COMMUNICATING EMOTIONS THROUGH ORNAMENTATION
Renee Timmers & Richard Ashley
School of Music, Northwestern University

ABSTRACT
This study investigated the use of musical ornaments to communicate and evoke emotions. Its aim was to clarify the relationship between the communicated emotion and the applied ornamentation as well as the basis of the power of ornaments to evoke an emotional response. Three professional musicians (a violinist, flutist and recorder player) performed three fragments from Handel’s G-minor sonata for recorder and basso continuo in nine different ways: in its printed form without ornamentation and in an adapted form with ornamentation to express mild and intense happiness, mild and intense love, mild and intense sadness, and mild and intense anger. The choice of ornamentation was left up to the performer. These recordings were presented in random order to musically trained listeners who judged the presence of the four emotions on a scale from 1 to 7, which ranges from absent (1) to moderately (4) to strongly present (7). Only the results of the pilot study that included one performer (the violinist) and six musically trained participants are available at this stage. The pilot results show that the performer was well able to communicate the four emotion types through ornamentation, especially the mild emotions. The results for the intense emotions were less strong. Sadness was communicated using fewer ornaments and fewer dissonances. In addition, it had relatively many substitutions. Anger had relatively many ornaments anticipating the beat. Both the performer’s data and the listeners’ data showed tendencies for emotions to confound and co-occur, especially for love and happiness.

1. BACKGROUND
Ornamentation is one of the means available to both performer and composer to add expression and meaning to a melody. A performer may use ornamentation to embellish and stress particular notes, but also to accentuate the character of the music. The presence of ornaments seems especially suited for certain expressions such as the expression of grief, which may be enhanced by a long downward moving dissonant appoggiatura. It is therefore surprising that ornamentation has not yet been considered as a means to communicate emotion in music psychological studies, especially since these studies do suggest ways in which ornaments may function emotionally.

Broadly speaking, at least two theories exist about the perception of emotion in music. The first theory holds that music is emotional if tendencies perceived in the music are violated and resolutions delayed [10, 9]. The second theory holds that music is emotional due to the interpretation of acoustic cues [6, 7, 8]. A combination of acoustic cues will make music sound happy (e.g. fast tempo and loud dynamics), while a different combination will make it sound sad (e.g. slow tempo and soft dynamics).

Ornaments’ emotional effect may be explained under both theories of musical emotion. A one-note ornament like the appoggiatura may violate melodic or harmonic expectations by falling out of the expected contour or harmony. Or it may contribute to the happy or sad connotation of the music by adding, for example, a lively or a dissonant feature.

Historical performance treatises incidentally mention affective circumstances that suit certain ornaments best and warn not to obscure the original affect of the music [11, 1, or 4, 5, 12, 14 for summaries]. The treatises are, however, far from conclusive about the relation between ornaments and communicated emotion and do not specify what characteristics of an ornament determine it to be affective.

2. AIMS
The aim of this study was to clarify the relationship between the communicated emotion and the applied ornamentation as well as the basis of the power of ornaments to evoke an emotional response.

3. METHOD
Musical material
Three fragments from Handel’s G-minor sonata for recorder and basso continuo (HWV 360) were chosen as musical material for the experiment. The fragments are the opening bars of the first movement, third movement and fourth movement. This music was considered suitable, because the melody is easily performed on different instruments, the original does not have a very strong and clear emotional connotation, and, most importantly, there is room for ornamentation.

Performances
The accompaniment was recorded separately from the solo part. A pianist from Northwestern University performed the accompaniment with the sole instruction to play the music rather plain and approximately at an indicated tempo. The tempi were taken a bit slower than might be considered typical in order to keep room for ornamentation in the solo part.

Three performers (a violinist, flutist and recorder player) performed the solo in different recording sessions. The music and instructions were sent to the performers in advance. They performed the fragments in nine different ways: in its original form without ornamentation (1) and in an adapted form with ornamentation to express mild and intense happiness (2 and
3), mild and intense love (4 and 5), mild and intense sadness (6 and 7), and mild and intense anger (8 and 9). The choice of ornamentation was left up to the performer. They performed along with the piano accompaniment that was presented over headphones.

The overdubbed composite of the recording of the piano accompaniment and the solo part was used as stimuli of the listening experiment with the solo part panned to the left and the piano part panned to the right.

Participants
Six musically trained listeners participated in the pilot study (average age was 29). Among them were an accordion player, a cellist, flutist, two pianists, and a violinist.

Procedure
In the pilot study, only the performances of the violinist were used. The recordings were grouped per fragment. The order of fragments was counter-balanced over participants. The order of the performances of one fragment was random with the exception of the neutral version, which was presented as the first and as the last performance of each fragment. The participants listened to a performance once and judged the presence of the four emotions on a scale from 1 to 7, which ranges from absent (1) to moderately (4) to intensely present (7). They did not rate the first neutral performance, which was presented only to familiarize the participant with the music. They did, however, rate the last neutral performance of a fragment.

4. RESULTS

Classification of ornaments
The ornaments that a musician applies can be analyzed in at least two ways. One way is to classify the ornament according to its type. An alternative is to analyze the characteristics of the ornament irrespective of its type. Performer treatises distinguish several types of ornaments, such as the appoggiatura, the trill, the mordent and the turn [4, 5]. Characterizations of ornaments often differentiate between upward or downward motion, stepwise or leap, dissonant or consonant, long or short and ornaments on the beat or before the beat [4, 5, 12].

To classify the ornaments used by the violinist in the first fragment of this study, we could not fully rely on the traditional classification, because the ornamentation used by the violinist was more elaborate than the strict ornamentation of long main notes. On the other hand, we felt a need to simplify the categorization to enhance the comparability between the characteristics of ornaments of different classes.

In short, all notes that were changed or added with respect to the score were considered ornaments. These ornaments were then classified as either an appoggiatura (a), a Vorschlag (b), or a Nachschlag (c). An appoggiatura (a) is performed in time of the main note that is displaced and shortened, and follows the ornamental notes. A Vorschlag (b) is performed in time of the preceding note, but belongs to the following main note. A Nachschlag (c) is performed in time of the main note, but does not displace the main note. The Nachschlag (c) follows the main note. The majority of ornaments could be classified as one of these three categories. In addition, trills were used and notes were sometimes substituted by a note with the same duration, but a different pitch. The mordent was used only once and was therefore classified in terms of the three grace note types (a, b and c). The other ornament classes were not used by the violinist.

Besides this classification of each ornament, each ornament was characterized. The direction was either upward (1) or downward (0); the length was short (0) or long (1), the interval was stepwise (0) or a leap (1), the harmony was a chord-tone (0), a consonant non-chord tone (1), or a dissonant non-chord tone (2), where dissonance or consonance was classified in relation to the tonic of the chord.

Expression of emotion by the performer
Table 1 shows a summary of the types of ornaments used by the violinist in the first movement. The number of ornaments of each class is indicated per emotion condition. Table 1 shows that the mild and intense forms of happiness, love and anger had together always between 40-42 ornaments. The majority of which were grace notes (type a, b and c). This in contrast to the sad conditions, which had considerably less ornaments and relatively many substitutions.

Table 1: Number of ornaments of each class per intense (i) and mild (m) emotion for the first fragment of the violinist. The classes include an appoggiatura (a), a Vorschlag (b), Nachschlag (c), trill (Tr.), and substitution (Subst).

<table>
<thead>
<tr>
<th>Emotion</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>Tr.</th>
<th>Subst.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger i</td>
<td>2</td>
<td>11</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>Anger m</td>
<td>3</td>
<td>10</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Happy i</td>
<td>10</td>
<td>6</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>27</td>
</tr>
<tr>
<td>Happy m</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Love i</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td>Love m</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Sad i</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Sad m</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>34</td>
<td>46</td>
<td>31</td>
<td>8</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 shows a summary of the characteristics of these ornaments. The average direction, length, interval and harmony of the ornaments are listed for each emotion condition. A number close to 0 indicates a majority of downward movement,
short durations, stepwise intervals, and chord-tone harmony, respectively. A number close to 1 indicates a majority of upward movement, long durations, leaps and a harmony that is on average neither dissonant nor always consists of chord-tones. A number close to 2 indicates a primarily dissonant harmony.

Table 2: Characteristics of the ornaments per intense (i) and mild (m) emotion for the first fragment of the violinist

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Direction (0-1)</th>
<th>Length (0-1)</th>
<th>Interval (0-1)</th>
<th>Harmony (0-2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger i</td>
<td>0.32</td>
<td>0.88</td>
<td>0.00</td>
<td>1.14</td>
</tr>
<tr>
<td>Anger m</td>
<td>0.44</td>
<td>0.93</td>
<td>0.07</td>
<td>0.90</td>
</tr>
<tr>
<td>Happy i</td>
<td>0.50</td>
<td>0.90</td>
<td>0.05</td>
<td>1.04</td>
</tr>
<tr>
<td>Happy m</td>
<td>0.45</td>
<td>0.89</td>
<td>0.09</td>
<td>1.00</td>
</tr>
<tr>
<td>Love i</td>
<td>0.47</td>
<td>0.89</td>
<td>0.17</td>
<td>0.96</td>
</tr>
<tr>
<td>Love m</td>
<td>0.46</td>
<td>0.92</td>
<td>0.07</td>
<td>0.73</td>
</tr>
<tr>
<td>Sad i</td>
<td>0.25</td>
<td>1.00</td>
<td>0.75</td>
<td>0.25</td>
</tr>
<tr>
<td>Sad m</td>
<td>0.63</td>
<td>1.00</td>
<td>0.00</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Table 2 shows again agreement between anger, happiness and love and a distinction from sadness. The direction of the ornaments is a bit more often downward than upwards (average is slightly below 0.50). The length is almost always long with some shorter ornaments. Except for the sad conditions, which only contain long ornaments (average is equal to 1). The interval is almost always stepwise, except for the intense sad condition that shows 3/4 of the ornaments to be leaps. Finally, the harmony is on average around 1 – neither dissonant, nor a chord tone, except for the intensely sad condition that shows an average close to 0 (a majority of chord tones).

Interpretation of emotion by listeners

Table 3 shows the correlation between instructed emotion and perceived emotion as rated by the listeners. The average rating of perceived emotion is significantly and positively related with the respective instructed emotion for anger, sadness, and happiness. The positive correlation between the instruction of love and the rating of love is not significant (p > 0.05). Significant negative correlations were between the instruction of anger and the rating of love, the instruction of anger and the rating of sad, and the instruction of sad and the rating of anger.

Table 3: Correlation between instructed emotion and average rating of perceived emotion

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Perceived Emotion</th>
<th>Happy</th>
<th>Love</th>
<th>Sad</th>
<th>Anger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happy</td>
<td></td>
<td>0.42*</td>
<td>0.28</td>
<td>-0.18</td>
<td>-0.12</td>
</tr>
<tr>
<td>Love</td>
<td></td>
<td>0.17</td>
<td>0.22</td>
<td>-0.01</td>
<td>-0.32</td>
</tr>
<tr>
<td>Sad</td>
<td></td>
<td>-0.59**</td>
<td>0.31</td>
<td>0.68**</td>
<td>-0.44*</td>
</tr>
<tr>
<td>Anger</td>
<td></td>
<td>0.01</td>
<td>-0.82**</td>
<td>-0.48**</td>
<td>0.88**</td>
</tr>
</tbody>
</table>

* p < 0.05, ** p < 0.01

In short, anger, happiness and sadness were reliably communicated, but the instruction of love was not reliably recognized. When we compare the communication for the mild and intense conditions, it turns out that especially the communication of intense love is unreliable. The correlation of the instruction of love with the rating of love is 0.46 for the mild conditions, but only 0.01 for the intense conditions.

Figure 1 shows the average ratings of the four emotions for the conditions that had love as instruction. For the mild love conditions, the rating of love was highest. For the intense love conditions, however, the rating of love decreases for all movements. Instead the rating of happiness increases for movement 1 and 3, while the rating of sadness decreases. For movement 4, the rating of angry is relatively high for the lovingly intense condition. This suggests that the category of love is restricted to a mild intensity. With increasing activity, the emotion becomes confounded with other emotions both positive and negative.

5. CONCLUSIONS

The analyses of these preliminary data of the performer’s actions highlighted the distinct characteristics of the intense sad condition from the other emotion conditions. The expressions of happiness, love and anger showed similar types of ornaments that also had similar characteristics. Further analyses will look at other aspects of expressive performance, including the deliberate use of dynamics and vibrato. In the Baroque, these devices would have been viewed as ornaments and used selectively rather than as a constant element of the sound. Our players followed this Baroque practice in their performances.

The listeners’ responses show both clear distinctions as well as a tendency to identify more than one emotion as fitting the music. The distinction between anger and the other emotions was very clear. However love and sadness as well as love and happiness confounded to a considerable extent.

This interplay between different emotions may seem surprising to readers of the modern psychological literature on emotion. However, it would have been far less surprising to a musician of Handel’s time. A few citations from seventeenth-century treatises help to illustrate this point:

First, Thomas Ravenscroft [13] gives some mention of a taxonomy of emotions in his discussion between love and music: “And the Philosophers three Principall Causes of
Musick, 1. Dolour, 2. Joy, 3. Enthusiasme or ravishing of the Spirit, are all found by him with Loves Territories. (Preface, Sect. 5) Taking this into the context of the present experiment, Ravenscroft’s taxonomy would suggest that anger would be most differentiated from the other emotions, and that the remaining three emotions (love, happiness, and sadness) would group together. Such is the effect we see obtaining here in some ways.

An even stronger case can be made from what is perhaps the single most influential treatise on the emotions in this period, Descartes’ “De Passionibus Animae” [3]. Descartes divides all the passions into two categories: the Concupiscent and the Irascible (Article 68). The former includes positively-valenced emotions and the latter the negatively-valenced ones. He goes on to list “simple and primitive” passions, saying that “...only six of them are of this kind--namely Wonder, Love, Hatred, Desire, Joy, and Sadness—and that all the others are composed of some of these six or are species of them (Article 69). Later, he opposes Hatred to Love (Article 87), and says that there are fewer subtypes of hatred than of love. His discussion of tears states that “It is Love joined to Sadness that causes most tears” (Article 117) and “tears do not come from extreme Sadness, but only that which is moderate and accompanied or followed by some sensation of Love, or Joy as well.”

From these sources, we see that some kind of taxonomy or grouping of emotions that put love, happiness, and sadness together, with anger standing apart, would have been sensible to a musician of the Baroque. This is rather different from the categorizations we would obtain by thinking in terms of a simple positive or negative valence for each emotion.

6. REFERENCES