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Exposure Influences Expressive Timing Judgments in Music

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This study is concerned with the question whether, and to what extent, listeners' previous exposure to music in everyday life, and expertise as a result of formal musical training, play a role in making expressive timing judgments in music. This was investigated by using a Web-based listening experiment in which listeners with a wide range of musical backgrounds were asked to compare 2 recordings of the same composition (15 pairs, grouped in 3 musical genres), 1 of which was tempo-transformed (manipulating the expressive timing). The results show that expressive timing judgments are not so much influenced by expertise levels, as is suggested by the *expertise hypothesis*, but by exposure to a certain musical idiom, as is suggested by the *exposure hypothesis*. As such, the current study provides evidence for the idea that some musical capabilities are acquired through mere exposure to music, and that these abilities are more likely enhanced by active listening (exposure) than by formal musical training (expertise).

Keywords: music cognition, implicit knowledge, explicit knowledge, exposure, expertise

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The ability to make, perceive, and enjoy music is generally regarded as an evolutionary by-product of more important functions, such as those involved in language (Pinker, 1997). However, there is increasing evidence that humans are born with musical biases and predispositions that are unique to human cognition (Hannon & Trehub, 2005; Peretz, 2006; Zatorre, 2005). Although it remains unclear whether this evidence can be interpreted as a sign that a capacity for music is rooted in nature, rather than nurture, there is little controversy around the idea that musical competence is a special human capacity that is shared across ages and cultures (Blacking, 1974; Jackendoff & Lerdahl, 2006; Mithen, 2005; Sloboda, 2000; Trehub, 2003). In the present article we concentrate on the question whether *musical competence*—the perceptual skills and musical knowledge that are required to perceive and appreciate musical input—is influenced by extensive formal musical training (explicit knowledge), or whether it can also be interpreted as a result of mere exposure to music (implicit knowledge).

Although some older studies argue that musical competence is a special, innate talent ("musicians are born, not made"; cf. Sloboda, 1994), the most common view is that musical abilities are shaped mostly by intense musical training (Dienes & Longuet-Higgins, 2004; Sloboda, 1994; Smith, 1997; Wolpert, 2000) and that they remain rather rough in untrained listeners (Jackendoff & Lerdahl, 2006). Some authors even suggest that after the age of 10, musical abilities no longer evolve without explicit musical training (Francès, Zenatti, & Imberty, 1979). These studies give support to the common idea that musicians, due to their specific musical talent and training, are more aware of musical detail (such as nuances in *expressive timing*,[1] discussed in the present study) than are average listeners (Sloboda, 1994). We refer to this view as the *expertise hypothesis*, in which explicit knowledge and extensive musical training are considered the main contributors to musical competence.

Another, more recent view is that listeners without formal musical training, when given sufficient exposure (e.g., listening to music in everyday life, moving and dancing to music, attending concerts) to a certain musical idiom, might actually perform similarly in a task when compared with musically trained listeners (Levitin, 2006; Schellenberg, 2006), especially when they are asked to do a musical task that uses realistic and ecologically valid stimuli. With regard to the latter, it could be argued that the differences in musical competence between musicians and non-

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[1] *Expressive timing* is the term used to refer to the minute deviations from regularity that contribute to the quality of a music performance (Clarke, 1999; Palmer, 1997).

musicians, as suggested by the literature, could well be an artifact of tasks using explicit naming—a situation in which musically trained listeners would have an advantage over untrained listeners. We refer to this view as the *exposure hypothesis*, in which implicit knowledge as a result of mere exposure (e.g., listening to one's preferred music) is considered the main contributor to musical competence.

An example in support of the exposure hypothesis is a study by Bigand and Poulin-Charronnat (2006), who discovered that non-musicians can be as sensitive as musicians to subtle aspects of music harmony, suggesting that musical training and explicit knowledge of music theory are unnecessary to acquire sophisticated knowledge about melody and harmony (Bigand, Tillmann, Poulin, D'Adamo, & Madurell, 2001; Tillmann, Bharucha, & Bigand, 2000).[2] Furthermore, prolonged exposure to a specific musical idiom seems to allow nonmusicians, without explicit knowledge about a certain musical genre, to internalize the rules that are typical to such a genre and do almost equally well as musicians in a comparison task. Dalla Bella and Peretz (2005) found that all listeners—musicians and nonmusicians alike—are sensitive to styles of Western classical music, arguing that this is supported by cross-cultural perceptual processes that allow for discrimination of key perceptual features.

In the present study we are interested in whether these recent findings (i.e., the effect of exposure on making sophisticated musical judgments) also hold in the temporal domain of music cognition.

Listening Experiment Using a Comparison Task

To study the effect of exposure and expertise in the temporal domain, we used a listening task that allows for testing the effect of different listener groups and different expertise levels on temporal sensitivity. In this task, participants were asked to compare two performances of the same composition (15 pairs, grouped in three musical genres: classical, rock, and jazz; see Tables 1, 2, and 3). Each stimulus pair consisted of an audio recording by one artist and a manipulated, tempo-transformed audio recording by another artist. The tempo-transformed version was originally performed at a different tempo, but was scaled to be similar in overall tempo to the other performance of the pair. This resulted in stimulus pairs that have the same tempo, one of which is not manipulated, the other tempo-transformed. The participants had to indicate which of the two stimuli sounds more "natural" or musically plausible by focusing on the expressive timing that could have been manipulated as a result of the tempo-transformation.

This particular task was used for a number of reasons. First, the use of different musical genres (rock, jazz, classical) allows every participant to be either explicitly or implicitly competent, through either formal training or listening experience, in at least one musical genre. Second, expressive timing tends to be characteristic for a particular genre.[3] In fact, Dalla Bella and Peretz (2005) showed that temporal variability can serve as an index to mark a certain musical style. Both aspects suggest that expressive timing could serve as an indicator of temporal sensitivity to a musical idiom. Third, because expressive timing was shown not to be perceptually invariant under tempo-transformation (Honing, 2006a), as such it can function as a cue for listeners to decide whether or not a performance is tempo-transformed. Fourth, the time-scale algorithm used to make the tempo-transformed stimuli (Bonada, 2000) allows for manipulating the temporal information while maintaining musically realistic stimuli. This algorithm manipulates expressive timing while the original sound quality (e.g., attack transients and timbre) is kept perceptually invariant. And finally, the task (i.e., comparing the quality of the expressive timing used in a performance) is similar to the "blindfold test" that is quite popular in media that review new CD recordings (such as magazines and radio shows). In such a test, a panel of music professionals is asked to compare and comment on the musical quality of a number of different recordings of the same music. Music lovers tend to find such a task attractive and challenging (Honing & Ladinig, 2008).

A previous study (Honing, 2006a) showed that experienced listeners are quite good at this comparison task and can distinguish between a real and a tempo-transformed performance. In the current study we investigate whether this is expert behavior or whether listeners without formal musical training, but with sufficient exposure to a certain musical idiom (e.g., jazz, rock, or classical music), can do this equally well. The expertise hypothesis predicts that experts should do better, independent of musical genre. The exposure hypothesis predicts that experienced listeners should do better, independent of the amount of musical training they have received.

Method

Participants

Invitations were sent to various mailing lists, online forums, and universities to reach a wide variety of respondents ($N = 208$). Five gift certificates were raffled among those who responded. The respondents were between 12 and 63 years old ($M = 34$, $SD = 11.5$, $Mode = 26$) and had various musical backgrounds. Thirty-four percent received little or no formal musical training, 29% could be considered musical experts (i.e., with more than 8 years of formal musical training and starting at a young age; Ericsson, Krampe, & Tesch-Römer, 1993), and the remaining 37% could be classified as "semimusician." Finally, 39% mentioned classical music as their main exposure category; 27%, jazz; and 34%, rock music.

Equipment

We processed the responses in an online version of the experiment using standard Web browser technologies (see Honing, 2006a, for details). The stimuli were excerpts of commercially available recordings and were converted to the MPEG-4 file format to guarantee optimal sound quality on different computer platforms and to minimize the download time.

[2] This is not to say that no differences exist between musicians and nonmusicians but that these differences remain tiny in light of the considerable difference in the amount of explicit training that exists between both groups.

[3] For instance, *tempo rubato* (local speeding-up and slowing-down in a performance) is often used in classical music (e.g., Hudson, 1994), whereas in jazz and rock it is more common to use timing deviations that are early or late with respect to a constant tempo (e.g., Ashley, 2002).

Table 1
Classical Recordings Used in Experiment

Pair	Composition	Musician	Record label	Recording date	Tempo (BPM)
1A	J. S. Bach, English Suite No. 4, BWV 809, Allemande	Glenn Gould	Sony, SK 87766, 2001	1974/76	87
1B	J. S. Bach, English Suite No. 4, BWV 809, Allemande	Sviatoslav Richter	Delos, GH 5601, 2004	1991	70
2A	L. v. Beethoven, Piano Sonata No. 14, Op. 17, no. 2. Allegretto	Arthur Rubinstein	RCA, 09026-63056-2, 1999	1976	56
2B	L. v. Beethoven, Piano Sonata No. 14, Op. 17, no. 2. Allegretto	Vladimir Ashkenazy	Decca, 452 982-2, 1997	before 1997	75
3A	F. Chopin, Grande Valse Brillante, op. 18	Claudio Arrau	Philips, 468 391-2, 2001	1979	70
3B	F. Chopin, Grande Valse Brillante, op. 18	Vladimir Ashkenazy	Decca, 417 798-2, 1990	1983/85	88
4A	J. S. Bach, WTC II, BWV 880, Fugue 11	Glenn Gould	Sony, SX4K 60150, 1997	1969	135
4B	J. S. Bach, WTC II, BWV 880, Fugue 11	Rosalyn Tureck	BBC, BBCL 4116-2, 2002	1976	102
5A	R. Schumann, Kinderszenen, Träumerei	Vladimir Horowitz	DGG, 474 370-2, 1991	1985/89	87
5B	R. Schumann, Kinderszenen, Träumerei	Claudio Arrau	Philips, 468 391-2, 2001	1974	70

Note. BPM = beats per minute; Op. = opus; BWV = Bach-Werke-Verzeichnis; WTC = Das Wohl Temperierte Clavier; BBC = British Broadcasting Corporation; RCA = Radio Corporation of America; DGG = Deutsche Grammophon Gesellschaft. SK, SX4K, GH, and BBCL are parts of record label identification.

Materials and Stimulus Preparation

For each of the three genres, 10 audio recordings were selected from commercially available CDs (see Tables 1–3). Each *performance pair* (labeled A and B in the tables) consists of two recordings of the same composition. These were selected such that they differed between 20% and 30% in overall tempo. All sound excerpts were taken from the beginning of a recording and restricted to instrumental music only (see motivation below). For the classical and jazz genres it was relatively easy to find such recordings (see Tables 1 and 2). However, for the rock genre this turned out to be quite a challenge, because it is less typical to have recordings of the same song in quite different tempi. However, using tools like iTunes (giving access to audio fragments of a large set of commercial recordings),[4] we were able to find 10 recordings that were instrumental and had the desired tempo differences (see Table 3).

From each performance pair A and B, two *stimulus pairs* were derived (A/B′ and A′/B, with prime indicating a tempo-transformed recording). This resulted in a total of 30 real and 30 tempo-transformed recordings. All 60 stimuli (constructed from the 30 recordings shown in Tables 1–3) can be found in the supplemental materials.

Furthermore, the two stimulus pairs derived from each performance pair were presented to two groups of listeners. This was done to prevent the respondents from remembering characteristics of the stimuli in one pair and using them to make a response to the other pair. Group 1 ($n = 101$) was presented with 15 A/B′ pairs, whereas Group 2 ($n = 107$) was presented with 15 A′/B pairs.

For each recording, the tempo was matched with a metronome to the first four bars and checked perceptually by playing it along with the music. The resulting tempo estimate (see Tempo column in the tables) was used to calculate the tempo-scaling factor to make the stimulus pairs similar in tempo. The average tempo difference for each genre was about 24% ($SD = 3.5\%$).

The tempo-transformed stimuli were made using state-of-the-art time-scale modification software (Bonada, 2000). This software can change the overall tempo of a recording while keeping the pitch and sound quality (e.g., attack transients and timbre) invariant. As such, this algorithm minimizes the effect of sound quality artifacts that could bias the results. This was confirmed by an earlier study (Experiment 2 in Honing, 2006a) in which audio experts were presented with original and tempo-transformed stimuli and asked to identify what they considered a manipulated recording. Over the whole set of 28 stimuli, audio experts did no better than chance. Although three stimuli attracted slightly more responses, these did not bias the overall results (in fact, these stimuli contained snippets of voice, such as audience coughs and humming, that apparently caused small phasing effects that some audio experts could spot when asked to do so).

In the current study we therefore decided to use the same stimuli for the classical genre as used in Honing (2006a), minus the pairs that could have biased the results. Furthermore, we made sure that the stimuli selected for the jazz and rock genres were instrumental and did not contain any voice.

Finally, there are two additional reasons why we think sound quality is less of an issue in this study. First, participants were explicitly instructed to base their judgment on the use of ex-

[4] See http://www.apple.com/itunes/.

Table 2
Jazz Recordings Used in Experiment

Pair	Composition	Musician	Record label	Recording date	Tempo (BPM)
6A	Au Privave	Phil Woods	Jazz classics 1036867, 2000	1957	113
6B	Au Privave	Wes Montgomery	Riverside, 4408, 1993	1959–63	90
7A	Blue in Green	Bill Evans	OJC, B000000Y59, 1991	1959	67
7B	Blue in Green	Miles Davis	Sony, 64935, 1997	1959	55
8A	Dolphin Dance	Ahmad Jamal	MCA Records, IMP 12262, 1997	1970	153
8B	Dolphin Dance	Herbie Hancock	Blue Note, 7243 4 95331 2 7, 1999	1959	120
9A	Caravan	Duke Ellington	Membran Music Ltd, 222427-444, 2005	1945	114
9B	Caravan	Duke Ellington	EMI, 7243-8-29964-2-2, 1994	1962	96
10A	All the things you are	Bert van de Brink	Challenge records 70062, 1999	1999	108
10B	All the things you are	Keith Jarrett	ECM records 847135, 2000	1989	140

Note. BPM = beats per minute; OJC = Original Jazz Classics; MCA = Music Corporation of America; EMI = Electric and Musical Industries Ltd. IMP is part of record label identification.

pressive timing, not on the sound quality of the recordings (see "N.B." under *Procedure*). Second, we were interested in differences between listener groups: With each listener group listening to the same stimuli, it is unlikely that the occasional participant ignoring these instructions would influence the results.

The presentation of the stimuli was randomized within and between pairs for each participant, as was the assignment of participants to either Group 1 or Group 2. Participants could choose between a Dutch or English version of the instructions.

Procedure

Participants were invited to visit a Web page of the online experiment.[5] First, they were asked to test their computer and audio system with a short sound excerpt and to adjust the volume to a comfortable level. Second, they were asked to fill in a questionnaire to obtain information on their musical background, listening experience, and musical training. Participants were, for instance, requested to estimate the distribution of their average listening time over particular musical genres (classical, jazz, pop, rock, etc.) in percentages. This information was used for the measures of exposure and expertise (see *Analyses*). Finally, they were referred to a Web page containing the actual experiment. The following instructions were given:

> You will be presented with fifteen pairs of audio fragments in three different repertoires (classical, jazz, and rock): one being a real recording (by one artist), the other a manipulated tempo-transformed recording (by another artist). The tempo-transformed version was originally recorded at a different tempo, but it has been time-stretched (or time-compressed) to become close in tempo to the other performance of the pair. Your task is to decide which is which. This might be quite a challenge.
>
> Please do the following: 1) Listen to a pair of audio fragments once and in their entirety (in a quiet environment without distractions or with headphones). 2) Focus on the use of expressive timing by the performer (such as note asynchrony, *tempo rubato* and articulation). 3) Then answer the questions listed next to the excerpts, namely: Which is the real (i.e. not tempo-transformed) recording, the top or the bottom excerpt? Are you sure? And, do you know this composition? 4) Please do this for all fifteen pairs of audio fragments presented below. N.B. All fragments are processed in some way, so please ignore sound quality as a possible cue for deciding which is which: Just focus on the timing of the performer(s).

The total experiment took, on average, 38 min to complete.[6]

Analyses

The response forms were automatically sent by e-mail to the authors and converted into a tabulated file for further analysis with POCO (Honing, 1990), music software for symbolic and numerical analyses, and SPSS (Version 11), for statistical analyses. To filter out the occasional nonserious responses, we included only entirely completed response forms and those responses that took more than 10 min for the listening part of the experiment. Dropout (percentage of visitors who did not finalize the experiment or did it too quickly, e.g., against instruction to listen completely through each audio fragment) was 36% of all respondents.

The information as collected in the questionnaire was used to assign expertise and exposure levels to each participant. With regard to expertise, participants were classified into three categories: (a) nonmusicians, who had received less than 3 years of training or no training at all; (b) expert musicians, with formal musical training longer than 8 years starting before the age of 9; and (c) semimusicians, participants that fall between these two extremes. We refer to these categories as *expertise.*

With regard to exposure, participants were also classified into three categories: classical, jazz, and rock listener. A participant was assigned to a certain listener category when he or she indicated preference for one particular genre (with a minimum differ-

[5] The online experiment can be found in the supplemental materials.

[6] Although this might seem a long time, note that listeners could quit the experiment at any time. Furthermore, 81% indicated that they would like to participate in a future experiment. Both aspects suggest that the participants were highly motivated (cf. Honing & Ladinig, 2008).

Table 3
Rock Recordings Used in Experiment

Pair	Composition	Musician	Record label	Recording date	Tempo (BPM)
11A	In a Gadda da Vida	Iron Butterfly	Elektra/WEA, B0000032YA, 1993	1968	115
11B	In a Gadda da Vida	Slayer	Def Jam, B0000024K5, 1995	1989	140
12A	Killing Floor	Jimi Hendrix	Warner Bros/WEA, B000008GHU, 1990	1969	137
12B	Killing Floor	The Jimi Hendrix Experience	Rhino/WEA, B000008IKZ, 1992	1967	156
13A	Muscle Museum (Version 1)	Muse	FAAB Records, FAAB-0012-1, 2002/3	2001	161
13B	Muscle Museum (Version 3)	Muse	FAAB Records, FAAB-0012-1, 2002/3	2001	138
14A	Stairway to Heaven	Dread Zeppelin	Capitol, B000000QG4, 1991	1991	86
14B	Stairway to Heaven	Stanley Jordon	Blue Note Records, B000002UZ8, 1991	1990	66
15A	Now I Wanna Be Your Dog	The Stooges	Elektra/WEA, B0009SOFGI, 2005	1969	123
15B	Now I Wanna Be Your Dog	Iggy Pop	Other People's Music, B000003TWS, 1997	1979	155

Note. BPM = beats per minute; WEA = Warner-Elektra-Atlantic records; FAAB = Free As A Boot records.

ence to the other genres of 10%).[7] We refer to these categories as *exposure*.

Results and Discussion

Overall the participants correctly identified the real performance 60.1% of the time (SD = 9.7%). In the classical genre this was 65.3% (SD = 21.0%); for jazz, 56.6% (SD = 19.0%); and for rock, 58.2% (SD = 20.2%). The average percentage correct for each of our nine participant groups (Exposure × Expertise) was found to be significantly above chance level (50%) using a t test ($p < .05$). From this we can conclude that each participant group was capable of distinguishing a real recording from a manipulated, tempo-transformed performance (see Figure 1). As such, we were able to replicate the main result from Honing (2006a), which used the same task and partly the same stimuli.[8]

Effect of Exposure and Expertise

In this study, however, we were interested in seeing whether these judgments are the result of expert behavior or whether listeners without formal training, but with sufficient exposure to a certain musical genre, can do this equally well.

To analyze the effect of exposure and expertise on the amount of correct timing judgments of the participants, we calculated a 3 (exposure) × 3 (expertise) × 3 (genre) analysis of variance, with exposure and expertise as between-subject variables and genre, with the levels classical music, jazz music, and rock music, as a within-subject variable.

We found an effect for genre, $F(2, 244) = 8.19$, $p < .01$, $\eta_p^2 = .063$, showing that the overall performance, regardless of exposure or expertise, differed for each genre. Contrasts revealed that subjects performed better for classical music as compared with both jazz, $F(1, 122) = 15.77$, $p < .001$, and rock, $F(1, 122) = 8.41$, $p < .01$.[9] Furthermore, we did not find effects for either of the between-subject variables, or an interaction of these variables. However, we did find a significant three-way interaction of genre, exposure, and expertise, $F(8, 244) = 2.14$, $p < .05$, $\eta_p^2 = .065$.

The interactions are indicated in Figure 1. In the left panel of Figure 1 the results are grouped according to expertise levels; in the right panel the results are grouped according to listener type. The interactions are indicated by asterisks (with an arrow pointing from the cell that got significantly higher values to the cell with the lower values). The majority of the interactions between exposure and expertise occur in the jazz genre. The interactions in the right panel show that expertise helps in making correct judgments, especially in the jazz genre. Also, the effect of exposure is visible in the jazz genre: Belonging to a certain listener group influences the performance, and this effect is emphasized for experts, less strong for semimusicians, and not visible for nonmusicians. The remaining interactions (not depicted in Figure 1) are for the participant groups "experts exposed to rock" and "naive listeners exposed to jazz." Both performed worse in jazz than in the other genres ($p < .05$ for classical and $p < .05$ for rock for the rock listeners, $p < .05$ for rock and $p < .01$ for classical for the jazz listeners). Finally, the participant group "experts exposed to classical music" performed better in the classical genre than in the other genres ($p < .05$ for jazz, $p < .01$ for rock).

A possible cause of these interactions, mainly occurring in the jazz genre (see Figure 1, middle row), could be the special role of timing in jazz music, often intentionally deviating from standard patterns (Ashley, 2002). In a previous pilot study as well, timing in jazz turned out to be more difficult to judge, making even experts fail to recognize a tempo-transformed recording (Honing, 2007).

Effect of Exposure and Expertise on Sure Judgments

However, due to the relative difficulty of the task, blurring the results with responses the participants were unsure about, and that

[7] Participants who did not have a specific musical preference (not exceeding a threshold of 10% between the categories) were not considered in the ANOVAs (reducing this set to $N = 131$). For the other analyses all responses ($N = 208$) were used.

[8] The current study shares 10 classical recordings (see Table 1) with the Honing (2006a) study. These 10 stimuli attracted 65.5% correct responses in the earlier study. In the current study this was 65.3%. As such, we replicate this earlier result.

[9] It is interesting to note that recent brain imaging research (Caldwell & Riby, 2007) suggests that exposure to one's favorite (preferred) music facilitates conscious cognitive processes, whereas unconscious cognitive processes might be facilitated by exposure to classical music in general, regardless of one's preferences.

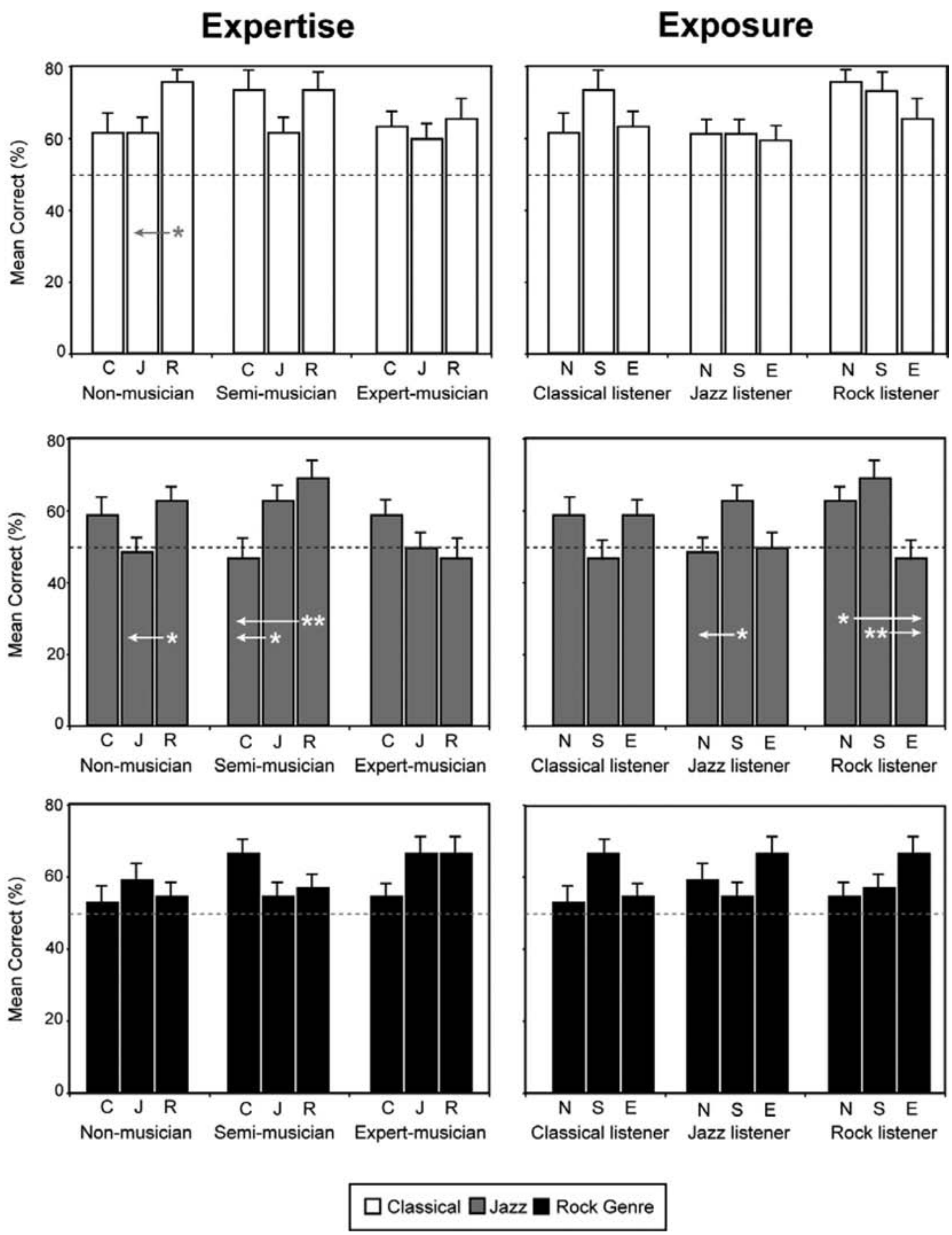

Figure 1. The effect of expertise and exposure on correct judgments. The panels show the mean percentage correct responses for the classical genre (top), jazz genre (middle), and rock genre (bottom). The left column shows the results grouped according to expertise levels (*expertise*); the right column shows the results grouped by listener type (*exposure*). The dotted line indicates chance level (50% correct). Asterisks mark a significant difference from the bar pointed at (*$p < .05$, **$p < .01$); error bars indicate standard error. C = classical listener, J = jazz listener, R = rock listener, N = nonmusician, S = semimusician, E = expert musician.

were likely a result of guessing, we decided also to consider only those judgments that the participants were sure about (referred to as "correct/sure" responses). For this we calculated a 3 (exposure) × 3 (expertise) × 3 (genre) analysis of variance, with exposure and expertise as between-subject variables; genre (with the levels classical music, jazz music, and rock music) as a within-subject variable; and correct/sure responses as a dependent variable.

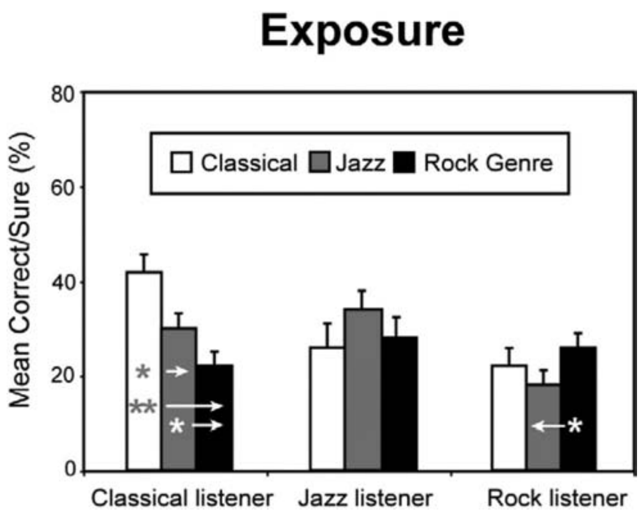

Figure 2. The effect of exposure on "correct/sure" judgments. Asterisks mark a significant difference from the bar pointed at (*$p < .05$, **$p < .01$); errors bars indicate standard error.

In this case the responses showed a significant interaction for genre and exposure, $F(4, 244) = 5.14$, $p < .001$, $\eta_p^2 = .078$, without apparent main effect of any variable or further interaction of these factors (see Figure 2).[10]

To view this interaction of genre and exposure in further detail, we first analyzed the differences in responses with regard to the different musical genres. For the classical genre, classical listeners showed higher scores ($p < .01$) than rock listeners. For the jazz repertoire, both classical and jazz listeners performed significantly better ($p < .05$ and $p < .01$, respectively) than rock listeners. For the rock repertoire, there were no significant differences between listener groups.

Second, we analyzed how the responses differ within the listener groups. Classical listeners performed better on the classical repertoire than on the jazz or rock repertoire ($p < .05$ and $p < .001$, respectively) and better for the jazz genre than for the rock genre ($p < .05$). Rock listeners performed better on the rock repertoire than on the jazz repertoire ($p < .05$). No significant differences were found for the jazz listeners (although there was a tendency; see Figure 2).

In short, these results are in line with the idea that listeners perform best in the genre they listen to most, irrespective of expertise level, as was suggested by the exposure hypothesis.

Conclusion

This study addresses the influence of exposure versus expertise in making expressive timing judgments. It involved using an online listening experiment in which listeners with different musical preferences (exposure) and music education (expertise) were asked to compare two performances of the same composition (15 pairs, grouped in three musical genres), one of which was tempo-transformed (manipulating the expressive timing). An earlier study (Honing, 2006a) showed that expert listeners perform significantly above chance in such a comparison task. Surprisingly, the current study reveals that these judgments are not primarily influenced by expertise level (e.g., years of formal training) but mainly by exposure to a certain musical idiom. The interplay of familiarity with a particular genre (exposure) and the level of formal musical training (expertise) had a significant effect on discriminating a real from a manipulated performance. In addition, taking into account confidence, exposure positively influences the performance in a listener's preferred genre. In short, performance is not simply a result of formal musical training, but is enhanced, and for the confident responses even solely influenced, by listening to one's preferred music.

These results are in line with what has been found in the pitch domain (Bigand & Poulin-Charronnat, 2006; Tillmann et al., 2000). These studies found responses of musically untrained listeners to be highly correlated with those of musically trained listeners, suggesting a musical capacity for melody and harmony judgments that is acquired through mere exposure to music, without the help of explicit training. Although not all listeners might be able to identify, label, or name explicitly what they perceive (Honing, 2006b; Schellenberg, 2006), most listeners seem to have a shared capability to distinguish between quite subtle musical nuances in a musical task (e.g., making judgments on expressive timing in the current study), a capability that is normally attributed to musical experts only.

Furthermore, these results are in line with Dalla Bella and Peretz (2005), who found that a sensitivity to Western musical styles is influenced by, but not conditional on, formal musical training, also showing an effect of both expertise and exposure.

In conclusion, the current study provides evidence in the temporal domain for the idea that some musical capabilities are acquired through exposure to music, and that these abilities are more likely enhanced by active listening (exposure) than by formal musical training (expertise).

[10] To make certain the reported result was not simply due to analyzing part of the data, we also analyzed the "correct/not sure" responses. For these data we found, however, neither a significant effect of the independent variables nor an interaction. As such, we can be sure that the results reported for the correct/sure responses are not an artifact of the selection made. In addition, we found the same effect of genre as we have in the genre-specific correct judgments, $F(2, 182) = 5.45$, $p < .01$, $\eta_p{}^2 = .057$. Contrasts revealed that subjects performed better for the classical genre than the jazz genre, $F(1, 91) = 10.74$, $p < .001$, and the rock genre, $F(1, 91) = 3.84$, $p < .05$.

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