

music training and musical experience may prime listeners to more readily perceive increased energy, power, depth, and sensitivity of emotion with increased harmonic complexity.

### NAMING THE ABSTRACT: BUILDING A REPERTOIRE-APPROPRIATE TAXONOMY OF AFFECTIVE EXPRESSION

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Time: 15:00

Studies measuring perceived musical affect have examined different groups of affects: “basic” emotions (Ekman 1992), arousal and valence terms (Schubert 1996), and eclectic lists of emotions (Eerola & Vuoskoski 2011). However, it is difficult to compare results between studies using different terms. Several recent projects have addressed this difficulty by building a general-purpose taxonomy of affective musical terms (Zentner, et al 2008, Schubert 2003). However, these studies assume that the same labels can be effectively used for many repertoires. Recently, Albrecht & Huron (2010) used a bottom-up approach to elicit piece-specific affective labels. This study seeks to expand this work by developing a taxonomy of terms to use for studying Beethoven’s piano sonatas. The current report compares lists of affective terms gathered from three participant-generated approaches. In the first study, 28 participants each chose 20 terms deemed most relevant for “early Romantic piano music” from a list of 91 terms taken from three studies (Zentner, et al 2008, Schubert 2003, and Albrecht & Huron 2010). In the second study, 21 participants listened to 15 excerpts from Beethoven’s piano sonatas and chose 5 terms for each excerpt from the same list. Finally, 43 participants provided free-response descriptions of the affect of the same excerpts, subjected to content analysis for derivation of affective terms. The results from these three studies were cross-referenced and a cluster analysis was used to determine a heuristic of affective categories. By cross-examining the results from the three different studies, nine affect terms are suggested for the Beethoven piano sonatas: angry, anticipating, anxious, calm, dreamy, exciting, happy, in love, and sad. The results from the three studies also illustrate how experimental paradigms influence participant-generated affective terms. The results from this study provide a taxonomy of affective terms that are repertoire-specific for the Beethoven piano sonatas. Allowing participants to provide free-response affect terms for this specific repertoire resulted in terms common to many studies (e.g. happy, sad), and also more unique terms that nonetheless seem relevant to this repertoire (dreamy, anxious, calm).

### EMOTION RECOGNITION FROM MUSIC-INDUCED MOVEMENT

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Time: 15:30

#### ABSTRACT

Emotions color all aspects of our interaction with music. Not only composing music or playing a musical instrument, but also perceiving sounds and responding to them implicates the involvement of human emotions. An interesting type of musical interaction, in particular with regard to emotion research, is dance, which is believed to facilitate the expression of several different emotions in a non-verbal way. In this study, the aim was to examine emotion perception from dance movement. Thirty participants observed a selection of silent videos showing depersonalized avatars of dancers moving to an emotionally neutral musical stimulus after emotions of either sadness or happiness had been induced. After every film clip, the participants were asked to assess the emotional state of the dancer. Results revealed that the emotional state of the dancers was successfully identified. In addition, emotions were more often recognized for female dancers than for their male counterparts. Finally, results of eye tracking measurements showed that observers primarily focused on movements of the trunk when decoding emotional information from dance. The findings of this study show that induced emotions can be successfully recognized from dance movement. They also illustrate the significance of emotions in the coupling between music perception, cognition, and action.

#### 1. INTRODUCTION

One of the main reasons why music is so abundantly present in almost every possible activity of our lives can be traced back to its emotional effects (Juslin & Laukka, 2004). Since music is often considered as a language of emotions (Cooke, 1959), it should not come as a surprise that a multiplicity of studies have been devoted to the exploration of the link between music and emotion (Juslin & Sloboda, 2001). Since it has been shown that cognition, perception, and action are tightly coupled (Leman, 2007), it is self-evident that when we interact with music, corporeal articulations are involved. Moreover, neuroscientific research has demonstrated that brain regions responsible for motor activities, as well as emotional responses, are activated through musical interaction (Blood & Zatorre, 2001; Janata & Grafton, 2003; Koelsch, 2010; Peretz & Zatorre, 2005). Hence, a disembodied, Cartesian mind as such does not exist. Therefore, either when dealing with emotion effects that are rooted in musical interaction or with effects of sound on affective experience, the impact of the body can simply not be ignored.

An interesting example of embodied interaction with music, in particular with regard to emotion research, is music-induced movement, or dance, which is believed to facilitate the expression of several different emotions in a non-verbal way (Levy, 1988). Moreover, dance is one of the oldest forms of cultural expressions (Sachs, 1937). The ability to successfully decode emotions from dance movement is already present from early childhood onwards. In addition, children as young as five years old have demonstrated to be capable of decoding the intensity of the emotions expressed by dancers when observing videos of adults moving expressively to music

(Boone & Cunningham, 1998). Previous research concerning emotion recognition from dance commonly used videos of actors or dancers portraying emotions such as happiness, sadness, fear, disgust and anger (Boone & Cunningham, 1998; Camurri, Lagerlöf, & Volpe, 2003; de Meijer, 1989; Lagerlöf & Djerf, 2000; Montepare et al., 1999; Pollick et al., 2001). The assumption underlying the selection of emotions presented through acting in previous studies is that actors are typically believed to be experts in displaying emotional information corporeally and that acted emotions parallel emotions experienced in real life (Gross, Crane, & Fredrickson, 2010). However, one might argue that these acted actions are exaggerated and should rather be regarded as symbolic portrayals of the emotions at issue. In addition, a number of studies have revealed that not all actors generate equally identifiable, emotionally expressive dance movements (Gross, Crane, & Fredrickson, 2010; Montepare et al., 1999; Wallbott, 1998). Therefore, instead of considering emotions portrayed through acting, the current study applies emotion induction techniques in order to examine the recognition of emotions from dance movement, as induced emotions are supposedly equivalent to naturally occurring emotions (Jallais & Gilet, 2010). Furthermore, contrary to previous studies, which have made use of choreography to study expressive dance movements (Brownlow et al., 1997; Camurri, Lagerlöf, & Volpe, 2003; Montepare et al., 1999; Wallbott, 1998), the dancers in this study were able to move freely as we believe that this facilitates more accurate expression of emotion.

In a previous study by Van Dyck et al. (2013), which examined the impact of induced emotions (happiness and sadness) on dance movements of participants dancing freely to emotionally neutral music by measuring and analyzing the kinematics of the movements, evidence of the effect of emotion induction on dance movement was provided. In the current study, it is investigated whether human observers are able to decode induced emotions from dance. Since both adults and children have been proved to master the ability to decode portrayed emotions from full body movements (Boone & Cunningham, 1998; Dittrich, 1996; Lagerlöf & Djerf, 2000; Shikanai, Sawada, & Ishii, 2013), we expect that observers are also capable of distinguishing between induced emotions manifested through dance movement. In addition, since little is known about visual search patterns people use to gather information on which emotion recognition is built, the behavioral method of eye tracking is used to examine the direction of the observers' focus. We also presume that female participants perform better in the recognition task than their male counterparts, as women are believed to be superior in understanding others' emotions (Hampson, van Anders, & Mullin, 2006). In addition, as women generally experience and express emotions more intensely than do men (Donges, Kersting, & Suslow, 2012), we expect the participants to have a higher success rate when judging the emotional state of female than of male dancers. Finally, as Van Dyck et al. (2013) revealed that the differences between the emotion conditions were mainly detectable from hand movement, we expect observers to primarily focus on the gestures of the dancers' hands.

## 2. METHOD

### 2.1. Participants

A total of 30 adult observers (15 females, 15 males) took part in the study. The average age of the observers was 27.23 years ( $SD = 3.43$ ). 60 % had received musical training, and of those, the average time spent in musical training was 6.23 years ( $SD = 6.70$ ). About half of the observers (56.70%) had also trained in dance and spent, on average, 2.67 years ( $SD = 4.02$ ) in dance training. The observers received no compensation for participating in the study.

### 2.2. Materials and stimuli

**Stimuli.** Sixteen video clips were used in this study. The video clips were recorded with motion capture cameras in a previous study (Van Dyck et al., 2013), in which the effect of induced emotions on the kinematics of dance movement was studied. In that particular study, non-expert dancers were induced to feel emotional states of either happiness or sadness and then danced intuitively to an emotionally neutral piece of music. Each participant performed both conditions. For the current study, silent video clips showing depersonalized, androgynous avatars were created from the movement data of the dancers. Each of the 16 video clips, consisted of a pair of dance performances (presented side-by-side and played simultaneously); one of a dancer in the happy condition and one of the same dancer in the sad condition. Both the order of the video clips and of the emotion conditions was randomized. Half of the dancers were female and all emotional states were presented an equal number of times on the left and on the right side of the screen. Each video clip had a duration of 10 seconds. Three practice clips preceded the actual clips that had to be rated. The video clips were presented on a 22-inch computer monitor.

**Eye tracking.** Eye movements were recorded using a Remote Eye tracking Device (RED) by SensoMotoric Instruments (SMI). To calculate the time participants watched the different regions of the body, dynamic Areas Of Interest (AOIs) were coded on the video clips. Once the AOIs were coded, dwell-time percentages (percentage of time the eyes were directed towards the AOI) were retrieved. In order to control for AOI size, dwell-time percentages were normalized for the size of the specific body area. All clips were coded with following AOIs: chest, feet, head, hips, arms, legs, and hands.

### 2.3. Procedure

Participants were asked to watch the video clips and to fill out a short questionnaire after each video. In the questionnaire, they were asked to point out which of the two dance performances was happy and which one was sad. At the end of the experiment, the observers were asked to fill out a second questionnaire, which contained questions concerning their music and dance background.

### 3. RESULTS

#### 3.1. Emotion recognition

A one-sample chi-square test revealed that observers were able to recognize the correct emotion from the dance movements,  $\chi^2(1) = 255.21, p < .001$ . Based on the odds ratio, the odds of observers recognizing the correct emotion were 6.38 times higher than making the wrong decision concerning the emotional state of the dancers. In addition, the effect of the order of the videos, the order of the emotions, the sex of the dancers, and the sex of the observers was examined. Pearson's chi-square tests revealed no significant associations between the order of the videos,  $\chi^2(2) = .64, p = .89$ , the order of the emotions,  $\chi^2(1) = 1.78, p = .18$ , or the sex of the observers,  $\chi^2(1) = 1.14, p = .29$ . However, there was a significant association between the sex of the dancers and the results of the emotion recognition task,  $\chi^2(1) = 28.47, p < .001$ . Based on the odds ratio, the odds of recognizing the correct emotional state were 5.38 times higher when observers were watching female dancers than when they were observing male dancers.

#### 3.2. Eye-tracking

Validation tests showed an average accuracy of  $0.37^\circ$  ( $SD = 0.12$ ) and the average tracking ratio (% of time eye movements was actually measured) was 89.90 % ( $SD = 3.70$ ), which signifies that the tracking data of all participants proved to be accurate enough in order to be analyzed statistically.

AOIs were analyzed in order to check the direction of the focus of the observers' gaze. A Kolmogorov-Smirnov test showed that the assumption of normality could not be accepted. A Friedman's ANOVA with the AOIs as test variables showed a significant difference in mean dwell time between the different AOIs,  $\chi^2(6) = 128.69, p < .01$ . Wilcoxon tests were used to follow up this finding. A Bonferroni correction was applied and so all effects are reported at a .00048 level of significance. Mean dwell time was significantly higher for the chest than for the head,  $Z(29) = -4.76$ , hips,  $Z(29) = -4.78$ , arms,  $Z(29) = -4.78$ , hands,  $Z(29) = -4.78$ , legs,  $Z(29) = -4.78$ , and feet,  $Z(29) = -4.78$ . In addition, mean dwell time was significantly higher for the arms than for the hips,  $Z(29) = -4.68$ , hands,  $Z(29) = -4.78$ , legs,  $Z(29) = -4.39$ , and feet,  $Z(29) = -4.78$ . Finally, mean dwell time was significantly lower for the feet than for the head,  $Z(29) = -4.33$ , chest,  $Z(29) = -4.78$ , hips,  $Z(29) = -4.61$ , arms,  $Z(29) = -4.78$ , hands,  $Z(29) = -4.70$ , and legs,  $Z(29) = -4.78$ . An overview of the mean dwell time for the different AOIs is presented in Figure 1.

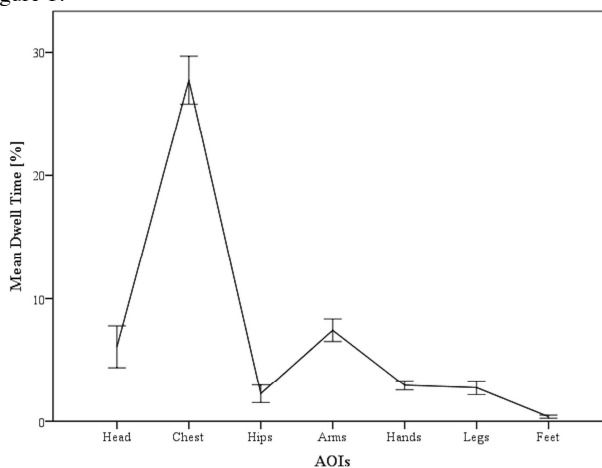


Figure 1: Mean dwell time for the AOIs. Data presented are mean  $\pm$  SE.

### 4. DISCUSSION

In this study, it was examined whether human observers are able to decode emotional content from corporeal articulations of dancers moving to an emotionally neutral piece of music after emotions (happiness or sadness) had been induced. The results revealed that the participants were indeed capable of identifying the intended emotion from the dance movements. This finding is in accordance with results of previous studies on emotion recognition from dance, examining portrayed emotions. For instance, Boone and Cunningham (1998), Montepare et al. (1999), and Shikanai et al. (2013) showed that portrayed emotions expressed in dance could be accurately identified by observers. Therefore, our results resonate with findings of previous studies, but also extend them by showing that, in addition to portrayed, or 'acted', emotions, also induced emotions can be decoded from dance.

As it is well documented that women are better at understanding and considering the feelings and needs of others compared to men (Hampson, van Anders, & Mullin, 2006), we presumed female observers to recognize the induced emotions more often than their male counterparts. However, our results did not support this premise. On the other hand, a significant association with recognition accuracy was unveiled regarding the sex of the dancers, as the emotional state was more often recognized for female dancers than when male dancers were being observed. This suggests that women are more proficient in expressing their personal feelings in a corporeal manner compared to men. This is in accordance with a fairly substantial body of research, which has demonstrated that women are more emotional, and both experience and express emotions more intensely than men (Donges, Kersting, & Suslow, 2012).

As the hands are generally believed to have a privileged role in music-related gestures (Godøy, 2010), and since Van Dyck et al. (2013) obtained more significant differences for the hands than for any other body part, we expected that participants would mainly focus on hand gestures. However, eye tracking data from the current study unveiled a specific focus of the observers on the chest area. Although this finding did not fit our expectations, several explanations arise from the data. First, most of our body movements tend to start from the more proximal segments and develop towards the more distal limbs (Chapman, 2008). This implies that information on changes in movement direction or acceleration might be readily seen in the trunk/shoulder area first. Second, even though the observers' general focus is on the chest area, gestural information concerning other body parts is not necessarily disregarded as the participants are still capable of perceiving movements of other parts of the body, in relation to the chest. In this specific experimental set-up, most of the movements of the arms and legs were still within the useful field of view when focusing on the chest. The reported gaze behavior therefore suggests that dancers' emotions were analyzed using an extended visual span and parafoveal processing. This visual strategy has been described in fields such as sports (Gegenfurtner, Lehtinen, & Säljö, 2011) and radiology (Kundel et al., 2007) and has been labeled as 'the holistic model of image perception'. This visual strategy suggests that observers do not pay attention to the head, the hands, the hips, etc. as separate parts of the body, but rather see the human body as one entity. Our finding with regard to the focus on the chest accords with previous research on emotions and body posture as several studies have emphasized the importance of the posture and position of the torso as indicators for emotional content. Schouwstra and Hoogstraten (1995), for instance, used stick drawings of armless figures and varied the positions of the spine (and head). Their study revealed that upright postures were judged more positively, and forward-leaning postures more negatively.

Previous research revealed that, even though emotion recognition is not fully matured until early teenage years (Tonks et al., 2007), children as young as about five years old perform above chance in successfully perceiving emotional information from body language. Moreover, they are capable of decoding the intensity of the emotions expressed through dance movement when observing videos of people moving to music (Boone & Cunningham, 1998). As it is believed that the duration of negative emotional states decreases with age (Larcom & Isaacowitz, 2009), the current study only considered a specific age group (from 24 to 34 years of age). However, a future study could investigate whether also children or observers in other age groups are capable of successfully recognizing induced emotions from free dance movements.

With regard to the stimuli used in this study, each film clip consisted of two dance performances executed by the same individual. Pairs of performances of one and the same dancer were employed in order to ensure optimal control over possible confounding effects caused by characteristics of the dancers, such as their personality, gender, and proclivity to dance, since these features have been proved to influence human dance movement significantly (Passmore & French, 2001; Risner, 2009). However, the skill to discriminate between happy and sad performances of the same dancer might be different from the ability to differentiate between happy and sad dances across different performers. Yet, this is a matter of some speculation and would benefit from further study.

In summary, this experimental study examined whether observers are able to decode induced emotions from dance movement. Our results are in tune with results of similar studies, but they also extend previous research, showing that, in addition to portrayed emotions, also induced emotions can be perceived from unchoreographed dances by adult observers. Moreover, this study shows that female dancers are better at communicating emotional meaning corporeally than their male counterparts. Finally, the results of this study unveiled that observers generally focus on movements of the chest when decoding emotional information from dance movement.

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## Session 5

### [5A] Tonality vs Atonality

SEOUL 16:30- 18:00 Tuesday 5 2014

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