Building an authentic listener:
Applying a passive exposure-based training paradigm to detecting differences among compositional styles

Frauke Jürgensen[1], David G. Pearson[2], and Ian Knopke[3]

[1] University of Aberdeen, Department of Music
[2] University of Aberdeen, School of Psychology
[3] British Broadcasting Corporation

Background in music history. Around 1600, there was a shift in compositional style whose most significant feature was the increasingly free use of unprepared and/or incorrectly resolved dissonance. It caused controversy at the time (Artusi vs. Monteverdi), and its proponents argued that it was justifiable as a means of text expression. It can be argued that, in order to be shocked at the "illegal" treatment of dissonances, a listener would have to be familiar with "legal" behaviour of dissonances. Modern audiences, when exposed to *seconda pratica* music, tend not to react with same degree of alarm. One can argue that this is because later developments in music, to which the audiences have been exposed, go much farther in their dissonance treatment than the music of the *seconda pratica* composers.

Background in psychology. Previous studies have shown that participants can rapidly develop both knowledge and subjective preference for grammatical structure following only a limited exposure to unfamiliar musical systems. Familiarity with musical structure has been shown to play a role in influencing the degree of emotional engagement experienced by participants while listening to music. The differences among the musical stimuli used in these studies are often maximised; in some cases, an entirely artificial musical grammar is used.

Aims. Can we, through exposure to a training set, build enough familiarity in modern listeners of the conventional rules of dissonance treatment, that they experience *seconda pratica* music as odd or alarming in some way? Our experiment is a pilot study to test the feasibility of such an approach to this problem.

Main contribution. We constructed an experiment in which a group of participants, drawn from among undergraduate students in music and psychology, were asked to rate two different pieces of Monteverdi (to represent *seconda pratica*), both before and after being exposed to a training set composed of either Monteverdi or Palestrina (to represent *prima pratica*). All pieces were presented once only without repetition. The training sets were chosen to minimise the effect of performers' interpretation on the listener, in an attempt to isolate compositional style as the most salient difference. Our results showed a significant difference in the rating of the Monteverdi pieces as "familiar" between the different groups. Other variables did not have a significant impact. This finding implies a degree of internalisation of the differences in musical grammar, and suggests that this paradigm for study might profitably be extended in the future.

Implications. Our research has implications for any situation in which a teacher, performer, or composer is attempting to communicate musical meaning to an audience that is unfamiliar with the style in question. If a fairly brief training period is sufficient to build an appreciation in a sample of untrained listeners, for differences that are as relatively subtle as those between Monteverdi and Palestrina, then a presenter of unfamiliar or new music might use such knowledge to consciously structure the listening experience.

Keywords: Familiarity, compositional style, performance

Introduction

There is no such thing as an authentic listener. As any person active in the research and performance of early music knows, while we may travel a reasonably long way along the road to reconstructing what a performance some centuries ago might have sounded like, by taking pains to reproduce as exactly as we know how the circumstances of instruments, performance spaces, techniques, and styles, the one thing we will never be able to reproduce is a set of historical ears, attached to a historical mind. Indeed, the term "authentic", used to describe performances of early music, has generally given way to the somewhat less loaded "historically informed". In this paper, we aim to engage with one specific instance of the difficulty of reconstructing historical ears, namely those which might have heard the madrigals of Monteverdi in the courts of late-sixteenth-century Italy, and been surprised, possibly even alarmed, and possibly delighted. This paper is in the nature of a speculative, pilot study, asking the question, "can a modern listener be made to hear the music of Monteverdi as 'new'?". Some previous studies, described below, explored the building of familiarity of musical grammars within an artificial context, using purpose-generated, repeated fragments of music that conform to a defined grammar. We want to determine whether this type of approach can be transferred into a more naturalistic listening context, using real compositions presented to the subjects without any repetition. Its implications might be of interest not only to the performer of early music, but to teachers, and composers of new music.

At the University of Aberdeen, third-year music students take a course entitled *New Directions*, in which they study the music of two time periods that are often considered to be turning points in the conventional narrative of music history: the early seventeenth century, and the early twentieth century. Part of the aim of the course is to encourage students to think about the extent to which "revolutionary" developments in music are rooted in the past, and by extension, the breadth of historical context which is necessary to fully engage with music of a given period. Traditionally, this particular course began by having the students view a video of a performance of Monteverdi's *Orfeo*, with no introduction—context was provided afterwards, in a series of lectures and discussions covering among them the topic of *prima* versus *seconda pratica*. It was easy to observe that the students, faced with a two-hour video sung in Italian with English subtitles, were often somewhat bemused. Unfamiliar instruments (which would have been normal to the "historical ears") were greeted with interest, as were certain aspects of the staging, but the truly innovative features of Monteverdi's style—extended passages of monodic singing characterised by adventurous treatment of dissonances in the service of text declamation and illustration—passed by completely unremarked.

One reason for the students' apparent lack of engagement with Monteverdi's innovative use of dissonance appears fairly obvious: even with subtitles, it is very difficult to associate words and their meaning with the precise notes to which they are sung. If one has a style of music in which the "new" feature is that "the words [are] the mistress of harmony" (Weiss & Taruskin, 1984, p. 172), meaning that unconventional compositional decisions may be justified by their ability to express

the text, then an inability to understand the text might well make it difficult to appreciate the compositional decisions made.

Another reason is related, but not as obvious. In his criticism of Claudio Monteverdi's madrigal *Cruda Amarilli*, Giovanni Maria Artusi gives several examples of dissonances which are incorrectly prepared and resolved (1950, p. 395; 1600), according to the conventions of the time, described among others by Artusi's own teacher Gioseffo Zarlino, who is cited by Giulio Cesare Monteverdi (Claudio's brother) as the codifier of the *prima pratica* (1929, 1607). Monteverdi's famous defense, elaborated by his brother and appended as a "*Dichiaratione*" to the *Scherzi musicali* of 1607, justifies these dissonances by coining the terms of *prima* and *seconda pratica* (1608), saying that the key difference among these two is that in the former, the rules of music take precedence over the expression of the text, while in the latter, the text is supreme (1607). While stylistic features beyond dissonance treatment can enter into this debate, one of the core issues in the distinction among these two practices is the justification of "incorrect" dissonances by the presence of the text. Other elements that might be considered, for example, are different styles of ornamentation, texture, or aspects of performance such as a deliberately affective way of singing. However, the initial criticism from Artusi (and Monteverdi's response) concern specifically the deployment of dissonances, and we focus onto this narrow definition for the purposes of this pilot study. From our perspective, we can say that Monteverdi won the debate: a freer approach to the treatment of dissonance soon became the norm, and indeed far stranger sounds than mere unprepared sevenths were heard in subsequent centuries. For the modern students exposed to *Orfeo*, this poses a problem: they cannot hear the dissonances deployed by Monteverdi when a singer cries, "*Ahi, caso acerbo!*" as bitter and alarming, because the musical language is, to their ears, more than conventional.

We designed an experiment to see if we could refresh the ears of a group of modern listeners, so that they might react with a sense of surprise to the music of Monteverdi. The basic principle was to see whether a group of listeners that had been trained with a set of music categorised as *prima pratica* (that is, with conventional dissonance treatment) would react differently when exposed to a piece of *seconda pratica* music (that is, with freer dissonance treatment), from a set of listeners that had been trained with a set of *seconda pratica* music.

For the purposes of this study, we tried to use unconventional dissonance treatment as the primary distinguishing factor among *prima* and *seconda pratica*, in keeping with Artusi's original criticism. This is very difficult to isolate as a feature of style, but we show one way in which this might be approached. We chose our pieces and recordings such that other features, such as texture, timbre, and performance style, were kept as homogenous as possible, leaving pitch and rhythm as the remaining elements. We use computational methods to check how much dissonance, as a fraction of the whole, is contained in our *seconda pratica* set, as compared with our *prima pratica* set. If the *seconda pratica* set is not more dissonant than the *prima pratica* set as a whole, then it seems more likely that listeners are picking up on a difference in the way in which the dissonances are treated.

If an effect could be measured using fairly tightly-controlled training sets, then this would suggest that a larger-scale, more nuanced study might be feasible. Since neither the modern lecturer nor the modern performer generally has the luxury of training a specific audience's ears over a period of years, we wanted to see if a measurable effect could be accomplished within a short time-frame, such as might be encountered in a concert or lecture. Could we begin to simulate a historical subjective experience, by priming a group of listeners to change their subjective experience in response to a training set?

Rationale

Previous research studies have demonstrated participants can rapidly develop both knowledge and subjective preference for grammatical structure following only a limited exposure to unfamiliar musical systems presented within an experimental setting. Experiments reported by Loui and Wessel (2008) used an artificial musical system based on the Bohlen-Pierce scale, which differs substantially from Western music. Their results suggest dissociation between the development of knowledge and preference for an unfamiliar musical system. They found evidence that internalisation of a new musical grammar followed from exposure to a large set size of melodies, while musical preference instead appeared to develop from repeated exposure to a smaller number of items. A similar dissociation between the acquisition of musical grammar and the development of subjective preference ratings is also reported by Loui, Wessel and Kam (2010). They found that just 25 to 30 minutes of exposure to an unfamiliar musical system was sufficient to demonstrate significant learning of the underlying grammatical structure, with participants able to both recognise previously encountered melodies and also generalise this knowledge to classifying new melodies.

These laboratory-based findings can be related to the classic 'mere exposure effect', in which participants' rated preference for stimuli increases purely as a result of being exposed to them more often (Zajonc, 1968). Familiarity with musical structure has been shown to play a role in influencing the degree of emotional engagement experienced by participants while listening to music (Ali & Peynircioglu, 2010). An fMRI study conducted by Pereira et al. (2011) found that emotion-related brain regions become significantly more activated when participants are passively exposed to familiar music relative to listening to unfamiliar music. Crucially, much of the previous experimental research suggests that both the learning and perception of new musical structures is driven by implicit rather than explicit learning processes (for a recent review, see Rohrmeier & Rebuschat, 2012). However, the extent to which such acquired implicit knowledge about music is represented in memory either abstractly or in a more context-specific fashion remains contentious. For example, "A surprising turn of phrase for Mozart may well sound trite coming from The Beatles." (Creel, 2011, p. 1512).

Overall previous research findings provide support for our hypothesis that a relatively brief training period (equivalent to what might be encountered during a concert or lecture) is sufficient to build an appreciation for differences in dissonance treatment

between *prima* and *seconda pratica* in a sample of untrained listeners. Nonetheless, there is also an important caveat to consider. In previous research the grammatical differences between music stimuli are often maximised, or in the case of the research by Loui and Wessel an entirely artificial musical grammar is presented (2008; Loui et al., 2010). In contrast, for our own study the grammatical overlap between *prima* and *seconda pratica* compositions is considerable, with mainly the treatment of dissonance as a distinguishing feature: Palestrina never uses unprepared dissonances, whereas Monteverdi uses them fairly frequently. The actual vocabulary of available simultaneities is quite small, although it is a little different among the two composers used. This similarity might have the consequence of diminishing the build-up of familiarity to differing compositional style of pieces over a short training period. Taking this caveat into account, however, we still found the strength of learning demonstrated for unfamiliar musical arrangements in previous experimental studies compelling. Our study therefore sought to apply a passive exposure-based experimental training paradigm to address the more naturalistic research question of how to build differential subjective experience for *prima* and *seconda pratica* compositions.

Method

Two groups of students were recruited to take part: 28 music students of fairly homogenous background, and 23 psychology students. None of the participants were considered experts in either of the two styles of music, although a degree of prior exposure (for example, in the course of a general music history course) was considered acceptable. The study was a between-participants design, in which the independent variable was whether the participants were exposed to a Palestrina or Monteverdi training set. Dependent variables were the participants' ratings of the pieces of Monteverdi to which they were exposed. None of the participants knew before taking part in the experiment that they would be exposed to either Palestrina or Monteverdi. This information was subsequently revealed in a debrief session after all of the experimental data had been collected.

The music was presented to the subjects in a more naturalistic way than in the studies discussed earlier, in that the pieces were listened to without any repetition, as complete compositions.

The ratings were among ten pairs of opposed words, where each participant rated each pair of words along a five-point scale. The pairs of words chosen were: like/don't like, sweet/harsh, bad/good, familiar/unfamiliar, unpleasant/pleasant, predictable/surprising, consonant/dissonant, unappealing/appealing, comfortable/uncomfortable, competent/incompetent.

Before the experiment commenced, a small pilot group of students rated eight pieces of Monteverdi. Mean scores were calculated across all the ratings for each piece. The two rated most similarly, with mean scores of 15.15 and 15.2, were chosen as pieces A and B, to be heard by the experiment participants before and after the training set. The contentious *Cruda Amarilli* was included among these eight pieces, to see if the

pilot group found it unusual in any way. Ratings of this piece did not differ significantly from those of the other pieces.

The participants were randomly assigned to one of four groups. All participants rated a piece of Monteverdi's music (A or B), before listening to a training set of approximately 30 minutes duration of either Palestrina or Monteverdi. After listening to the training set, all participants rated a second piece of Monteverdi (B or A). All participants also answered a few general questions about their gender, age, and musical background, as well as disclosing any previous familiarity with any of the test materials. The relative position of pieces A and B was switched for half of each group, to ensure that any reaction measured was not due simply to a specific piece. Thus, the four groups were: A-Palestrina-B, B-Palestrina-A, A-Monteverdi-B, B-Monteverdi-A. All participants were seated at computer workstations to listen to their playlists, using headphones.

The participants were provided with text translations of both pieces A and B, and were encouraged to read these before listening to those pieces. The translations were prepared to close correspondence between the relative position of the Italian and English words.

The pieces used in the experiment

To our knowledge this study represents the first time a passive exposure-based training paradigm has been applied to the issue of differentiating *prima* and *seconda pratica* styles of composition. In the absence of previous empirical findings the design of the study was therefore constructed to isolate, as much as possible, dissonance treatment as the most salient stylistic difference between the training sets. To accomplish this we restricted the number of composers featured in the study to two (Claudio Monteverdi and Giovanni Pierluigi da Palestrina), where Palestrina was chosen because he does not use unprepared dissonances: while there are plenty of instances of expressive text setting in Palestrina's madrigals, unconventionally deployed dissonances are not a feature of his style. Although he is not specifically on Monteverdi's list of *prima pratica* composers, his music is generally seen as exemplary of the codification of the rules of counterpoint as laid down by Zarlino (see, for example, Jeppesen, 1946, Preface and p. 11), and he is temporally a bit closer to Monteverdi than the composers who are on Monteverdi's list, such as Willaert. In addition, he is specifically listed by Artusi as a composer who obeys the rules of harmony (1950, p. 400; 1600). This proximity can help reduce (though not eliminate) some of the other aspects of stylistic variation, which might cause differences in perception. Another difficulty with this study is the potential of the performers' interpretation of the pieces to affect the perception of the participants. Modern historically-informed performers, well aware of the problem of the lack of historical ears, will often emphasise those features which they consider significant; in the case of Monteverdi, for example, a singer might attempt to highlight the unprepared dissonances. This may well have been a feature of performance for a listener of Monteverdi's time; however, we argue that a "historical ear" might not have required this performance emphasis in order to be aware of the unconventional behaviour of

the dissonances. To control this problem as far as possible, commercially-available recordings were chosen by the same ensemble of performers (Concerto Italiano) for both styles of music (Monteverdi, 2010; Palestrina, 2010). Only pieces with no instrumental participation were included.

In order to preserve a naturalistic listening experience none of the training pieces were artificially edited, and instead different pieces were selected to ensure a comparable overall duration between the two training conditions. The *seconda pratica* pieces were all drawn from Claudio Monteverdi's fifth book of madrigals, which contains *Cruda Amarilli*. Piece A was *O Mirtillo*, and Piece B was *Ma tu, più che mai dura*. The *prima pratica* training set was drawn from Giovanni Pierluigi da Palestrina's first book of madrigals in four voices. The training set of Monteverdi's pieces consisted of the remaining eleven pieces from Monteverdi's fifth book of madrigals without *basso continuo*, while the Palestrina set consisted of seventeen pieces selected from Palestrina's first book of madrigals in four voices. Both training sets had a duration of about thirty minutes, to ensure that participants in both conditions listened to either Palestrina or Monteverdi for the same length of time. English translations of the texts for pieces A and B were provided, but not for the texts of the training sets. All pieces were presented to participants once only without repetition.

Quantifying a stylistic variable

As mentioned, one difficulty with this type of study is disentangling the various features of musical style which might influence the listeners' reactions. Since the original Artusi/Monteverdi debate revolved primarily around dissonance treatment, we decided to test if Monteverdi's pieces inherently contained more dissonance than Palestrina's. To do this, both sets of pieces were also electronically encoded from modern editions (Monteverdi, 1927; Palestrina, 1884). Using the *PerlHumdrum* analysis toolkit, the two sets were broken down into vertical slices of eighth-note durations. All vertical intervals were then calculated against the lowest sounding note and collapsed to within an octave, to yield a figured-bass symbol. Then, all figures containing dissonances could be extracted and counted, as a fraction of total sonorities. This included both dissonances against the lowest sounding voice (such as seconds, fourths, and sevenths) and dissonances among upper voices (such as a co-incidence of a sixth and fifth, creating a second among those two voices). Figure 1 shows the ten most frequent vertical sonorities of the Palestrina set, and Figure 2, the Monteverdi set.
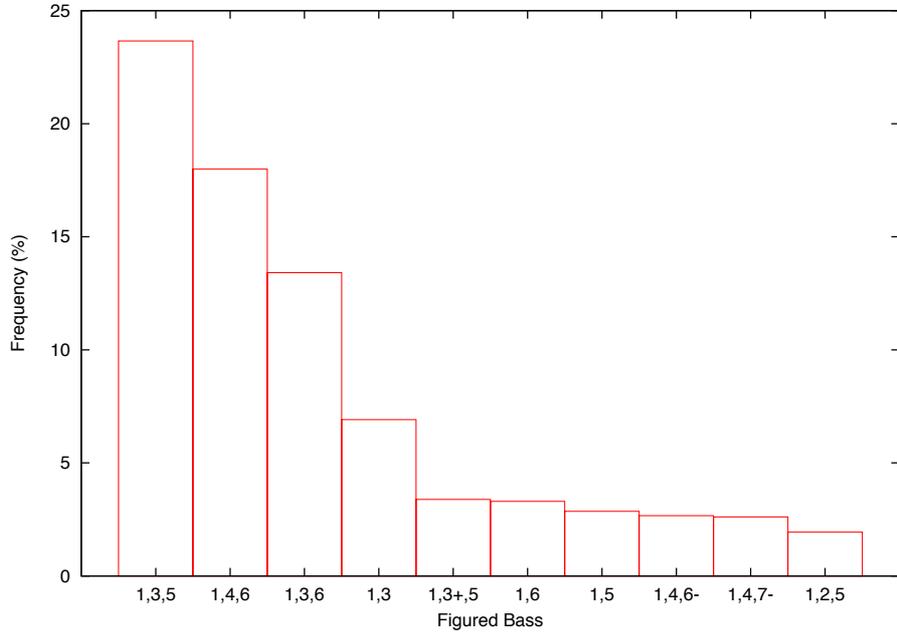
Figure 1. Vertical sonorities of Palestrina madrigals against the lowest sounding note, time-based to eighth-note duration, ten most prominent sonorities. + and - indicate chromatic alteration of a pitch.
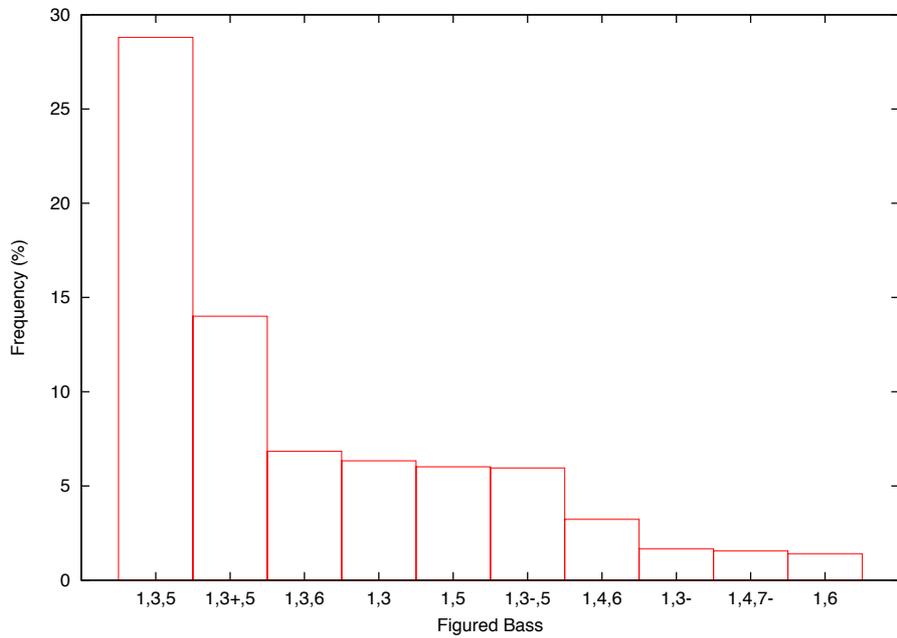
Figure 2. Vertical sonorities of Monteverdi madrigals against the lowest sounding note, time-based to eighth-note duration, ten most prominent sonorities.

In both sets, the most common sonority was a diatonic root-position triad (1,3,5), accounting for nearly a quarter of sonorities in Palestrina, and nearly 30 percent in Monteverdi. Other consonant sonorities, such as first-inversion triads, or simple consonant diads (3rds, 5ths, 6ths) were quite common in both. The most interesting difference was in the appearance of the first dissonant sonority: 1,4,6 accounted for nearly 20 percent of total sonorities in Palestrina, while it appeared in seventh place (at about 3 percent) in Monteverdi. Over all, the Palestrina set would appear to contain significantly more dissonance than the Monteverdi set. In a Monteverdi madrigal, a fair amount of time can be spent declaiming phrases of text over a single consonant triad, which probably explains this difference. If the Monteverdi set over all is not more dissonant than the Palestrina set, it is not the mere presence of dissonance that might be new to the listener, but the way in which they are deployed. Whereas Palestrina's dissonances are carefully prepared and resolved (a known feature of his style, and a main reason to choose him to represent *prima pratica*), Monteverdi's dissonances occur in more concentrated bursts, and include precisely those unprepared and/or unresolved dissonances to which Artusi took exception. There is precedence for this argument in Artusi, as well: in fact, he gives a long list of composers whom he considers worthy of emulation, and states that they have written "full heaps" of dissonances (1950, p. 400). An astonished listener, then, might be astonished at the declamatory treatment of text over a consonant harmonic basis in Monteverdi's music, or at the way in which the dissonances are used.

However, looking at sonorities containing chromatically-altered notes (indicated by + or - beside the figure), Monteverdi shows many more chromatic alterations than Palestrina (nearly 20 percent compared to less than 10 percent). The most common of these is a root-position triad with raised third (1,3+,5).

Figure 3 and Figure 4 show the ten most prominent *dissonant* sonorities of the two sets of madrigals. The Monteverdi madrigals show a fairly even distribution: after the most common dissonance (1,4,6) at about 3 percent, the next nine most prominent all fall into a range of about 0.5 to 1.5 percent. The range of variation (among positions two to nine) in Palestrina is slightly greater, from about 0.5 to 2.5 percent.
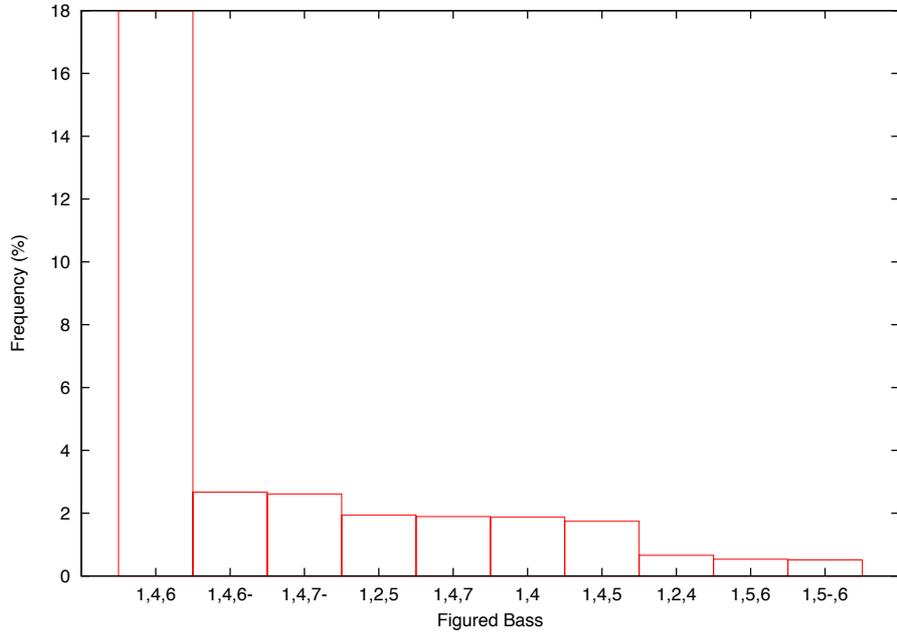
Figure 3. Dissonant vertical sonorities of Palestrina madrigals against the lowest sounding note, time-based to eighth-note duration, ten most prominent sonorities.
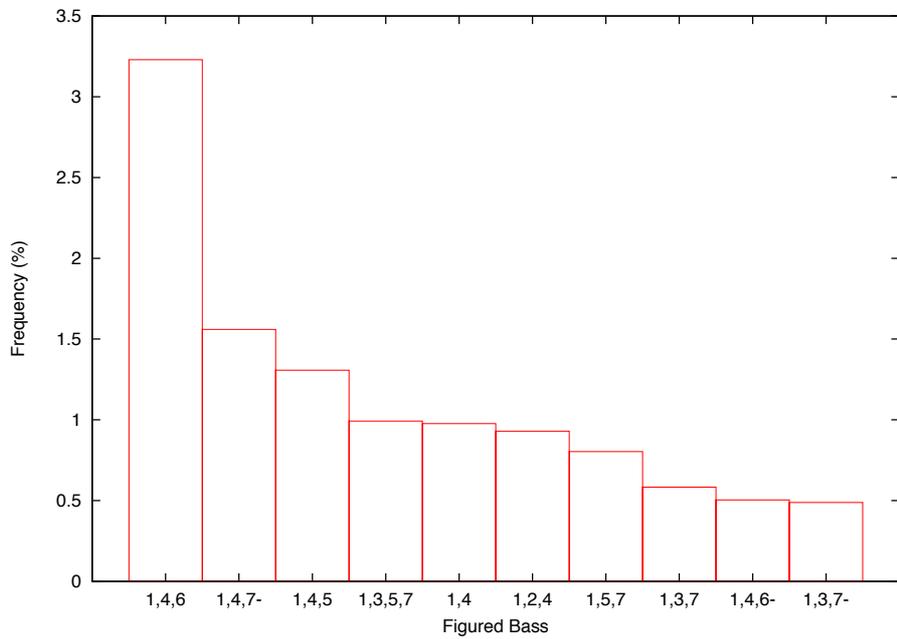
Figure 4. Dissonant vertical sonorities of Monteverdi madrigals against the lowest sounding note, time-based to eighth-note duration, ten most prominent sonorities.

Results and discussion

The experimental data was analysed using a between-participants analysis of variance (ANOVA) with group (psychology or music students), order (Piece A followed by Piece B, or vice versa), and training set (Palestrina or Monteverdi) specified as factors. Upon analysis of the results, there were no significant inter-group differences among psychology or music students (F<1; ns). This allowed us to collapse the results of these two groups. Similarly, there was no significant difference among those who listened to Piece A before the training set, to those who listened to Piece B first; $F(1,47)=1.36$; $p>0.26$. This suggested that any difference perceived was not due to any specific choice of Monteverdi test piece. Thus, we could confine our analysis to comparing the effects of Palestrina versus Monteverdi training set.

In general, reactions of fatigue were observed among many students during the experiment: some were rolling their chairs back and forth, and one was surreptitiously trying to check his email while listening to the training set. One student stated on finishing that he felt that his reaction to the second Monteverdi piece had been affected by fatigue. A de-briefing session was held with the music students, during which a consensus was reached that the homogeneity of each training set (same performers, same style) was likely the cause of the fatigue. One student made the observation during the de-briefing session that she thought that Piece A and B were the same piece. She wondered if perhaps she had the Palestrina training set, and was reacting to a perceived difference in style.

However, on analysis, one of the variables, familiar/unfamiliar, produced a significant interaction ($F(1,49)=6.61$; $p<0.01$); see Figure 5. After training with the set of Monteverdi, there was a significant increase in familiarity for the second *seconda pratica* piece. There was no such increase after training with the set of Palestrina. This suggests that despite the problems of fatigue encountered during the experiment, the training may be having an impact at least on the perception of familiarity of the second Monteverdi piece. Analyses of the impact of Palestrina or Monteverdi-training on other variables were not significant (all $p>0.1$).

Interestingly, the research assistant who encoded the pieces electronically reported experiencing a strong reaction: to verify her encoding, she listened to midi-playback of the encoded pieces, while comparing them with her scores. She had previously spent many months encoding and working with another set of Palestrina pieces (the first book of motets) for another project. She reported having difficulty assessing the accuracy of the Monteverdi set by listening to the midi playback, since to her, the pieces in this set sounded "wrong".

While our results suggest that it may be possible on some level to prime listeners to have a changed subjective experience of a style of music, they serve more to highlight the difficulties that were encountered. Our attempt to control for the variables of stylistic variation in composition and individual interpretation in performance created the very artificial situation of concentrated exposure to a very homogenous sound, which in turn is a likely cause for the sense of fatigue experienced by the participants.

In fact, the way in which the experiment was conducted (listening to recordings using headphones while seated at a computer) is problematic, for the same reason.

One possible way to address this problem would be to conduct a similar experiment in the context of live performance. The added visual stimulus and performer-audience interaction could counteract to a certain degree the choice of an unusually homogenous programme. Furthermore, live performance would help remove constraints imposed on the selection of test pieces by the availability of suitable pre-recorded music, thereby allowing for a greater variety of composers to be examined, for example, using the composers from Monteverdi's own categorisation of *prima* and *seconda pratica*. Also, differing interpretations of the same pieces by the same performers could be compared with each other.
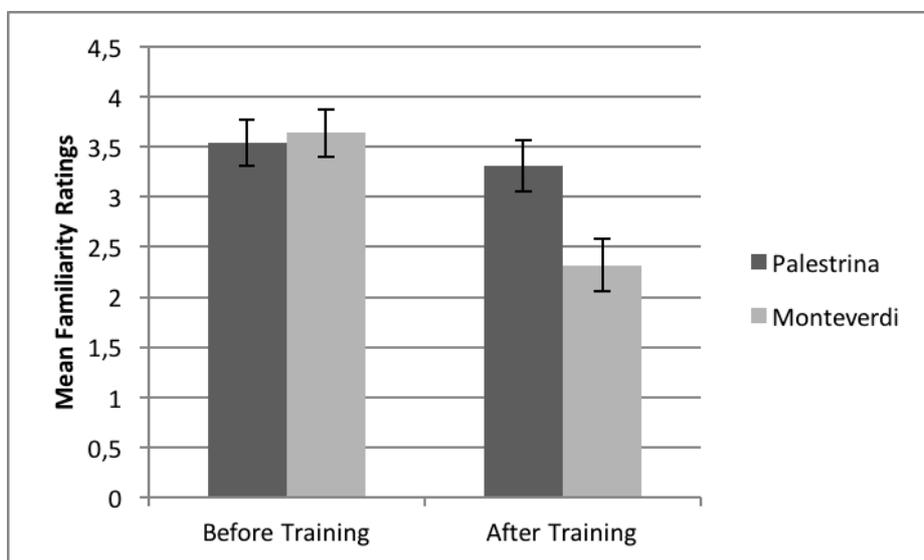
Figure 5. Significant interaction between training pieces (Palestrina or Monteverdi) and familiar-unfamiliar ratings for the Monteverdi test pieces before and after each training session. Note that with the rating scale lower values correspond to higher degrees of familiarity. Monteverdi training leads to significantly greater familiarity ratings than Palestrina training ($F(1,49)=6.61$; $p<0.013$).

The language barrier also remains a problem. While the participants, none of whom were native Italian speakers, had translations of the two pieces to be rated, a group of Italian speakers would be better able to understand the texts of the training set as well, and might experience less of a sense of fatigue. However, it is unlikely that the language barrier would impact directly on participants' experience of dissonance treatment, for example, between the different training sets. This is because passive exposure-based training paradigms involve implicit learning of grammatical structure, and previous research has demonstrated that this occurs even during exposure to unfamiliar languages (e.g., Rohrmeier, Rebuschat & Cross, 2011; Archibald & Joanisse, 2013). Nonetheless, using the passive exposure-based paradigm with a

sample of Italian speakers could help reduce boredom and fatigue resulting from listening to the training sets, although the divergence from modern conversational Italian may be an additional limiting factor. Another possibility would be to use sets of music with English texts; however, this would take us away from the setting of the original debate that is being examined. Since our findings suggest that the music students did not have sufficient expertise in this area to differentiate them from the non-music students, we can at least eliminate that as a selection criterion.

Conclusions and Implications

This exploratory study was conducted with the aim of establishing whether exposure-based training paradigms can usefully be applied to settings where musical meaning is being communicated to an audience of untrained listeners. Notably, such paradigms have previously been used in settings that are difficult to relate to how music may be experienced in a naturalistic setting.

Despite the speculative nature of this pilot study, the initial results are promising regarding the application of an exposure-based training paradigm to building different subjective listening experiences for *prima* and *seconda pratica* pieces. We found that thirty minutes of exposure to Monteverdi was sufficient to produce a significant increase in familiarity ratings for a second Monteverdi piece, in comparison to an equivalent training period spent listening to Palestrina pieces. In contrast the lack of an effect on variables other than familiarity was less encouraging, with no observed effect of training on direct measures of preference for the two styles of music. However, this patterns of results is nonetheless consistent with previous studies reported in the literature. Loui and Wessel (2008) reported (using an artificial musical system based on the Bohlen-Pierce scale) evidence of a dissociation between grammar learning and development of musical preference. They argue that implicit learning of musical structures results from exposure to set of different melodies, while musical preference develops from *repeated* exposure to a much smaller set of items. In our study we note that the significant result on familiarity ratings was achieved despite the lack of repetition of any of the presented pieces during training, suggesting that participants were able to generalise across sets of different Monteverdi pieces when evaluating the familiarity of the second Monteverdi test piece. This finding is consistent with the work of Loui and Wessel, and implies some degree of internalisation of the different compositional styles, even amongst a group of non-Italian speakers unable to directly comprehend the meaning of the text without reference to a translation. We believe it will be interesting in future studies to examine whether introducing some degree of repetition in the training sets might engender more significant shifts in preference measures for the two musical styles.

The absence of any significant effect of musical expertise in our study is also consistent with previous findings reported by Rohrmeier et al., 2011). They found that musical expertise is not advantageous when learning unfamiliar melodic systems generated by an artificial finite-state grammar. Rohrmeier et al. argue on the basis of these findings that musical training exerts little influence during incidental learning of

musical structures that are associated with an unfamiliar system. We have successfully demonstrated a similar finding using existing musical pieces presented within a much more naturalistic listening context.

Overall based on these initial findings we conclude there is a clear foundation for further extension of this paradigm, particularly with regard to a more naturalistic mode of exposure through the medium of live performances.

Acknowledgements

References

Ali, S.O., & Peynircioglu, Z.F. (2010). Intensity of emotions conveyed by familiar and unfamiliar music. *Music Perception, 27(3),* 177–182.

Archibald, L.M.D, & Joanisse, M.F. (2013). Domain-specific and domain-general constraints on word and sequence learning. *Memory and Cognition, 41,* 268–280.

Artusi, G. M. (1600). *L'Artusi, ovvero, Delle imperfezioni della moderna musica*. Venice.

Artusi, G. M. (1950). From *L'Artusi, ovvero, Delle imperfezioni della moderna musica*. In Strunk, O., ed., *Source Readings in Music History*. New York: W. W. Norton and Co. Inc, 393–404.

Creel, S.C. (2011). Specific previous experience affects perception of harmony and meter. *Journal of Experimental Psychology: Human Perception and Performance, 37(5),* 1512–1526.

Jeppesen, K. (1946). *The Style of Palestrina and the Dissonance*. London: Oxford University Press.

Loui, P., & Wessel, D. (2008). Learning and liking an artificial musical system. Effects of set size and repeated exposure. *Musicae Scientiae, 12(2),* 207–230.

Loui, P., Wessel, D.L., & Kam, C.L.H. (2010). Humans rapidly learn grammatical structure in a new musical scale. *Music Perception, 27(5),* 377–388.

Monteverdi, C. (1927). *Il Quinto libro de Madrigali a cinque voci. Tutte le opere V*. G. F. Malipiero (Ed.). Vienna: Universal Edition.

Monteverdi, C. (1929). *Canzonette e Scherzi Musicali. Tutte le opere X*. G. F. Malipiero (Ed.). Vienna: Universal Edition, 69–72.

Monteverdi, C. (1608). Studiosi lettori. In *Il Quinto Libro de Madrigali a cinque voci*. Venice: Ricciardo Amadino.

Monteverdi, C. (2010). [recorded by Concerto Italiano and Rinaldo Alessandrini]. *Madrigali* [CD]. Naïve.

Monteverdi, G. C. (1607). Dichiaratione della lettera stampata nel Quinto libro de suoi Madregali. In Monteverdi, C., *Scherzi Musicali a tre voci di Claudio Monteverde raccolti da Giulio Cesare Monteverde suo fratello, & novamente posti in luce*. Venice: Ricciardo Amadino.

Palestrina, G. P. (1884). *Madrigali a quattro voci*. *Opera Omnia Ioannis Petraloysii Praenestini, Tomus XXVIII*. F. X. Haberl (Ed.). Leipzig: Breitkopf & Härtel.

Palestrina, G. P. (2010). [recorded by Concerto Italiano and Rinaldo Alessandrini]. *Il Primo Libro de' Madrigali a quattro voci* [CD].Tactus.

Pereira, C.S., Teixeira, J., Figueiredo, P., Xavier, J., Castro, S.L., & Brattico, E. (2011). Music and emotions in the brain: Familiarity matters. *PLOS ONE, 6(11)*. DOI: 10.1371/journal.pone.0027241

Rohrmeier, M., & Rebuschat, P. (2012). Implicit learning and acquisition of music. *Topics in Cognitive Science, 4(4)*, 525–553.

Rohrmeier, M., Rebuschat, P., & Cross, I. (2011). Incidental learning of melodic structure. *Consciousness and Cognition, 24(2)*, 214–222.

Weiss, P., & Taruskin, R. (Eds) (1984). *Music in the Western World: A History in Documents*. New York: Schirmer Books.

Zajonc, R.B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology, 9(2)*, 1–27.

Biographies

Frauke Jürgensen is a Lecturer in Music at the University of Aberdeen. Her research interests include historical performance and compositional practice, the history of theory, and computational musicology. She is also active as a performer.

David Pearson is a Lecturer in Psychology at the University of Aberdeen. His research interests include the role of eye movements in visuo-spatial working memory, the cognitive effects of perceiving natural and man-made environments, cognitive factors that modulate the experience of autobiographical memory, the effects of contextual representations on instrusive and involuntary memory, and the role of mental imagery during creative thinking.

Ian Knopke received his PhD in Music Technology from McGill University, and has been a researcher at the Indiana University School of Informatics and Goldsmiths College. He is the author of the PerlHumdrum Analysis Toolkit for Symbolic Music Analysis, and currently researches in the field of search and recommendation for the BBC in London.