

Emotion perception in music is mediated by socio-emotional competence

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ABSTRACT

This study investigated how adolescents' general socio-emotional competence, in terms of empathy and problem behavior, would relate to a) biases in emotion perception, b) ability to recognize emotion in music, and c) biases in emotions felt as a response to music. Sixty-one 14-15-year-old adolescents (26% males) filled in self-report scales for empathy (IRI), and adolescent conduct problems (SDQ). For measuring emotion perception, they rated 50 music excerpts regarding 8 emotions (happiness, sadness, anger, fear, tenderness, hope, longing, and potency), and for measuring emotion recognition, they were asked to identify emotions from 15 music excerpts representing five emotions (happiness, sadness, anger, fear, tenderness). In addition, they rated their personally felt emotions regarding the excerpts. Empathy was related to increased, and problem behavior to decreased, perception of emotion in music. Empathy was also related to higher, and problem behavior to lower, recognition rates of emotion (tenderness) in music. Furthermore, the results showed that the affect-related sub-components of socio-emotional competence correlated with perception biases, while the cognition-related aspects correlated with emotion recognition. As regards felt emotion, problem behavior correlated with lower ratings of felt emotion in music. The results show that general socio-emotional competence indeed is related to adolescents' perception of emotions in music, and broaden our knowledge on musical behavior as a part of adolescents' socio-emotional development.

I. INTRODUCTION

Music provides a great means for studying emotional communication: music has been called the 'language of emotions', and been shown to accurately communicate basic emotions between performers and listeners (e.g., Gabrielsson & Lindström, 2001; Juslin & Laukka, 2003; 2004). Responses have been collected through free descriptions, adjective ratings, multivariate analysis techniques, and continuous measurement paradigms, (e.g., Gabrielsson & Lindström, 2001), using both listener judgments and the analysis of the acoustic characteristics of the music (e.g., Luck, et. al., 2008; Friberg & Bresin, 2008). A wide range of studies have identified certain musical features (e.g., tempo, sound level, timbre) that relate to the performers' expression (Juslin & Timmers, 2010) and the listeners' perception (Juslin & Laukka, 2004) of various discrete emotions such as happiness, sadness, anger, fear, and tenderness in music. Overall, the agreement between individuals regarding the identification of the expression of basic emotions in music appears extremely high (Juslin & Laukka, 2004; Juslin & Timmers, 2010; Vieillard et al. 2008). There is also little difference between musically trained and untrained individuals regarding judgments of basic emotions expressed by music (Bigand, Vieillard, Madurell, Marozeau, & Dacquet, 2006; Fredrickson, 2000; Juslin, 1997).

Nevertheless, a variety of studies on emotion perception in general have shown that emotion perception (in facial, vocal and bodily expression) is not a pure bottom-up process. Instead, several top-down processes related to individual differences and situational factors actually influence recognition as well (e.g., Kret, Sinke, & de Gelder, 2011). Indeed, recent studies have also found that broad individual differences in state and trait emotionality cause biases in emotion perception in music. State negative mood has been shown to correlate with higher ratings of perceived negative, and lower ratings of perceived positive, emotion in music (Vuoskoski & Eerola, 2011a), and clinical depression has been found to bias emotion perception towards perceiving more negative emotion in music (Punkanen, Eerola, & Erkkilä, 2011). Personality can be seen as an integrative, long-term representation of a person's emotional behavior, and many researchers refer to extraversion as trait positive emotionality, and neuroticism as trait negative emotionality (Revelle & Scherer, 2010). Regarding the connection between personality and emotion perception in music, Vuoskoski and Eerola (2011a) showed trait-congruent biases, with extraversion correlating with lower, and neuroticism correlating with higher, ratings of perceived negative emotion in music. Similarly, Liljeström (2011) found that extraversion, openness, and agreeableness were all related to higher ratings of perceived positive, and lower ratings of perceived negative, emotions in music, while people scoring high on neuroticism gave higher ratings of perceived negative, and lower ratings of perceived positive, emotions in music. Ladinig & Schellenberg (2011) found that agreeableness was related to more intense emotional responses to music, and proposed that this was due to the connection between agreeableness to empathic responding in emotional situations. This notion is further supported by the findings of Vuoskoski and Eerola (2012), who reported that empathy relates to the intensity of emotional responses induced by sad music. General emotionality may also relate to the ability to recognise emotions in music: Resnicow, Salovey, and Repp (2004) showed that better identification of emotions in classical music performances (Bach, in particular) was related to certain aspects of general emotional intelligence (Perceiving Emotions and Using Emotions to Facilitate Thought). Similarly, Wöllner (2012) found that higher empathy was related to better recognition of musicians' intended expression of emotion.

Thus, there is good evidence that general emotionality plays a role in music-related emotion perception. In the current paper, we further investigate how emotion perception in music relates to broader socio-emotional competence in adolescence. It has been proposed that music enhances social bonds, as it is communication through abstract patterns that are emotionally meaningful to other humans (Dissanayake,

2008). Communication through music is thus somewhat isomorphic to communication of emotion. Indeed, emotional contagion, a sub-component of empathy, has been proposed as one of the mechanisms through which music induces emotions in listeners (Juslin & Västfjäll, 2008). We therefore propose that emotion perception in music should be reflective of both adaptive (e.g., empathic responding towards others) and maladaptive (e.g., conduct problems) aspects of general socio-emotional communication.

Empathy and prosocial behavior have both been shown to relate to the general ability to recognize and identify emotions in self and in others (Gohm, 2003). Empathy refers to a person's responsiveness to the observed experiences of another person, involving both affective and cognitive components (Davis, 1980). The affective, other-oriented sympathetic responding component (empathic concern), in particular, has been shown to correlate with prosocial behavior (e.g., altruism, helping behavior) (Eisenberg, Lennon, & Roth, 1983; Eisenberg, Shell, Pasternack, Lennon, Beller, & Mathy 1987; Eisenberg & Fabes, 1990; Eisenberg, Miller, Shell, & McNalley, 1991; Eisenberg, Carlo, Murphy, & Van Court, 1995; Eisenberg & Fabes, 1999). As regards age differences, several aspects of emotionally competent behavior develop relatively late, i.e., not only during childhood, but also over the course of adolescence (e.g., Eisenberg, 1990; Eisenberg, et.al, 1987; 1991; 1995). This is due to the fact that empathy requires complex cognitive abilities related to perspective-taking and understanding of the feelings of others (Moore, 1990). As regards age differences in musical emotion perception, it is known that the ability to perceive emotion in music begins to develop very early (e.g., 5-7-month-olds already showing a preference for happy over sad expression (Nawrot, 2003), three-year-olds distinguishing happy and sad music (Kastner & Crowder, 1990), and 4-6-year olds correctly identifying happiness, sadness, anger, and fear in music (Dolgin & Adelson, 1990; Cunningham & Sterling, 1988)), but there is virtually no research on emotion recognition in music during adolescence. Knowledge on how emotion perception in music relates to adolescents' general socio-emotional competence and emotional tendencies is also lacking. In light of the relatively slow development of general socio-emotional competence, this is a serious deficit.

Therefore, the current study focused on investigating the connections between socio-emotional competence and the perception of emotion in music, particularly in teenagers. The aim of the study was to clarify whether individual differences in adolescents' levels of socio-emotional competence (measured by empathy and problem behaviour) would be reflected in a) biases in emotion perception in music, b) ability to recognize emotions in music, and c) biases in the emotions felt in response to music. We hypothesized that empathy would be positively related to perceived and felt emotions ratings and recognition ability, while problem behaviour would be negatively related.

II. METHOD

A. Participants

A total of 61 adolescents took part in the study (45 females; average age: 14.72, SD: .45). All participants were eighth-

graders recruited from local schools. Consent to participate was obtained from adolescents themselves, their parents, and school officials. Approximately half of the participants (n = 32) had received music lessons. Participation was rewarded with a movie ticket.

B. Procedure

The adolescents participated in all research settings alone. They completed self-report scales on socio-emotional competence (empathy and problem behavior), and took part in two separate settings where they listened to musical stimuli and rated them on emotion scales.

C. Socio-emotional competence measures

Empathy was measured with the Empathic Concern and Perspective Taking subscales of the Interpersonal Reactivity Index (IRI; Davis, 1980; 1983). The IRI is a self-report measure of dispositional empathy consisting of four subscales: Perspective Taking, Empathic Concern, Personal Distress, and Fantasy. In the current study, we particularly focused on the Empathic Concern subscale because it assesses sympathetic and compassionate responding towards others, and is shown to be most relevant for prosocial behaviour (Eisenberg & Fabes, 1990). In addition, we chose to use the Perspective Taking subscale because it measures the tendency to adopt other peoples' viewpoints, and we therefore assumed it could be relevant for the correct (congruent with other's opinions) recognition of emotion in music. Each sub-scale of the IRI consists of 7 item statements, such as "I sometimes try to understand my friends better by imagining how things look from their perspective" (Perspective Taking). The items are answered on a 5-point scale ranging from *does not describe me well* to *describes me very well*.

Problem behavior was measured with the Conduct Problems and Hyperactivity subscales of the Strengths and Difficulties Questionnaire (SDQ). This is a brief self-report measure for screening for behavioural and emotional problems with children and adolescents, consisting of 5 subscales in total (Goodman, Meltzer, & Bailey, 1998). The Conduct Problems subscale assesses a tendency to break rules, fight, and lose one's temper, and the Hyperactivity scale assesses the tendency to be restless, hasty, and easily distracted. Both of these subscales focus on problems in external social behavior and conduct, and it has been suggested they could be combined into a unified scale of externalized symptoms (Goodman, Lamping, & Ploubidis, 2010). However, as the scales have slightly different foci (Conduct Problems – being emotionally rude and inconsiderate; Hyperactivity – being unable to concentrate), we assumed they might also have slightly different connections to emotion perception and recognition in music, and therefore used these scales separately. Each subscale consists of five item statements such as "I get very angry and often lose my temper" (Conduct Problems), which are answered on a 3-point scale with options *Not True*, *Somewhat True*, and *Certainly True*.

D. Emotion perception ratings

The first research setting was designed to measure emotion perception in music. Participants listened to 50 short music excerpts (approximately 15s each) selected from a broader set

of music from movie soundtracks (excerpts 001-050 from Eerola & Vuoskoski, 2011). Based on previous research on the original sample set, we selected excerpts that had been rated as expressive of a range of emotional characters (happiness, sadness, tenderness, fear, anger), with a varying degree of clarity/conformity regarding the emotional expression. The stimuli were played through loudspeakers (in a different random order for every participant) using a specially designed Max/MSP application running on Mac OS X.

After listening to each music excerpt, the adolescents were asked to rate how much they perceived 8 different emotions in the excerpt. The list of emotion words for the ratings was carefully selected based on previous research (e.g., Juslin & Laukka, 2004; Zentner & Scherer, 2008), pilot data of free descriptions collected from 20 adolescents, and a pilot listening test with 30 students using the next-to final list of emotion words in rating the actual stimulus data. The final list of emotion words consisted of the following: *happiness/joy, sadness, anger, fear, tenderness, longing, power, and hope*. Each music excerpt was rated on these eight emotions on a 7-point scale ranging from *not at all* to *very much*.

E. Ratings for emotion recognition and the intensity of perceived and felt emotion

The second research setting focused on measuring emotion recognition ability as well as the intensity of felt emotions in music. Participants were presented with 15 music excerpts expressive of five basic emotions (happiness, sadness, tenderness, fear, anger). The excerpts were selected based on pre-ratings of a panel of three judges (music & emotion researchers): only excerpts receiving the highest score on the target emotion (5 on a scale of 1 to 5) by all of the judges were included in the stimulus set.

After listening to each music excerpt, the participants were asked to select which of the abovementioned five basic emotions they found the music to be most representative of (the recognition task). Thereafter, they rated how intensely - on a 5-point scale ranging from *not at all* to *very much* - they felt the selected emotion in response to the music.

III. RESULTS

A. Emotion perception in music

The socio-emotional competence measures were first correlated with the emotion *perception* ratings. The ratings were averaged across all 50 excerpts for all participants, thus reflecting each person's evaluations given to the whole stimulus set. This allowed us to measure overall biases in the emotion ratings. The correlations are presented in Table 1. As regards empathy, the Perspective Taking subscale was not related to any biases in emotion perception, but the Empathic Concern scale correlated significantly with higher ratings for perceived fear ($r = .27$; $p < .05$) and hope ($r = .28$; $p < .05$) in the music. It thus appears not to be cognitively objective but emotionally sympathetic responding towards others that relates to increased perception of certain emotions in music.

Table 1: Correlations (Pearson) between the socio-emotional competence measures and emotions perceived in music

Emotion ratings	Perspective Taking	Empathic Concern	Conduct Problems	Hyper-activity
<i>Happiness</i>	.02	-.10	.06	-.09
<i>Tenderness</i>	.13	.08	-.30*	-.16
<i>Anger</i>	.02	.02	.15	-.04
<i>Sadness</i>	.18	.03	-.01	-.12
<i>Fear</i>	.23	.27*	-.10	-.16
<i>Longing</i>	.10	-.02	.02	-.08
<i>Hope</i>	.10	.28*	-.32*	-.19
<i>Power</i>	.08	.07	-.012	-.16

** = $p < .01$; * = $p < .05$

As regards problem behaviour, the Hyperactivity subscale was not related to any emotion ratings, but the Conduct Problems subscale was negatively correlated with perceived tenderness ($r = -.30$; $p < .05$) and hope ($r = -.32$; $p < .05$) in the music. In line with the results on empathy, it appears that it may not be problems in concentration (cognitive ability) but problems in emotional behaviour towards others that relates to biases in emotion perception in music. Overall, the results confirmed the hypothesis that empathy would relate to increased perception of emotions while conduct problems would relate to decreased perception of emotions in music.

B. Emotion recognition in music

Next, we investigated whether the socio-emotional competence measures would relate to emotion *recognition* ability in music. Percentage of congruency with the intended emotion was calculated for each participant's ratings for each emotion. We deliberately did not want to refer to correct but to congruent recognition to stress that the task measures recognition that was similar to the emotion intended by other people (in this case, the expert judges). The correlations between the socio-emotional competence measures and emotion recognition rates for each emotion are shown in Table 2.

Table 2: Correlations (Pearson) between the socio-emotional competence measures and congruent emotion recognition in music

Congruent recognition	Perspective Taking	Empathic Concern	Conduct Problems	Hyper-activity
<i>Happiness</i>	-.06	.05	-.06	-.02
<i>Sadness</i>	.06	-.03	-.09	-.09
<i>Anger</i>	-.14	.12	.03	-.02
<i>Fear</i>	.08	-.06	-.07	-.18
<i>Tenderness</i>	.54**	.26(*)	-.08	-.30*

** = $p < .01$; * = $p < .05$; (*) $p = .056$

As regards empathy, the Perspective Taking subscale was significantly correlated with better recognition of Tenderness

in music ($r = .54$; $p < .01$). A similar, but lower (only approaching significance, $r = .26$; $p = .056$) correlation was found for the Empathic Concern subscale. It thus appears that a better emotion recognition rate in music relates particularly to the ability to take the perspective of other people. As regards problem behavior, we found a significant negative correlation between Hyperactivity and recognition of tenderness in music ($r = -.30$; $p < .05$). No correlations were found for Conduct Problems. Taken together, the results confirm our hypothesis that empathy relates to better, and problem behavior to worse, recognition of emotion in music. Furthermore, recognition rate appears to be more connected to cognitive (perspective taking, concentration) rather than emotional aspects of behavior. Also, these socio-emotional competencies appear to be relevant only for some emotional expressions (tenderness) in music.

C. Intensity of felt emotion as a response to music

Finally, we investigated the connections between socio-emotional competence measures and the intensity of *felt* emotions as a response to listening to music. The intensity ratings were averaged across all music excerpts for each participant, which again allowed us to investigate general biases in the emotion ratings. The correlations are shown in Table 3.

As regards empathy, no correlations were found, but significant negative correlations were found for both Conduct Problems and Hyperactivity. Conduct Problems correlated negatively with experiencing fear as a response to music ($r = -.27$; $p < .05$), and Hyperactivity correlated negatively with experiencing sadness ($r = -.32$; $p < .05$), anger ($r = -.27$; $p < .05$), and fear ($r = -.41$; $p < .05$) as a response to music.

Table 3: Correlations (Pearson) between the socio-emotional competence measures and the intensity of felt emotion

Congruent recognition	Perspective Taking	Empathic Concern	Conduct Problems	Hyper-activity
<i>Happiness</i>	-.11	.06	-.15	-.23
<i>Sadness</i>	.06	.03	-.09	-.32*
<i>Anger</i>	-.01	-.02	.07	-.27*
<i>Fear</i>	.00	.17	-.27*	-.41*
<i>Tenderness</i>	.12	.07	-.13	-.15

** = $p < .01$; * = $p < .05$

The connection of problem behavior to lower ratings of felt emotion is in line with our hypothesis. However, the opposite hypothesis for empathy did not receive support from the data, and may indicate that empathy is more relevant for the perception and recognition of emotion in music than for personally felt emotion.

IV. DISCUSSION

The results of this study show that adolescents' socio-emotional competence indeed relates to their perception of emotion in music. The findings confirmed our hypothesis that empathy relates to increased, and problem behavior to decreased, perception of emotion in music. Empathy was also related to higher, and problem behavior to lower, recognition

rates of emotion (tenderness) in music. As regards felt emotion, the hypothesized connection was only found for problem behavior, which correlated with lower ratings of felt emotion in music. Overall, these findings on music-related emotion perception are greatly in line with the findings from general psychology regarding the connections of empathy and prosocial behavior to the ability to recognize and identify emotions in self and others (Gohm, 2003).

Additionally, we found differences in the connections as regards the affective versus cognitive components of socio-emotional competence. The more affect-related sub-component of empathy (empathic concern) was related to *biases in emotion perception* (higher perceived fear and hope) in music, while the more cognition-related sub-component (perspective taking) was correlated with *better emotion recognition* (more congruent ratings of tenderness) in music. A somewhat similar tendency was observed for problem behavior: the more affect-related aspects of problem behavior (conduct problems) were related to *biases towards decreased perception of emotion* (lower perceived tenderness and hope) in music, while the more cognition/concentration-related aspect of problem-behavior (hyperactivity) was related to *lower recognition of emotion* (more incongruent ratings of tenderness) in music. These results indicate that it may be the development of cognitive abilities in particular that contributes to the ability of congruently recognizing emotions in music. This is somewhat in line with previous results connecting emotion recognition in music to the general ability of using emotions to facilitate thought (Resnicow et al., 2004). Meanwhile, the development of - or the tendency for - sympathetic responding towards others may be better reflected in the intensity of emotions perceived in music. This is actually greatly in line with previous results showing that agreeableness (Ladinig & Schellenberg, 2011) and empathy (Vuoskoski & Eerola, 2012) are connected to more intense emotional responses to music.

Furthermore, it must be noted that significant correlations were not observed for all emotions in music. Instead, connections were particularly found for the perception and recognition of tenderness, which indicates that tenderness perception in particular is reflective of empathy and prosocial behavior. This is in line with previous findings of Vuoskoski and Eerola (2011b), who found that the intensity of emotional responses to tender music excerpts correlated with agreeableness and the empathy-subscale Fantasy, and proposed that this would be due to trait-congruence, as agreeable people themselves are typically tender-minded, altruistic, and trustful (e.g., John & Srivastava, 1999). Trait-congruence seems a plausible explanation also as to why empathy and problem behavior particularly relate to the perception of tenderness in music.

Finally, as hypothesized, problem behavior was also negatively related to the intensity of felt emotion in music, and this connection was found particularly for negative emotions. Low ratings of felt negative emotion may reflect unwillingness to experience or report these emotions, and the finding is somewhat in line with a variety of research showing that poor interpersonal functioning is related to the suppression of emotions (e.g., Gross & John, 2003). Moreover, although this connection was found for both subscales, it was particularly clear for Hyperactivity, showing that low ratings

of felt emotion relate to deficits in concentration. Whether this is a more general pattern, or somewhat specific to our listening task in a laboratory, should be studied further. With regard to empathy, we did not find the hypothesized correlations between the intensity of felt emotion and trait empathy, although previous studies have reported a connection between the two (e.g., Vuoskoski & Eerola 2011b; Vuoskoski & Eerola, 2012). It may well be that for adolescents, empathy is more relevant for the recognition and perception of emotion in music, i.e., understanding the emotional expression of an outside object, but may not predict the emotions evoked in the listener her/himself. Emotions felt as a response to music are typically complexly intertwined with a range of factors such as music preferences and situational factors (e.g., Juslin & Laukka, 2004), which may partly account for the fact that empathy was not significantly associated with the intensity of felt emotion in the present study.

Overall, our results demonstrate that the perception of emotion in music is mediated by socio-emotional tendencies. This is relevant not only for research on music perception, but also on adolescent development and psychosocial wellbeing. Music perception can be seen as an interesting approach to understanding adolescents' socio-emotional experience and development, and the current findings may also prove to be useful in terms of therapeutic interventions.

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