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Autoreferát disertační práce

Emoční paradox schizofrenního okruhu

THE EMOTION-PARADOX IN SCHIZOPHRENIA SPECTRUM DISORDERS

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THE EMOTION-PARADOX

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Disertační práce bude nejméně pět pracovních dnů před konáním obhajoby zveřejněna k nahlížení veřejnosti v tištěné podobě na Oddělení pro vědeckou činnost a zahraniční styky Děkanátu 1. lékařské fakulty.

Abstract

The emotion-paradox in schizophrenia describes a dissociation between the grossly impaired perception of emotion and relatively preserved experience thereof. Most posit that the emotion-paradox arises from a generalized emotion perception impairment. Others counter that it represents an artefact of methodological restrictions or a separate dissociation between explicit and implicit emotion. This thesis aimed to explain the emotion-paradox in schizophrenia and resolve the competing interpretations of its root. Two studies were conducted to this end. The studies drew from the same sample, including 45 persons with schizophrenia of various symptomatology, and 45 controls with no psychiatric anamnesis or familial history of schizophrenia. The groups did not differ in age, gender, education or music education. In Study 1, the participants listened to musical stimuli and rated their perception and experience of the valence and arousal that these stimuli relayed. In Study 2, the participants completed a newly developed emotional Stroop task, in which they identified the colour of a series of neutral and negative descriptors of positive, negative, or no symptoms of schizophrenia. Findings of Study 1 indicated: a) that persons with schizophrenia recognize musical emotions as accurately as controls, b) that they demonstrate an association between the

perceived and experienced component of a musical emotion as strongly as controls, and c) that they may perceive and experience musical emotions with higher intensity than controls. Study 2 suggested that persons with schizophrenia demonstrate a healthy level of interference towards negative words, but may exhibit increased reactivity towards emotional stimuli which describe their specific symptomatology. The results support the second alternative interpretation of the emotion-paradox in schizophrenia, suggesting that it describes a dissociation between the impaired explicit and the relatively preserved implicit emotion. Future research should aim to identify the point of this split. This goal might be achieved by adding more measures of musical emotion processing, or by manipulating the presentation of emotional Stroop stimuli. The findings of this thesis may have several other, more practical implications. They may help explain and improve the effects of music therapy, assuming that the observed characteristics of musical emotion in schizophrenia can transfer onto other emotional processes. The emotional Stroop task could see use in prognostic studies, given that increased reactivity to disorder-related information may relate to a worse outcome.

Keywords: Schizophrenia, emotion-paradox, implicit emotion, musical emotion, emotional Stroop task

THE EMOTION-PARADOX

Abstrakt

Emoční paradox u schizofrenie popisuje disociaci mezi hrubě narušeným vnímáním emocí a jejich zachovaným prožíváním. Většina zastává, že emoční paradox vzniká z generalizovaného poškození emočního vjemu. Ostatní oponují, že představuje pouhý artefakt metodických omezení, popřípadě odlišnou disociaci mezi explicitním a implicitním zpracováním emocí. Předmětem této práce bylo objasnit původ emočního paradoxu u schizofrenie. Za tímto účelem byly provedeny dvě studie. Obé vycházely ze shodného vzorku, který zahrnoval 45 osob se schizofrenií o různorodé symptomatologii a 45 osob bez vlastní či rodinné psychiatrické anamnézy. Skupiny si odpovídaly věkem, pohlavím, vzděláním a hudebním vzděláním. Ve Studii 1 si probandi poslechli řadu hudebních podnětů a zhodnotili svůj vjem a prožitek jejich libosti a budivosti. Ve Studii 2 zodpověděli emocionální Stroopův test, v němž identifikovali barvu neutrálních či záporně laděných slov, která popisovala positivní, negativní či nijaké příznaky schizofrenie. Výsledky Studie 1 naznačily: a) že osoby se schizofrenií rozpoznávají hudební emoce s obdobnou přesností jako osoby bez schizofrenie, b) že projevují asociaci mezi vnímanou a prožívanou složkou hudební emoce s obdobnou silou, a c) že vnímají a prožívají hudební emoce s vyšší intenzitou. Studie 2 ukázala, že osoby se

schizofrenií vykazují normální míru interference vůči záporně laděným podnětům a zvýšenou reaktivitu vůči emocionálním podnětům, které popisují jim vlastní příznaky. Výsledky podporují druhou z alternativních interpretací emočního paradoxu u schizofrenie, tedy že popisuje disociaci mezi narušením explicitních a zachováním implicitních emocí. Do budoucna by se měl výzkum zaměřit na určení bodu, v němž k této disociaci dochází. Cíle lze dosáhnout přidáním dalších měr hudebních emocí nebo upravením způsobu prezentace podnětů u emocionálního Stroopova testu. Výsledky práce mohou mít další, praktičtější důsledky. Mohou pomoci objasnit a navýšit účinnost muzikoterapie, tedy za předpokladu, že pozorované charakteristiky hudebních emocí mají schopnost přenosu i na jiné emoční procesy. Emocionální Stroopův test může najít využití v prognostických studiích, neboť zvýšená reaktivita vůči podnětům vztaženým k poruše může předvídat zhoršení této poruchy.

Klíčová slova: Schizofrenie, emoční paradox, implicitní emoce, hudební emoce, emocionální Stroopův test

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THE EMOTION-PARADOX

Introduction

Schizophrenia is a severe mental disorder characterized by positive (PS) and negative symptomatology (NS). A lingering debate concerns the contribution of emotional disturbances to the disorder and its symptoms. Meta-analyses of laboratory studies highlight that schizophrenia affects the perception and experience of emotions incongruently. The perception of emotion is grossly impaired by the disorder and the socio-cognitive deficits that accompany it (Aleman & Kahn, 2005; Trémeau, 2006). Conversely, the experience of emotion appears to be mostly unaffected (Aleman & Kahn, 2005; Cohen & Minor, 2008; Trémeau, 2006).

This dissociation between emotions perceived and felt has become a well-replicated finding in schizophrenia research. Yet the root of the so-called emotion-paradox is not well understood (Aleman & Kahn, 2005). Most posit that the emotion-paradox reflects a generalized emotion perception impairment (see e.g. Edwards, Jackson, & Pattison, 2002; Schneider et al., 2006; Shayegan & Stahl, 2005) but critics argue that it represents an artefact of methodological limitations (Darke et al., 2013; Rossell & Boundy, 2005) or a misinterpretation of the results (van 't Wout et al., 2007).

The first alternative explanation of the emotion-paradox suggests that the dissociation it describes is untrue,

and stems from methodological restrictions in emotion perception studies. Compared to emotion experience studies, which utilize a multitude of materials including videos, activities, or smells, emotion perception tasks rely on facial and prosodic expressions. The fact that persons with schizophrenia err when perceiving these could reflect deficits in processes which are not primarily emotional, including the processing of complex, semantic and socially relevant stimuli, as well as in attention and cognitive appraisal (Darke et al., 2013; Rossell & Boundy, 2005).

A second explanation of the emotion-paradox suggests that it may reflect a genuine dissociation, but one which signifies a split between explicit and implicit emotion processing, not between perceived and experienced emotion. Emotion perception tasks require that participants be fully aware of the emotion that they are perceiving, and able to appraise and name it. In contrast, emotion experience studies utilize a wealth of measurement methods, including psychophysiological readings, EEG and imaging, or open forms of self-report (such as the circumplex model of emotion). Therefore, conclusions of emotion perception studies tend to be limited to the perception of explicit emotion, whilst emotion experience studies more commonly measure the implicit emotion experience (Mano & Brown, 2012; van 't Wout et al., 2007).

The primary aim of this thesis was to explain the emotion-paradox in schizophrenia, and two studies were conducted to this end. Study 1 assessed the concurrent perception and experience of emotion relayed by stimuli of few socio-cognitive demands: music. Study 2 probed patient reactivity to implicit emotion of various valence and symptom-relatedness, using a newly developed emotional Stroop task.

2. Background & Aims

2.1. Musical Emotions in Schizophrenia

A review of previous studies (see Kerkova, 2018, or chapter 2.1. in thesis) - which quantitatively examined the perception or experience of musical emotion in psychotic disorders – suggests that music breeds indistinguishable percepts and experiences in persons with schizophrenia. However, these studies differed widely in their method, and shared a few critical shortcomings. In particular, no studies to-date used a standardized battery of musical stimuli, nor took advantage of the opportunity to examine the emotion music expresses and elicits at once. This method can be especially sensitive to variations between percepts and experiences (Schubert, 2013).

Existing studies on musical emotion in schizophrenia introduced further research questions. Most agreed that individuals with schizophrenia recognized emotions less accurately than individuals without the disorder (Abe, Arai, & Itokawa, 2016; Feingold et al., 2016; Rossell & Boundy, 2005; Simon, Holzberg, Alessi, & Garrity, n.d.; Weisgerber et al., 2015). However, the studies calculated accuracy inconsistently, reported a varied extent to the impairment, and depended on the discrete model of emotion, meaning that deficits in the cognitive appraisal and explicit labelling of emotion may have confounded the findings.

Existing research failed to provide a reliable account of the role which stimulus valence may play in musical emotion of persons with schizophrenia. The arousal or intensity of musical emotion, however, appeared to exhibit a consistent increase in this population: according to all self-report (Nielzén & Cesarec, 1982; Nielzén, Olsson, & Ohman, 1993; Weisgerber et al., 2015), spectral EEG (Burge & Siebert, 2010; Günther et al., 1993, 1991), and imagining measures (Dyck, Loughead, Gur, Schneider, & Mathiak, 2014).

Musical emotions seemed mostly unaffected by listener symptomatology. It was postulated, however, that some properties of music connote psychotic symptoms, and that these connotations trigger abnormal music perception (Nielzén & Cesarec, 1982; Nielzén et al., 1993).

2.1.1. Aims

Study 1 investigated the concurrent perception and experience of musical emotions, using standardized and symptom-related stimuli. The study aimed to:

1. Assess the association between perceived and experienced musical emotion, and the extent to which this association may differ in persons with and without schizophrenia, anticipating that:
   1.1. the perception and experience of musical emotions in schizophrenia will not show a dissociation,

1.2. both musical percepts and experiences will not be affected by stimulus valence,

1.3. both musical percepts and experiences will show greater arousal or intensity.

2. Compare musical emotion recognition in persons with and without schizophrenia.

3. Explore the roles of symptomatology and musical symptom-relatedness.

2.2. Emotional Stroop Performance in Schizophrenia

Previous studies, which examined emotional Stroop performance in the extended schizophrenia spectrum, suggested some maintenance of implicit emotion processing in the population. This matches the view that the emotion-paradox in schizophrenia reflects a dissociation between explicit and implicit emotion, rather than between percept and experience, but also raises further questions.

In particular, EST findings suggested that individuals diagnosed with a schizophrenia spectrum disorder, no matter their symptomatology, could efficiently process an implicit emotion which was unrelated to their concern, no matter its valence (Demily et al., 2009; Phillips, Deldin, Voglmaier, & Rabbitt, 2005). However, patient processing appeared to heighten when triggered by an implicit emotion related to the respondent's concern.

Symptom-related emotions appeared to stimulate reactivity in all EST studies which probed the effect (Bentall & Kaney, 1989; Besnier et al., 2011; Fear & Healy, 1996; Fear, Sharp, & Healy, 1996; Kinderman, Prince, Waller, & Peters, 2003). These studies focused on the relation between paranoid symptomatology and paranoia-related interference, whereas non-paranoid symptomatology and respective symptom-relatedness received minimal attention. One study attempted to examine the relationship between acute psychosis and reactivity to stimuli describing major psychiatric illness but uncovered inconsistent effects, including some evidence of disorder-related facilitation (Wiffen et al., 2014). No studies examined symptom-related reactivity in persons with negative symptomatology or NS-related reactivity in persons with schizophrenia.

Existing studies shared at least three critical shortcomings in study design an analysis. First, they compared patient reactivity to negatively valent descriptors of symptoms and patient reactivity to neutral stimuli unrelated to those symptoms. This method of analysis narrows the interpretation of its results. Second, the studies used potentially questionable methods of score standardization, ranging from log-transformation to an otherwise unexplained removal of some trials. Third, the

studies were self-paced, which weakens the applicability of their results to implicit emotion processing.

2.2.1. Aims

Study 2 adjusted the EST design and analysis, adding categories of symptom-related words of neutral valence, taking advantage of the D-transformation procedure (Greenwald, Nosek, & Banaji, 2003), and restricting the response window. The study aimed to:

1. Compare negativity-related interference in persons with and without schizophrenia, and in patients with various symptomatology, anticipating no statistically significant differences between groups or subgroups.
2. Compare symptom-related interference in persons with and without schizophrenia, and in patients with various symptomatology, anticipating that:
   - 2.1. Persons with PS display PS-related interference,
   - 2.2. Persons undergoing an acute psychosis show signs of symptom-related facilitation,

   and exploring:
   - 2.3. NS-related variations in RTs between groups and subgroups,
   - 2.4. Symptom-related effects in persons with NS.

3. Research Methods

The project was approved by the Ethics Committee of the General University Hospital in Prague. Participation was voluntary and anonymous. All participants signed an informed consent form and were debriefed after the experiment. General inclusion criteria specified that participants were to be 18 – 60 years old, have normal or corrected-to-normal hearing and vision, and be fluent speakers of the Czech language.

3.1. Participants

The SZ group consisted of 45 stabilized patients (21 (46.7%) females; age $M = 38.49$, $SD = 9.69$, range = 19 – 63; years of education $M = 13.88$, $SD = 3.68$, range = 7 - 22) diagnosed with an ICD-10 psychotic disorder. In total, 27 (60%) persons with schizophrenia (F20), 8 (17.8%) persons with schizoaffective disorder (F25) and 10 (22.2%) persons with an acute psychotic disorder (F23.1 or F23.2) were included in this group, all medicated.

The control group - 45 volunteers without a psychiatric anamnesis or familial history of a schizophrenia spectrum disorder - did not differ in age ($M = 39.53$, $SD = 11.18$, range = 19 – 62), $t(88) = -.474$, $p = .637$, gender (19 (42.2%) females), $\chi2(1, N = 90) = .180$, $p = .671$, years of education ($M = 14.07$, $SD = 2.66$, range = 9 – 20), $t(78.3) = -$

.284, $p = .778$., or the highest attained music education, $\chi2(3, N = 90) = 6.055$, $p = .109$.

The SZ group included three subgroups: a positive-symptom subgroup (PS), a negative-symptom subgroup (NS), and an acute psychosis subgroup. Group assignment adhered to ICD criteria first. Persons with undifferentiated schizophrenia and mixed schizoaffective disorder were assigned based on their scores on the Community Assessment of Psychic Experience (CAPE) (Stefanis et al., 2002). The CAPE measures the frequency with which individuals experience positive, negative, and depressive symptoms. The questionnaire was pre-validated for Czech use, showing good psychometric characteristics (see Keřková & Martínková, in press, or chapter 3.1.2. in thesis). In total, there were 24 members of the PS group, 11 members of the NS group and 10 members of the acute group: they did not significantly differ in age, $F(2, 42) = .198$, $p = .821$, gender, $\chi2(2, N = 45) = 3.004$, $p = .223$, or years of education, $F(2, 41) = 1.816$, $p = .175$.

3.2. Study 1: Musical Emotions

The task was designed in OpenSesame (version 3.1) (Mathôt, Schreij, & Theeuwes, 2012). Participants completed the Music Engagement Style I (MES-I) questionnaire, which measures the extent to which a listener uses music for self-regulation (Chin & Rickard, 2012). Next, they were

instructed to listen to each musical stimulus and rate both the perceived and experienced valence and arousal of each. The task counted 18 trials, separated into two blocks of a counterbalanced order. Within a trial, a random musical stimulus played on a loop with a two seconds intermission, until the participant submitted their rating. An interactive variant of the affect grid (Russell, 1980) was developed to record these ratings.

The stimuli were 15 – 25 s long samples of instrumental music. Nine control stimuli originated from a standardized battery of unfamiliar film music (Eerola & Vuoskoski, 2011). These were selected to represent combinations of negative, high and moderate valence and arousal. Nine exploratory stimuli were newly composed to simulate positive and negative symptoms of schizophrenia. The stimuli were composed in FL Studio (v. 12) (Dambrin, 1997) in cooperation with Dr Tim Metcalfe, a psychoacoustics specialist. A pre-test with 35 healthy participants (26 females, Age $M = 28.09$, $SD = 8.50$) was conducted to check if the arousal and valence of control and exploratory stimuli matched. Some stimuli underwent minor edits to improve their accordance with the control stimuli.

3.3. Study 2; Emotional Stroop Performance

The EST was designed in OpenSesame (v. 3.1) (Mathôt et al., 2012) and counted 30 practice and 360

experimental trials. Participants were presented with a series of words and indicated the colour of each word (red, green, or blue) by pressing a relevantly coloured key on a keyboard. Each trial was preceded by a 1000 ms or 2000 ms inter-trial-interval, and appeared on-screen for a 1000 ms maximum response period. Stimulus presentation was randomised, with each word presented once in each colour.

The EST included three blocks of emotionally threatening words derived from the Affective Norms for English Words (ANEW) (Bradley & Lang, 1999) and secondary sources, including: general threat (Demily et al., 2009; Phillips et al., 2005), and medical and phenomenological descriptors of positive (Bentall & Kaney, 1989; Besnier et al., 2011) and negative symptoms of schizophrenia (Martin et al., 1991; Mattia et al., 1993).

A list of 30 threatening words was compiled per each category and translated to the Czech language. Emotionally neutral counterparts were selected so that they matched in word type, word length, and frequency (Čermák, 2007). These words were then submitted to a pre-test, in which 20 healthy participants (9 females, age $M = 40.90$, $SD = 11.85$) rated their valence on a 1-9 Likert scale. With ambiguous words removed, the final list included 20 negative words and 20 neutral words in each of the three categories, or 120 words in total.

4. Results

4.1. Study 1; Musical Emotions

4.1.1. Emotion Perception and Recognition

Accuracy was calculated by subtracting the population mean rating of each standardized excerpt from the rating observed. A two-way repeated-measures MANOVA was conducted.

All main and interaction effects of group were non-significant and paired with an effect size $\eta 2 \leq .1$. On average, patients were as accurate (M = -.141, SD = .602) as controls (M = -.162, SD = .521.

4.1.2. Emotion Experience and the Emotion Paradox

Per-participant standardized regression coefficients were calculated for the experience of an emotion component as predicted by the perception of the component, and for each of the stimulus types. This yielded four new variables - each assessing the degree of change in experience as related to observed change in perception - which were submitted to a separate repeated-measures MANOVA.

All main and interaction effects of group were non-significant and paired with an effect size $\eta 2 < .1$. On average, patient perceptions and experiences were as strongly associated (M_r = .759, SE = .032) as control perceptions and experiences (M_r = .752, SE = .026).

4.1.3. Emotion Intensity and Symptomatology

The absolute values of individual ratings were averaged into four new variables, each assessing the intensity of musical arousal or valence for the standardized or newly composed stimuli. A repeated-measures MANCOVA was performed.

The main effect of group on emotion intensity was significant, $V = .019$, $F(2, 75) = 3.471$, $p = .036$, $\eta^2 = .085$, as was the type x group interaction effect, $V = .176$, $F(2, 75) = 7.995$, $p = .001$, $\eta^2 = .176$. The effects of the MES-I score, stimulus type, or their interactions were non-significant.

On average, patient emotions ($M = 1.975$, $SD = .407$) were more intense than control emotions ($M = 1.763$, $SD = .357$). Within-subjects analysis found a significant effect of group on valence intensity, $F(1, 76) = 4.304$, $p = .041$, $\eta^2 = .054$, and arousal intensity, $F(1, 76) = 5.905$, $p = .017$, $\eta^2 = .072$. Controls but not patients were affected by stimulus type, as their emotion intensity decreased for the newly composed stimuli. This effect was significant for both valence intensity, $F(1, 76) = 4.304$, $p = .041$, $\eta^2 = .054$, and arousal intensity, $F(1, 76) = 5.905$, $p = .017$, $\eta^2 = .072$.

Subgroup analysis found no significant main effect of subgroup on emotion intensity, irrespective of stimulus type. However, the effect of subgroup on emotion intensity associated with the newly composed stimuli was statistically

significant, $F(2, 37) = 3.584$, $p = .038$, $\eta^2 = .162$. Simple effects specified that both the PS and the NS subgroups recorded higher emotion intensity than the acute psychosis subgroup ($p = .020$, $p = .028$, respectively).

4.2. Study 2; Emotional Stroop Performance

Controls made less errors ($M = 14.90$, $SD = 10.97$, range = 1 - 43) than the SZ group ($M = 76.46$, $SD = 67.97$, range = 7 - 237) and this difference was significant, $t(35.6) = 5.298$, $p < .001$. Individual subgroups did not significantly differ in the number of errors made.

Mean RTs were calculated for each word category, with error or missed responses and trials in which the RT fell more than 2 SDs from the participant's mean RT removed. All analysis derived from D-transformed variables, which reflected interference (positive values) or sensitization (negative values) towards negative control, PS-related, or NS-related words.

A repeated-measures ANCOVA compared the effects of group membership and word category on D-SIs, controlling for CAPE-42 scores. Neither group membership, symptom-relatedness, or their interaction alone affected D-SIs. The interaction effect of symptom-relatedness and CAPE-42 scores was near significant, $F(2, 144) = 2.982$, $p = .054$, $\eta 2 = .040$. Simple contrasts suggested that CAPE-42 scores accounted to a significant difference in PS-related

compared to control D-SIs, $F(1, 72) = 5.684$, $p = .020$, $\eta 2 = .073$.

A separate repeated-measures ANOVA compared the effects of subgroup membership and symptom-relatedness on D-SIs. The main effects of subgroup and symptom-relatedness failed significance. The interaction effect between symptom-relatedness and subgroup was significant, $F(4, 64) = 5.901$, $p < .001$, $\eta^2 = .269$. Simple contrasts disclosed a significant subgroup difference in the D-SIs of PS-related compared to control words, $F(2, 32) = 4.507$, $p = .019$, $\eta^2 = .220$, and NS-related compared to control words, $F(2, 32) = 4.975$, $p = .013$, $\eta^2 = .237$.

A series of "protected" one-way ANOVAs with Tukey HSD tests were conducted to determine the statistical significance of subgroup differences in each D-SI. Post-hoc tests revealed that the acute psychosis subgroup had significantly lower PS-related D-SIs than both the PS ($p = .005$) and the NS subgroup ($p = .041$), who themselves displayed comparably high interference. NS-related D-SIs were significantly lower in the NS subgroup compared to the PS subgroup ($p = .015$) but not compared to the acute subgroup, and did not differ between the latter two.

5. Discussion & Conclusion

The emotion-paradox in schizophrenia describes a dissociation between explicit and implicit emotion processing. Two studies raised support for this conclusion, owing to their use of novel material and method. In Study 1, participants with and without schizophrenia experienced the same musical emotion which they accurately perceived. In Study 2, participants with schizophrenia demonstrated preserved, and at times heightened implicit emotion. The results suggest that the notorious impairment of schizophrenic emotion perception does not generalize to implicit emotion, and that the perception and experience of implicit emotion do not dissociate. Therefore, this thesis contradicts the staple interpretation of the emotion-paradox in schizophrenia (Edwards et al., 2002; Schneider et al., 2006; Shayegan & Stahl, 2005) and concurs with its critics (Darke et al., 2013; Mano & Brown, 2012; Rossell & Boundy, 2005; Roux et al., 2010; van ’t Wout et al., 2007). In particular, the second alternative interpretation of the emotion-paradox in schizophrenia (Mano & Brown, 2012; Roux et al., 2010; van ’t Wout et al., 2007) is recommended for use and further study.

Several methodologic decisions strengthened the conclusion. Study 1 marked the first time that the perception and experience of an emotion relayed by the same stimulus

faced actual, empirical investigation. Study 2 included the development of an emotional Stroop task, which helped provide a particularly comprehensive picture of implicit emotion reactivity in schizophrenia in its various states.

Future research should modify the overall study design to enable the supplementing of present findings. Indeed, identifying the point of the break - at which emotion turns explicit and withers in schizophrenia –will require an innovative study design, which accommodates multiple measures of emotion processing, yet does not overwhelm its participants.

The findings and implications of this thesis can go beyond the mostly technical matter of the emotion-paradox in schizophrenia. Study 1 indicated that musical emotions can be effectively perceived in schizophrenia, whilst growing in intensity. Assuming that these characteristics can transfer onto other emotional processes, they could help combat a variety of negative symptoms in the context of music therapy. This indeed appears to be the case (Silverman, 2003), but will require further empirical support.

However, the heightened intensity of musical emotions in schizophrenia could be less desirable in some phases of the disorder. Schizophrenia relates to a reduced capacity to regulate emotion, which can drop further during psychosis (Aleman & Kahn, 2005; Cohen & Minor, 2008).

Intense musical emotions may exacerbate dopaminergic hyperactivity (Chanda & Levitin, 2013), which itself underlies positive symptomatology (Davis et al., 1991; Howes & Kapur, 2009). Music therapy in psychosis may thus require modification and careful management. Relatedly, maladaptive uses of music could be problematic in this stage of the disease (Farhall et al., 2007).

Fortunately, symptom-related music did not produce a stress reaction in persons with schizophrenia. In fact - and only in more experienced patients - symptom-related music related to a seemingly improved ability to perceive and experience the emotion it relayed. This suggests that symptom-relatedness may affect schizophrenic music perception. Unfortunately, the finding also highlights a key limitation of Study 1, i.e. its failure to assess the degree and kind of auditory deficits present in the sample. The relationship between the high rate of schizophrenia-related amusia (Hatada et al., 2014) and musical emotion has not been previously examined, yet may be critical.

Study 2, which derived from an emotional Stroop task, delivered concise evidence of some of the specific conditions in which implicit emotion processing is preserved, and in which it heightens in schizophrenia. These findings suggested that the implicit processing of negative content was unaffected by schizophrenia, and only heightened in

response to symptom-related emotion. Study 2 provided the first comprehensive account of this relationship between patient symptomatology and symptom-related emotion reactivity, finding distinct patterns of changes in persons with both positive and negative symptomatology, as well as in individuals with an acute psychotic disorder.

The findings were likely unmediated by hidden variations in cognitive ability. All subgroups demonstrated comparable error rates, suggesting that whichever cognitive deficits may have affected their performance did not differ between them. Replication studies should, however, use more demanding measures of symptomatology, such as would be the PANNS.

Increased reactivity to symptom-related emotion may promote the emergence and maintenance of schizophrenia (Krabbendam & Van Os, 2005), as has long been known for other psychiatric disorders (Williams et al., 1996). The emotional Stroop task, as developed for Study 2, represents an easy and efficient means of measuring this. As such, the task should see application in clinical and prognostic studies. A longitudinal study of the high-risk population may be of particular benefit.

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List of Publications

Publications

Keřková, B. & Martínková, Z. (in press). Validizace české verze dotazníku Community Assessment of Psychic Experiences (CAPE). *Československá psychologie.* IF(2017) =.193.

Kerkova, B. (2018). Perception and experience of musical emotions in schizophrenia. *Psychology of Music*. Advance online publication. doi: 10.1177/0305735618792427. IF(2017) = 1.275.

Cumulative IF = 1.468.

Articles under Review

Kerkova, B. Symptom-specificity of the emotional Stroop effect in psychotic disorders.

Conference Presentations

Kerkova, B. (2018, March). *Emotional Stroop performance in psychotic disorders.* Poster presented at the 26th European Congress of Psychiatry, Nice.

Kerkova, B. & Martinkova, Z. (2017, April). *Validation of the Czech version of the community assessment of psychic experiences (CAPE).* Poster presented at the 25th European Congress of Psychiatry, Florence.