstein & Gigerenzer, 2002) and more in line with the cue

integration framework (Oeusoonthornwattana & Shanks, 2010). That is, listeners consider all available cues and combine them according to their usefulness in pointing to one choice option over another. Thus, although recognition is a highly accessible cue, there is nothing special about it and it can either be contradicted or compensated for by other information. This finding broadly supports previous research on preferential choice in the context of consumer behavior (Oeusoonthornwattana & Shanks, 2010; Thoma & Williams, 2013). Interestingly, we found that the presence of negative social information suppressed the effect of title recognition almost completely. This is different from the results obtained in Oeusoonthornwattana & Shanks (2010) and Thoma & Williams (2013), who found that presenting well-known brands with negative information did not completely suppress the effect of recognition cues on choice. This could be because participants did not perceive the negative statements used in their study as truly negative, whereas in our study, popularity ratings presented with music may have had a stronger effect on preference. It is also plausible that music preferences are more susceptible to social information than preferences for brands.

Finally, the results of Experiment 2 show that it is important to test the generalizability of 2AFC paradigms to more complex situations with multiple-choice options, such as choosing music in playlists with 10 songs (Hypothesis 3). Only in this situation, we found that title recognition influenced musical choices in both playlist conditions, even when participants were allowed to listen to all music options. This suggests that in more realistic multiple-choice scenarios, visual recognition may be more influential due to the higher demands of the task. A potential model to explain music decision making in situations with multiple alternatives is the *elimination by aspects* model (Tversky, 1972), which argues that people tend to reduce a large set of alternatives by eliminating them based on probabilistically selected criteria. This model corroborates choice theories from marketing literature proposing a two-stage process. That is, when people are facing multiple alternatives they first form a smaller set of relevant alternatives and then inspect the alternatives in this consideration set in more detail (Alba & Chattopadhyay, 1985; Hauser & Wernerfelt, 1990; Howard & Sheth). We believe our paradigm can be easily

extended to test the applicability of these models to further study listener choices in complex decision situations with multiple alternatives.

Does visual recognition provide a useful decision heuristic to choose music effectively? Choosing based on recognition might function as a shortcut to infer the quality of the music without any additional information. For example, songs are recognized when they are popular (i.e., liked by many others) or recommended by someone else (i.e., implying a good intrinsic quality or fit with one's own preferences). Thus, choosing music based on title recognition allows listeners to use very little information, cognitive resources, and processing time to make decisions that approximate (seemingly) optimal consumption. However, relying on title recognition also comes with certain 'risks'. From the listeners' point of view, it may decrease seeking behavior, favoring a status quo bias where listeners overplay known songs while decreasing the potential of discovering unknown artists that may be rewarding. But perhaps the most important risk concerns the winner-takes-all phenomenon – i.e., the highly skewed distribution of success that characterizes the music market, where only a few hits expand across the time and the globe while the majority of music is consumed locally and for shorter periods (Keuschnigg, 2015). Many factors contribute to this phenomenon, such as the scalability of cultural products and the dynamics of social influence and popularity (Salganik, Dodds, & Watts, 2006). Similarly, the bias to choose music that can be quickly recognized observed in this study (in particular when choosing music visually), could further contribute to inequality in the music market.

There are some limitations to the experiments reported here. First, the recognized titles in our experiments were learned within the experimental setting. It is thus possible that this design feature might have artificially enhanced or lowered the role of recognition. Second, we did not consider the degree of involvement of our participants while taking part in the two experiments. Models of persuasion, including the Elaboration Likelihood Model (Petty & Cacioppo, 1986) and the Heuristic-Systematic Model (Chaiken, 1980), suggest that peripheral cues (such as title recognition) are more persuasive under low-involvement consumption and when listeners only spend a limited time to make a

decision (Pachur & Hertwig, 2006). Thus, in a real-world scenario, title recognition may be less influential when consumers are highly involved and motivated in listening to a specific piece.

Third, our results are also limited by the forced choice imposed at the song level. Naturally, playlist choices in the real world do not only involve decision at the song level but also at the playlist level, such as choosing based on musical genres rather than song titles. We thus encourage future research to use more ecological approaches to validate our findings in real-world situations, using personal playlists and taking into account moderating variables, such as the time spent choosing music in a specific situation and the associated functions of music listening (Greb, Schlotz, & Steffens, 2018). This also includes more holistic research on how people approach large digital music collections in general intending to maximize their user experience while implicitly minimizing the adverse effects of choice overload (see Scheibehenne, Greifeneder, & Todd, 2010, for a review). Here, we assume that many listeners follow a hierarchical, multistep approach including the search for digital playlists matching one's preferences and situational affordances in the first step and selecting relevant titles based on recognition and/or other cues or simply using the shuffle function (Sanfilippo, Spiro, Molina-Solana, & Lamont, 2020) in the second step.

Overall, our results support previous research in music-related decision making showing that listeners are not utility maximizers who use all information and time available to make optimal choices. Instead, they use information selectively to apply fast and frugal decision strategies to achieve satisfying (instead of optimal) solutions (Anglada-Tort et al., 2022). This work was inspired by the extensive literature on the recognition heuristic on decision making (Goldstein & Gigerenzer, 2002; Pachur et al., 2011), but many other insights from behavioral economics may also be valuable to improve our understanding of listening behavior and aesthetic preferences, such as choice overload, time preferences, and game theory.

Acknowledgements

This work was supported by a PhD studentship from the “Studienstiftung des Deutschen Volkes” (Bonn, Germany) awarded to author 2. We would also like to thank Till Noé whose support has been of great value for the realization of Experiment 2.

References

Alba, J. W., & Chattopadhyay, A. (1985). Effects of context and part-category cues on recall of competing brands. *Journal of Marketing Research*, *22*(3), 340–349.

Anglada-Tort, M., Masters, N., Steffens, J., North, A., & Müllensiefen, D. (2022). The Behavioural Economics of Music: Systematic review and future directions. *Quarterly Journal of Experimental Psychology (2006)*, 17470218221113761. https://doi.org/10.1177/17470218221113761

Anglada-Tort, M., Steffens, J., & Müllensiefen, D. (2019). Names and titles matter: The impact of linguistic fluency and the affect heuristic on aesthetic and value judgements of music. *Psychology of Aesthetics, Creativity, and the Arts*, *13*(3), 277–292. https://doi.org/10.1037/aca0000172

Barrington, L., Oda, R., & Lanckriet, G. R. (2009). Smarter than Genius? Human Evaluation of Music Recommender Systems. In *Proceedings of the 10th International Society for Music Information Retrieval Conference (ISMIR 2009),* Kobe, Japan.

Berlin, N., Bernard, A., & Fürst, G. (2015). Time spent on new songs: word-of-mouth and price effects on teenager consumption. *Journal of Cultural Economics*, *39*(2), 205–218.

Berns, G. S., Capra, C. M., Moore, S., & Noussair, C. (2010). Neural mechanisms of the influence of popularity on adolescent ratings of music. *NeuroImage*, *49*(3), 2687–2696. https://doi.org/10.1016/j.neuroimage.2009.10.070

Bornstein, R. F. (1989). Exposure and affect: overview and meta-analysis of research, 1968–1987. *Psychological Bulletin*, *106*(2), 265.

Chaiken, S. (1980). Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology*, *39*(5), 752.

Dewan, S., Ho, Y.-J., & Ramaprasad, J. (2017). Popularity or Proximity: Characterizing the Nature of Social Influence in an Online Music Community. *Information Systems Research*, *28*(1), 117–136. https://doi.org/10.1287/isre.2016.0654

Dewan, S., & Ramaprasad, J. (2012). Research Note —Music Blogging, Online Sampling, and the Long Tail. *Information Systems Research*, *23*(3-part-2), 1056–1067. https://doi.org/10.1287/isre.1110.0405

Fields, B. (2011). *Contextualize your listening: The playlist as recommendation engine* (PhD thesis). Goldsmiths College (University of London).

Fields, B., Lamere, P., & Hornby, N. (2010). Finding a path through the juke box: The playlist tutorial. In *Proceedings of the 11th International Society for Music Information Retrieval Conference (ISMIR).,* Utrecht, Netherlands.

Goldstein, D. G., & Gigerenzer, G. (2002). Models of ecological rationality: the recognition heuristic. *Psychological Review*, *109*(1), 75–90.

Greb, F., Schlotz, W., & Steffens, J. (2018). Personal and situational influences on the functions of music listening. *Psychology of Music*, *46*(6), 763-794.

Greenberg, D. M., & Rentfrow, P. J. (2017). Music and big data: A new frontier. *Current Opinion in Behavioral Sciences*, *18*, 50–56. https://doi.org/10.1016/j.cobeha.2017.07.007

Guasch, M., Boada, R., Ferré, P., & Sánchez-Casas, R. (2013). NIM: A Web-based Swiss army knife to select stimuli for psycholinguistic studies. *Behavior Research Methods*, *45*(3), 765–771.

Hauser, J. R., & Wernerfelt, B. (1990). An evaluation cost model of consideration sets. *Journal of Consumer Research*, *16*(4), 393–408.

Howard, J. A., & Sheth, J. N. *The theory of buyer behavior*. New York: Wiley.

Hoyer, W. D., & Brown, S. P. (1990). Effects of brand awareness on choice for a common, repeat-purchase product. *Journal of Consumer Research*, *17*(2), 141–148.

Ifpi (2021). Global Music Report 2021. Retrieved from https://www.ifpi.org/wp-content/uploads/2020/03/GMR2021_STATE_OF_THE_INDUSTRY.pdf

Keuschnigg, M. (2015). Product success in cultural markets: The mediating role of familiarity, peers, and experts. *Poetics*, *51*, 17–36.

Lepa, S., Herzog, M., Steffens, J., Schoenrock, A., & Egermann, H. (2020). A computational model for predicting perceived musical expression in branding scenarios. *Journal of New Music Research*, 1–16. https://doi.org/10.1080/09298215.2020.1778041

Macdonald, E. K., & Sharp, B. M. (2000). Brand awareness effects on consumer decision making for a common, repeat purchase product: A replication. *Journal of Business Research*, *48*(1), 5–15.

Marian, V., Bartolotti, J., Chabal, S., & Shook, A. (2012). Clearpond: Cross-linguistic easy-access resource for phonological and orthographic neighborhood densities. *PloS One*, *7*(8), e43230. https://doi.org/10.1371/journal.pone.0043230

Am de Mooij, & Verhaegh, W. F.J. (1997). Learning preferences for music playlists. *Artificial Intelligence*, *97*(1-2), 245–271.

Oeusoonthornwattana, O., & Shanks, D. R. (2010). I like what I know: Is recognition a non-compensatory determiner of consumer choice? *Judgment and Decision Making*, *5*(4), 310–325.

Pachur, T., Bröder, A., & Marewski, J. N. (2008). The recognition heuristic in memory-based inference: Is recognition a non-compensatory cue? *Journal of Behavioral Decision Making*, *21*(2), 183–210.

Pachur, T., & Hertwig, R. (2006). On the psychology of the recognition heuristic: Retrieval primacy as a key determinant of its use. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *32*(5), 983–1002. https://doi.org/10.1037/0278-7393.32.5.983

Pachur, T., Todd, P. M., Gigerenzer, G., Schooler, L. J., & Goldstein, D. G. (2011). The recognition heuristic: A review of theory and tests. *Frontiers in Psychology*, *2*, 147. https://doi.org/10.3389/fpsyg.2011.00147

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in Experimental Social Psychology*, *19*, 123–205.

Routley, N. (2018). Visualizing 40 Years of Music Industry Sales. Retrieved from https://www.visualcapitalist.com/music-industry-sales/

Salganik, M. J., Dodds, P. S., & Watts, D. J. (2006). Experimental study of inequality and unpredictability in an artificial cultural market. *Science (New York, N.Y.)*, *311*(5762), 854–856.

Sanfilippo, K. R. M., Spiro, N., Molina-Solana, M., & Lamont, A. (2020). Do the shuffle: Exploring reasons for music listening through shuffled play. *PloS One*, *15*(2), e0228457.

Scheibehenne, B., Greifeneder, R., & Todd, P. M. (2010). Can There Ever Be Too Many Options? A Meta-Analytic Review of Choice Overload. *Journal of Consumer Research*, *37*(3), 409–425. https://doi.org/10.1086/651235

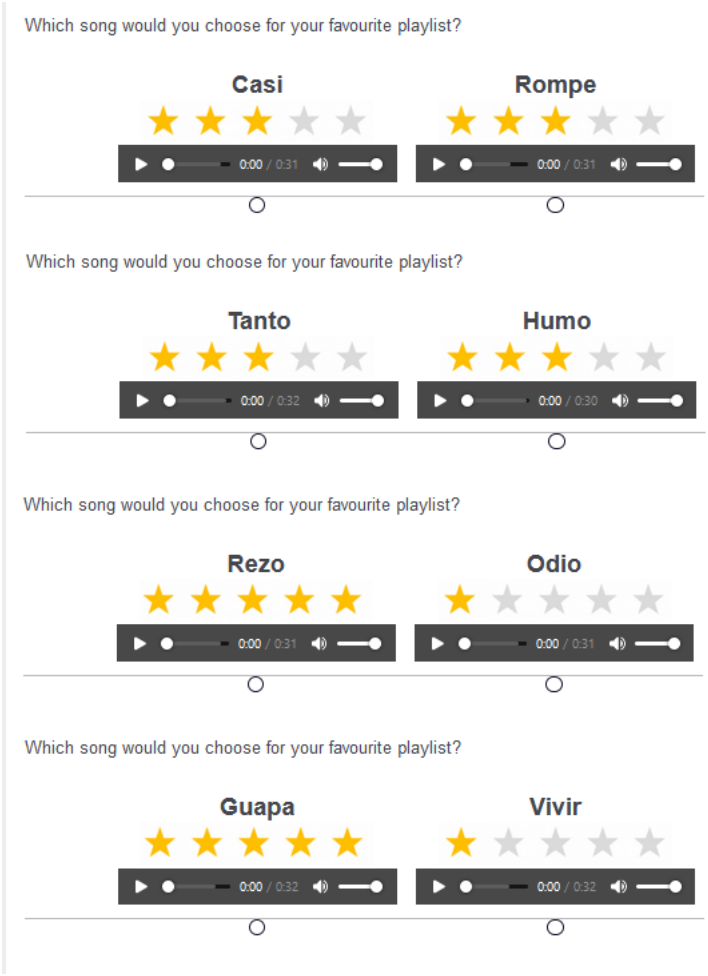
Shocker, A. D., Ben-Akiva, M., Boccara, B., & Nedungadi, P. (1991). Consideration set influences on consumer decision-making and choice: Issues, models, and suggestions. *Marketing Letters*, *2*(3), 181–197.

Thoma, V., & Williams, A. (2013). The devil you know: The effect of brand recognition and product ratings on consumer choice. *Judgment and Decision Making*, *8*(1), 34–44.

Tversky, A. (1972). Choice by elimination. *Journal of Mathematical Psychology*, *9*(4), 341–367.

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, *9*(2p2), 1.

Appendix A: Screenshot of the visual-and-auditory condition (Experiment 1).



Appendix B: Music titles used in the two experiments, separated by both test versions and choosing conditions

	Test version A	**Test version B**	**Test rad**	**Test version B**
	Visual-only condition		*Visual-and-auditory condition*	
Learned Titles	Casi	Odio	Humo	Rezo
	Rompe	Jaleo	Ahora	Miedo
	Déjame	Miente	Vuelve	Cuando
	Quisiera	Chantaje	Pasarela	Culpable
	Besándote	Malabares	Escuchame	Mentiroso
New Titles	Odio	Casi	Rezo	Humo
	Jaleo	Rompe	Miedo	Ahora
	Miente	Déjame	Cuando	Vuelve
	Chantaje	Quisiera	Culpable	Pasarela
	Malabares	Besándote	Mentiroso	Escuchame

Note: The distractor titles used in the learning phase were the same for both test versions: *Vivir, Guapa, Grita, Tanto, Perdóname, Quién, Manteca, Querida, Volverá, Delgadito*.

Appendix C: List of the 15 songs used in both experiments

Half Dreaming Reprise (CFCF)
Sunset Park (Flamingosis)
a1 (Ólafur Arnalds und Nils Frahm)
Sound Of Innocence (Mandalay Soundsystem)
Electro 2 Steppin Riddim (Jeremy Sylvester)
Evol Peed (Bender und Sevensol)
Rare Bloom (Dark Sky)
Shox (Cocolores)
Dance The Dance (Jazzanova)
9 Years (Roman Flügel)
Looped (Kiasmos)
Open Eye Signal (Jon Hopkins)
Bamboo (Harvey Sutherland)
Vi nå (Finnebassen)
Balearic Incarnation (Dølle Jølle)