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Research Article

Efficacy of theatre activities in facial expression categorization in schizophrenia

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ABSTRACT

The aim of the study was to assess the efficacy of theatre activities in improving facial expression categorization in people who have schizophrenia by means of a controlled psychophysical experiment performed on matched groups of participants, and appropriate statistical analyses on collected data. In two experiments participants engaged in four alternative labelling tasks of pictures randomly taken from four morphed continua between two emotional facial expressions. Results of Experiment 1 showed that the identification rate was specifically lower for participants who have schizophrenia-spectrum disorders (SSD) than for matched controls for the response fear, and less dramatically lower for the response sadness. Results of Experiment 2 showed that the specific impairment in the identification of fear expression improved in people with SSD who have experience of theatre activities with respect to matched SSD patients without theatre experience. These results suggest that theatre activities may be included in broad-based social cognitive training programs for those diagnosed with schizophrenia, and that it may be considered a useful means to directly affect social cognition, given the effects we found in the domain of facial expression recognition.

Introduction

Mind-Body Medicine (MBM) treatments are commonly used approaches for addressing psychiatric symptoms in people who have psychotic diagnoses. These can include relaxation technique along with mindfulness, meditation, guided imagery, hypnosis/self-hypnosis, bio-feedback, art therapy, music therapy, dance therapy, drama therapy, breathwork, autogenic training, journal writing, and ritual. However, current clinical practice offers few guidelines regarding the application of MBM to those with psychotic disorders. A review of the literature specifies that the overall body of evidence of MBM in the treatment of schizophrenia is limited by aspects of the quality of the research; which often lacks objective outcome measures (Helgason & Sarris, 2013).

Poor methodology has made it difficult to draw conclusions from the data regarding drama therapy, a form of therapy that seeks to achieve a therapeutic outcome via enhanced expression of emotions by means of a theatrical-based experience without necessarily requiring participants to have insight into their conditions or psychological mindsets. Drama therapy has multiple influences such as Greek theater (with its ideas of ritual and catharsis) (Landy, 1997), Winnicott's ideas

on the overlap between play and therapy (Winnicott, 2005) and Boal's concept of drama as social action (Boal, 1993). The rationale for the use of drama therapy with those diagnosed with schizophrenia is that as an action-oriented therapy it has some useful features not present in therapies focused on verbal expression. In order to be able to impersonate a character, people need to control their bodies and minds carefully, and they have to be able to recognize and imitate characters' feelings. The most basic form of drama therapy is known as the creative-expressive mode (Jennings, 1990) and may consist of activities such as drama games and improvisational exercises to encourage spontaneity and creativity within a safe framework. Images and material created are left uninterpreted. More demanding forms of drama therapy encourage participants to recognize their own projections in the work they produce, or modify and experiment with the roles they play. The drama therapy meetings have three different moments: warm-up phase; creation phase (focusing and main activity); phase of sharing (closure, de-rolling, completion). In these meetings the therapist could use different strategies such as projective techniques or silent scream (Landy, 1986; Emunah, 1994). Some drama therapists use existing text to allow participants to explore roles that are new or challenging to

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them (Jenkyns, 1996). A third approach is to make use of the archetypal myths, fairy tales and folk tales from various cultures for their ability to mirror and facilitate human developmental tasks (Bettelheim, 2014; Gersie & King, 1990; Lahad, 1992).

A Cochrane review (Ruddy & Dent-Brown, 2007) examined the efficacy of drama therapy and related approaches as adjunctive treatments for schizophrenia. They included all controlled trials considering people diagnosed with schizophrenia or schizophrenia-like illnesses using any criteria, with participants of any age, nationality or gender, and with any length of illness, treated in any treatment setting. Ruddy and Dent-Brown (2007) considered drama therapeutic interventions (in groups or individually), for any length of time, as an adjunctive treatment regardless of other interventions; using the British Association for Dramatherapists' definition for inclusion as follows: "Dramatherapy has as its main focus the intentional use of healing aspects of drama and theater as the therapeutic process. It is a method of working and playing that uses action methods to facilitate creativity, imagination, learning, insight and growth." (The British Association of Dramatherapists (BADth), 2018). Consequently, they considered any intervention using role play, drama games, improvisation, dramatic text, story making or any similar approaches. Despite the large criteria of inclusion, of 341 references found, 329 were clearly not relevant. Of the twelve remaining reports authors were able to include only five trials (Nitsun, Stapleton, & Bender, 1974; Qu, Li, & Xiao, 2000; Zhou & Tang, 2002; Gutride, Goldstein, & Hunter, 1973; Whetstone, 1986). Theater-based research underlines the creative side of patients with schizophrenia despite their psychopathology. Through a tool inspired by Aristotle's poetics it is possible to carry a qualitative analysis of the narration (Yotis, 2018). The drama therapy is able to become a tool to facilitate the reintegration of the individual with schizophrenia into the community, with the creation of links with the other participants, with the operators and other significant figures (2016, Yotis, 2006).

The objectives of the studies included in the Cochrane review (Ruddy & Dent-Brown, 2007) were to explore the effect of drama therapy on improving self-esteem (Zhou & Tang, 2002) and improving mental state (Qu et al., 2000), to look at its effects on clinical, psychological and social functioning (Nitsun et al., 1974), to enhance social interactions (Gutride et al., 1973), and for developing social skills (Whetstone, 1986). Sometimes outcomes were the result of open trials, leading the authors of the Cochrane review to conclude there were major risks of bias based on lack of randomization and blindness.

Consequently, in the present study we tried to avoid both risks by comparing the performance of two matched groups of patients with schizophrenia-spectrum disorders (SSD) in a very sensitive psychophysical test, whose results may not be influenced by the experimenter. The two groups of SSD patients differed in their past experience with theatre activities.

The psychophysical test consisted in a task of facial expression categorization whose sensitivity to external manipulation was recently assessed in normal participants (Mele, Ghirardi, & Craighero, 2017). We decided to test facial expression categorization since individuals with schizophrenia experience problems in face emotion recognition throughout the course of the disorder (Edwards, Jackson, & Pattison, 2002; Kohler, Walker, Martin, Healey, & Moberg, 2010). Rather than a general deficit that encompasses all emotions, schizophrenia may be associated with a more specific deficit in the processing of a subset of negative emotions including anger, disgust, sadness and/or fear (Kucharska-Pietura, David, Masiak, & Phillips, 2005). Furthermore, the indication that emotion recognition impairment is present early and is consistent in magnitude across the phases of illness fits the pattern of a vulnerability indicator (Comparelli et al., 2013). Some authors have claimed that the inability of persons with schizophrenia to recognize emotional faces reflects the presence of aberrant neural circuits involved in the perception of facial features or, more generally, in the regulation of social relations (Green & Phillips, 2004). The dysfunction between the temporo-limbic regions, (amygdala, hippocampus,

parahippocampal gyrus, thalamus), and the prefrontal cortex, could explain the social functioning deficit in this type of patients (Streit, Wolwer, Brinkmeyer, Ihl, & Gaebel, 2001). Finally, given the significant relationship between facial emotion perception and social outcome (Addington, Saeedi, & Addington, 2006; Hooker & Park, 2002), an easy-testable improvement in the former may be considered an indication for the more demanding investigation of the presence of an improvement in the latter.

The facial expression categorization test used in the present study was recently demonstrated to be a sensitive method to prove the role of the motor system in the perception of others' actions (Mele et al., 2017), granting a further demonstration that the mirror neuron system (Rizzolatti & Craighero, 2004) may be considered at the basis of social cognition (Rizzolatti & Sinigaglia, 2016). It is to note that dysfunctional mirror neuron system activity has been posited to underlie diverse symptoms of schizophrenia (Enticott et al., 2008; Mehta et al., 2014; Möhring et al., 2015). The present test consisted of the brief randomized presentation of single face pictures taken from four computer-generated continua between different expressions (angry-fear, angry-sad, fear-happy and happy-sad). This visual stimuli manipulation allowed researchers to implicitly ask the participants to categorize ambiguous pictures, a task able to indicate subtle modifications in the perception of facial emotions.

Therefore, the aim of the present study was, firstly, to verify if and how the performance of SSD patients in the test was different from that of normal matched controls (Experiment 1), and, secondly, to investigate if the experience of theatre activities was able to modify the facial expression categorization in a group of SSD patients compared to a matched group of SSD patients with no experience of theatre activities (Experiment 2). Schizophrenia is a complex, heterogeneous behavioral and cognitive syndrome, with an overlap of biological, psychological and psychosocial factors, and requires employment of integrated multimodal treatments. An improvement in the recognition of facial emotions would suggest that theatre activities can be included in an integrated multimodal therapeutic approach.

Experiment 1

Materials and methods

Participants

Twenty-one inpatients participants with SSD (inclusion criterion: code 295, Schizophrenic psychoses, according to the International Classification of Diseases-9th revision, ICD-9) (6 females; mean age = 49.47 years, standard deviation = 7.09) and 21 normal participants (6 females; mean age = 49.90 years, standard deviation = 7.33) matched for gender, age, and education, participated in this study (Table 1) and gave their written informed consent. All were native Italian speakers of Caucasian ethnicity (as were the models depicted in the stimuli) and reported having normal or corrected-to-normal visual acuity. The patients were hosted at the long-term Psychiatric Residence S. Bartolo in Ferrara (Italy). Participants were unaware of the purposes of the study. The procedures were approved by the local Ethics Committee and were in accordance with the guidelines of the Declaration of Helsinki (Table 2).

Stimuli and procedure

Stimuli were selected in a previous study (Pollak & Kistler, 2002) and used here with permission. They consisted in 88 pictures of two human face models (one female, one male). Four original pictures of each model portraying different expressions of emotion (anger, fear, happiness and sadness) were chosen from a set of published photographs (Ekman & Friesen, 1978) and submitted to a morphed transformation. This transformation allowed for the creation of four continua: angry-fear, angry-sad, fear-happy and happy-sad. Each continuum was composed of 11 images in which 2 originals were

Table 1

List of participants in Experiment 1. Patients: 21 inpatients participants with SSD (inclusion criterion: code 295, Schizophrenic psychoses, according to ICD-9) (6 females; mean age = 49.47 years, standard deviation = 7.09). Controls: 21 healthy participants (6 females; mean age = 49.90 years, standard deviation = 7.33).

Patients			Controls		
age	gender	education	age	gender	education
35	M	middle school	35	M	middle school
41	M	upper secondary school	41	M	upper secondary school
42	M	upper secondary school	42	M	upper secondary school
43	F	middle school	42	F	middle school
44	M	upper secondary school	44	M	upper secondary school
46	F	upper secondary school	46	F	upper secondary school
46	M	upper secondary school	46	M	upper secondary school
47	M	upper secondary school	48	M	upper secondary school
48	F	upper secondary school	48	F	upper secondary school
48	M	upper secondary school	50	M	upper secondary school
49	F	university degree	49	F	university degree
49	M	middle school	50	M	middle school
50	M	middle school	53	M	middle school
52	M	upper secondary school	54	M	upper secondary school
53	M	upper secondary school	55	M	upper secondary school
53	M	middle school	54	M	middle school
53	F	middle school	51	F	middle school
56	M	middle school	53	M	middle school
57	M	middle school	60	M	middle school
60	F	middle school	60	F	middle school
67	M	university degree	67	M	university degree

Table 2

List of participants in Experiment 2. Column Theater-Patients: 13 inpatients participants with SSD (inclusion criterion: code 295, Schizophrenic psychoses, according to the ICD-9) participating in theater activities (4 females; mean age = 47.92 years, standard deviation = 7.38). The average time of theater experience was 7.4 years (standard deviation = 4.79). Column Patients: 13 inpatients participants with SSD (inclusion criterion: code 295, Schizophrenic psychoses, according to the ICD-9), matched for gender, age, and education (4 females; mean age = 49 years, standard deviation = 8.40).

Patients			Controls		
age	gender	education	age	gender	education
37	M	upper secondary school	35	M	middle school
37	M	upper secondary school	41	M	upper secondary school
38	M	upper secondary school	42	M	upper secondary school
44	F	middle school	43	F	middle school
44	F	upper secondary school	46	F	upper secondary school
48	M	upper secondary school	47	M	upper secondary school
49	M	upper secondary school	48	M	upper secondary school
50	M	middle school	50	M	middle school
53	F	middle school	53	F	middle school
54	M	upper secondary school	52	M	upper secondary school
55	M	upper secondary school	53	M	upper secondary school
56	F	middle school	60	F	middle school
58	M	university degree	67	M	university degree

scanned to 315 × 480 pixels and morphed to produce a linear continuum. To create this transformation, the pixels composing one image were changed from their positions in the start image to their positions in the end image. In the passage between one image and the subsequent, pixels were shifted by steps of 10% of the total distance between their initial and final positions (for details see Pollak & Kistler, 2002) (see Fig. 1).

All the pictures were repeated twice each, except those presenting a 40%, 50%, and 60% blend of each emotion pair which were repeated four times each (pictures numbered 5, 6, and 7 in Fig. 1). The total number of stimuli presented was, therefore, 224 (28 for each model in each continuum × 2 models × 4 continua).

Participants sat in front of a 19-inch LCD monitor (resolution:

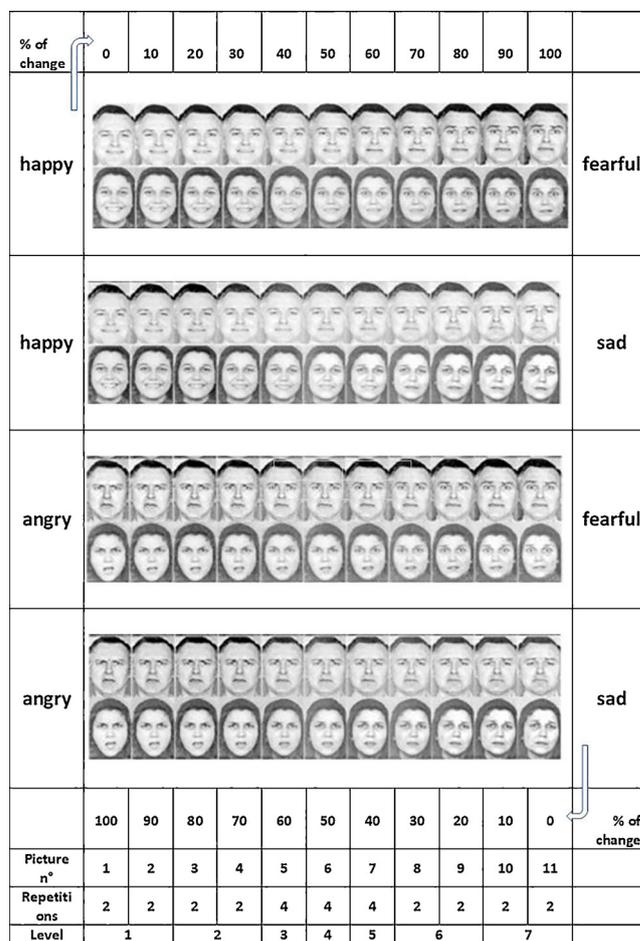


Fig. 1. The 88 stimuli used in the Experiments. The four pictures for each model numbered 1 and 11 were the original pictures chosen from a set of published photographs (Ekman & Friesen, 1978). Pictures numbered 2, 3, 4, 5, 6, 7, 8, 9 and 10 were morphed images created to lie between original pictures, considered prototypes of happiness and fearfulness, happiness and sadness, anger and fearfulness, and anger and sadness. The images each differed by 10% in pixel displacement of the total distance between their initial and final positions. Pictures numbered 6 were a 50% blend of each emotion pair. Pictures 1, 2, 3, 4, 8, 9, 10, and 11 were presented two times each. Pictures 5, 6, and 7 were presented four times each. (Adapted from Pollak & Kistler, 2002).

1.280 × 800 pixels; refresh frequency: 60 Hz) on which stimuli appeared on a grey background subtending an 11° × 17° square region around the fovea. Stimulus-presentation timing and randomization were controlled with E-prime V2.0 (Psychology Software Tools Inc., Pittsburgh, PA).

Stimuli were presented one at a time in randomized order so that the continuum being examined was not apparent to the subject. Each trial started with the presentation of a central fixation cross lasting 250 ms, followed by the stimulus presented for 500 ms at the center of the screen. After stimulus disappearance, four text boxes "anger" (*rabbia* in Italian) "fear" (*paura* in Italian) "happiness" (*felicità* in Italian), and "sadness" (*tristezza* in Italian) appeared on the screen in horizontal alignment. The order of the four text boxes was balanced between participants. Participants were asked to say the name of the emotion the face most resembled, and the experimenter recorded the response on the data-recording computer.

The experiment was subdivided into four blocks of 56 trials each, for a total of 224 trials.

Data analysis

For each continuum, we grouped responses given to presentation of

pictures 1 and 2 (level 1: displacement 0% and 10%), of pictures 3 and 4 (level 2: displacement 20% and 30%), of pictures 8 and 9 (level 6: displacement 70% and 80%), and of pictures 10 and 11 (level 7: displacement 90% and 100%). These pictures represented the steps in the continuum in which the percentage of displacement was minimum or maximum and, consequently there was less ambiguity as to which emotion was expressed. The number of responses recorded for each level was four for each model. Responses given to pictures 5 (level 3: displacement 40%), 6 (level 4: displacement 50%), and 7 (level 5: displacement 60%) were maintained separated. These pictures represented the steps in the continuum in which the percentage of displacement was around 50% and, consequently there was more ambiguity as to which emotion was expressed. The number of responses recorded for each level was four for each model.

For each continuum and for each level we calculated the percentage of responses relative to each emotion. We considered using recognition responses to emotions outside of the continuums as intrusions (e.g., for the continuum angry-sad, the intrusions were both happiness and fear identification).

For each continuum, we considered emotion recognition responses relative to each of the two emotions represented by the original pictures, and we entered data into a two-way 2×7 repeated-measure Analysis of Variance (ANOVA) with group (patients, controls) as between-subject variable, and level (1–7) as within-subject variable. All pairwise comparisons were performed using the Newman-Keuls post-hoc test. A significance threshold of $p < 0.05$ was set for all statistical analyses. Effect sizes were estimated using the partial eta square measure (η_p^2). The data are reported as the mean \pm standard error of the mean (sem).

Results

We ran a preliminary analysis to verify the amount of intrusions across continua. Considering that for the outer levels the amount of intrusions was zero, we collapsed the seven levels, and for each of the two possible emotion intrusions in each continuum we compared the results of the two groups by means of Independent Samples t Tests (level of significance $p < 0.05$). For all continua the amount of the two possible emotion intrusions in each continuum was greater for patients than for the control group (Angry-fear: happiness intrusion 4.42% patients, 0.09% controls, $t_{(40)} = 2.74$, $p = 0.009$; sad intrusion 10.71% patients, 3.40% controls, $t_{(40)} = 2.97$, $p = 0.005$. Angry-sad: happiness intrusion 3.49% patients, 0.17% controls, $t_{(40)} = 2.61$, $p = 0.013$. Happy-fear: anger intrusion 10.37% patients, 1.96% controls, $t_{(40)} = 3.55$, $p = 0.001$. Happy-sad: fear intrusion 9.86% patients, 1.79% controls, $t_{(40)} = 3.70$, $p = 0.0006$; anger intrusion 5.02% patients, 0.68% controls, $t_{(40)} = 2.08$, $p = 0.04$) except for the fear intrusion in the angry-sad continuum (17.52% patients, 11.82% controls, $t_{(40)} = 1.69$, $p = 0.10$), and the sadness intrusion in the happy-sad continuum (10.20% patients, 7.91% controls, $t_{(40)} = 0.89$, $p = 0.38$).

Fig. 2 shows the percentage of the average emotions recognition responses related to each of the two morphed emotions for each continuum. Below we present the results of ANOVAs performed on emotion recognition responses relative to each emotion, separately for each continuum.

Angry-Fear continuum

The two-way ANOVA performed on the anger responses revealed that the group main effect was not significant ($F_{1,40} = 0.565$, $p = 0.456$, $\eta_p^2 = 0.013$). The main effect of level ($F_{6,240} = 151.930$, $p < 0.0001$, $\eta_p^2 = 0.791$) was significant indicating that at the increase of the presence of the expression in the image corresponded an increase of the identification rate of that expression. At the post-hoc analysis each level differed from each other (all $p < 0.001$), except level 1 from level 2 ($p = 0.401$), level 4 from level 5 ($p = 0.80$), and level 6 from level 7

($p = 0.064$). The 2-way interaction group \times level was significant ($F_{6,240} = 6.899$, $p < 0.0001$, $\eta_p^2 = 0.147$). The post-hoc analysis indicated that the two groups differed each other in the identification rates only at level 6 ($p = 0.0003$) since the anger identification rate was higher for control group (level 6: 89.88% \pm 3.06) than for patients group (level 6: 69.64% \pm 6.01).

The two-way ANOVA performed on the fear responses revealed that the group main effect was significant ($F_{1,40} = 4.130$, $p = 0.048$, $\eta_p^2 = 0.093$) since for controls the identification rate was higher than for patients. The main effect of level ($F_{6,240} = 109.256$, $p < 0.0001$, $\eta_p^2 = 0.732$) was significant indicating that at the increase of the presence of the expression in the image corresponded an increase of the identification rate of that expression. At the post-hoc analysis each level differed from each other (all $p < 0.03$), except level 4 from level 5 ($p = 0.181$), and level 6 from level 7 ($p = 0.115$). The 2-way interaction group \times level was significant ($F_{6,240} = 7.785$, $p < 0.0001$, $\eta_p^2 = 0.164$) and the post-hoc analysis revealed that the identification rate was lower for patients than for controls at level 1 (patients: 66.66% \pm 6.41, controls: 91.66% \pm 2.63 $p = 0.001$), level 2 (patients: 57.73% \pm 7.49, controls: 83.33% \pm 5.12 $p < 0.001$), and level 3 (patients: 50% \pm 5.72, controls: 70.83% \pm 4.75 $p = 0.009$).

Happy-fear continuum

The two-way ANOVA performed on the happiness responses revealed that the main effect of group was not significant ($F_{1,40} = 0.005$, $p = 0.943$, $\eta_p^2 = 0.0001$). The main effect of level ($F_{6,240} = 281.551$, $p < 0.0001$, $\eta_p^2 = 0.875$) was significant. At the post-hoc analysis each level differed from each other (all $p < 0.008$), except level 1 from level 2 ($p = 0.487$), and level 6 from level 7 ($p = 0.339$). The 2-way interaction group \times level was significant ($F_{6,240} = 3.097$, $p = 0.006$, $\eta_p^2 = 0.071$) and the post-hoc analysis revealed that the identification rate was higher for patients than controls at level 3 (patients: 19.64% \pm 4.09, controls: 7.73% \pm 2.35 $p = 0.038$).

The two-way ANOVA performed on the fear responses revealed that the main effect of group was significant ($F_{1,40} = 8.354$, $p = 0.006$, $\eta_p^2 = 0.172$) since for controls the identification rate was higher than for patients. The main effect of level ($F_{6,240} = 144.062$, $p < 0.0001$, $\eta_p^2 = 0.782$) was also significant. At the post-hoc analysis each level differed from each other (all $p < 0.01$), except level 1 from level 2 ($p = 0.243$), and level 6 from level 7 ($p = 1$). The 2-way interaction group \times level was significant ($F_{6,240} = 7.573$, $p < 0.0001$, $\eta_p^2 = 0.159$) and the post-hoc analysis revealed that the identification rate was lower for patients than controls at level 1 (patients: 63.69% \pm 6.50, controls: 91.66% \pm 2.90 $p < 0.0001$), at level 2 (patients: 60.11% \pm 6.71, controls: 86.31% \pm 4.47 $p = 0.0002$), at level 3 (patients: 46.42% \pm 6.10, controls: 70.23% \pm 5.41 $p = 0.001$), and at level 4 (patients: 19.04% \pm 4.45, controls: 33.33% \pm 6.24 $p = 0.026$).

Happy-sad continuum

The two-way ANOVA performed on the happiness responses revealed that the main effect of group ($F_{1,40} = 1.03$, $p = 0.316$, $\eta_p^2 = 0.025$) and the 2-way interaction group \times level ($F_{6,240} = 1.716$, $p = 0.117$, $\eta_p^2 = 0.041$) were not significant. The main effect of level ($F_{6,240} = 217.292$, $p < 0.0001$, $\eta_p^2 = 0.844$) was significant. At the post-hoc analysis each level differed from each other (all $p < 0.02$), except level 1 from level 2 ($p = 0.564$).

The two-way ANOVA performed on the sadness responses revealed that the main effect of group was significant ($F_{1,40} = 4.674$, $p = 0.036$, $\eta_p^2 = 0.104$) since for controls the identification rate was higher than for patients. The main effect of level ($F_{6,240} = 214.806$, $p < 0.0001$, $\eta_p^2 = 0.843$) was also significant. At the post-hoc analysis each level differed from each other (all $p < 0.001$), except level 1 from level 2 ($p = 0.197$), and level 6 from level 7 ($p = 0.102$). The 2-way

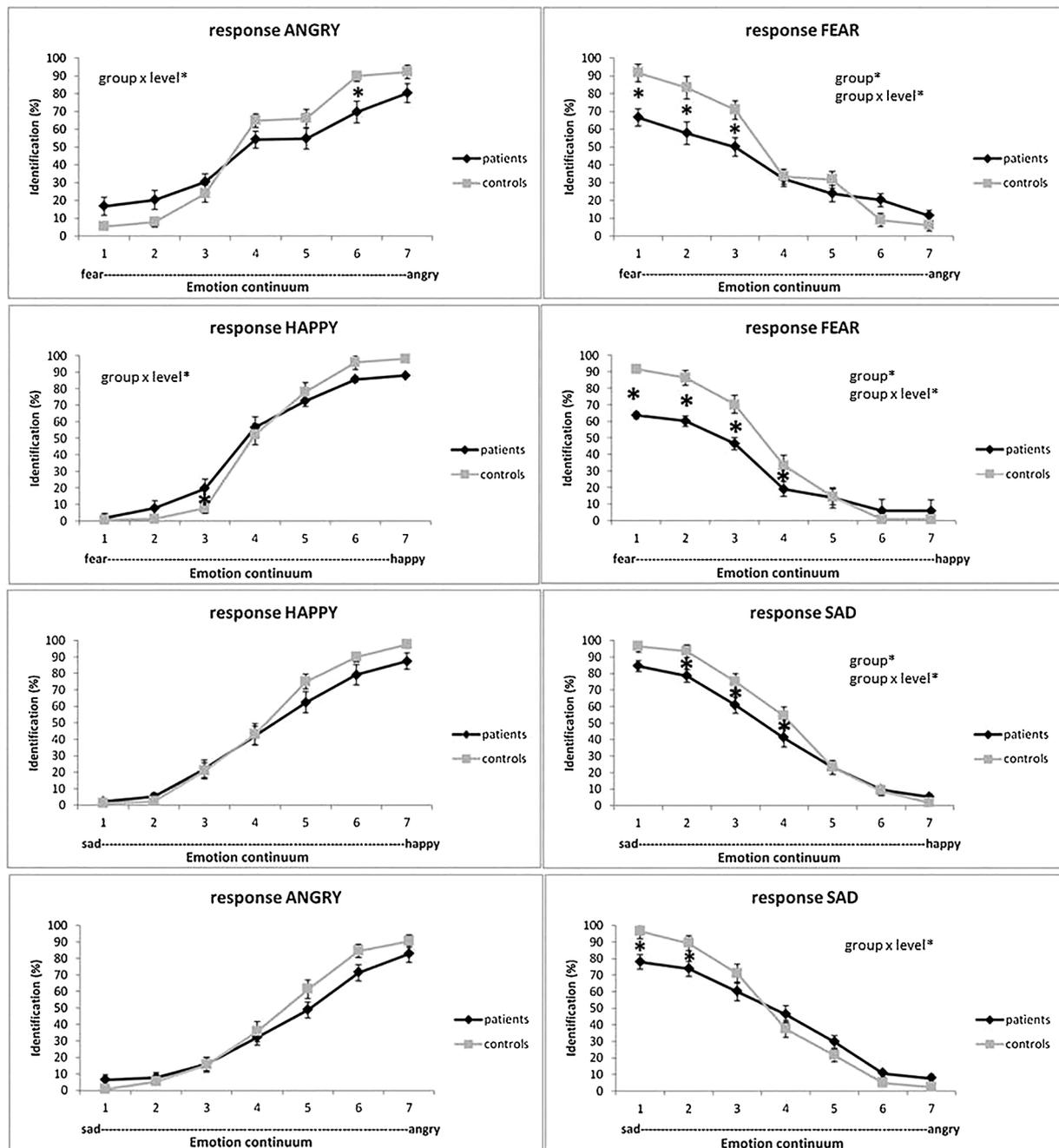


Fig. 2. Experiment 1. The figure shows the percentage of average responses for each emotion relative to each continuum, for patients and controls. From top to bottom: angry-fear, happy-fear, happy-sad, angry-sad continuum. The x-axes indicate each level of the image on the morphed continuum (1–7). Error bars represent the standard errors of the means. The labels group* and group x level* indicate, respectively, the presence of a statistically significant main effect of group and of a statistically significant 2-way interaction group \times level. Asterisks indicate statistically significant comparisons.

interaction group \times level was significant ($F_{6,240} = 2.743, p < 0.013, \eta_p^2 = 0.064$) and the post-hoc analysis revealed that the identification rate was lower for patients than controls at level 2 (patients: $78.57\% \pm 4.73$, controls: $96.42\% \pm 2.67, p = 0.021$), at level 3 (patients: $60.71\% \pm 4.66$, controls: $75\% \pm 5.17, p = 0.010$), and at level 4 (patients: $41.07\% \pm 4.41$, controls: $54.16\% \pm 6.53, p < 0.19$).

Angry-sad continuum

The two-way ANOVA performed on the anger responses revealed that the main effect of group ($F_{1,40} = 1.418, p = 0.240, \eta_p^2 = 0.034$) and the 2-way interaction group \times level ($F_{6,240} = 1.908, p = 0.080, \eta_p^2 = 0.045$) were not significant. The main effect of level ($F_{6,240} =$

$159.901, p < 0.0001, \eta_p^2 = 0.799$) was significant. At the post-hoc analysis each level differed from each other (all $p < 0.03$), except level 1 from level 2 ($p = 0.432$).

The two-way ANOVA performed on the sadness responses revealed that the main effect of group was not significant ($F_{1,40} = 0.537, p = 0.467, \eta_p^2 = 0.013$). The main effect of level ($F_{6,240} = 158.317, p < 0.0001, \eta_p^2 = 0.799$) was significant. At the post-hoc analysis each level differed from each other (all $p < 0.001$), except level 1 from level 2 ($p = 0.138$), and level 6 from level 7 ($p = 0.482$). The 2-way interaction group \times level was significant ($F_{6,240} = 4.993, p < 0.0001, \eta_p^2 = 0.110$), and the post-hoc analysis revealed that the identification rate was lower for patients than controls at level 1 (patients: $77.97\% \pm 5.90$, controls: $96.42\% \pm 2.13, p = 0.004$), and at level 2

(patients: 73.81% \pm 5.84, controls: 89.28% \pm 2.32, $p = 0.02$).

Summary of results

The comparison between the responses given to the facial expression categorization task by inpatients participants with SSD and those given by matched control participants showed that the identification rate was statistically significant lower in patients. The difference in performance was constantly present during trials requiring to produce the response fear, and less dramatically during trials requiring the response sadness. The main effect of group was significant for angry-fear, happy-fear, and happy-sad continua.

Experiment 2

Materials and methods

Participants

Thirteen inpatients participants with SSD (inclusion criterion: code 295, Schizophrenic psychoses, according to the ICD-9), hosted at the long-term Psychiatric Residence S. Bartolo in Ferrara (Italy) (named patients: 4 females; mean age = 49 years, standard deviation = 8.40), and 13 inpatients participants with SSD (inclusion criterion: code 295, Schizophrenic psychoses, according to the ICD-9) referring to the Public Mental Health Service of the Emilia-Romagna Region, coming from different cities in the region, and participating in theater activities (named theater-patients: 4 females; mean age = 47.92 years, standard deviation = 7.38) participated in this study and gave their written informed consent. The two groups were matched for gender, age, and education. All were native Italian speakers of Caucasian ethnicity (as the models depicted in the stimuli) and reported having normal or corrected-to-normal visual acuity.

Theater activities were organized and coordinated by the Public Mental Health Service, in collaboration with local companies and with the guide of professional directors. The commitment of each patient was supported and coordinated by a professional educator and consisted in the regular participation to the rehearsals for the shows, and to the public performances in regional theaters, as well as in national and international tours. The pieces were taken from classic dramaturgy, in original writing or reworked with personal material, as well as from unpublished plays, sometimes written by the patients themselves. The average time of theater experience in the sample was 7.4 years (standard deviation = 4.79).

Participants were unaware of the purposes of the study. The procedures were approved by the local Ethics Committee and were in accordance with the guidelines of the Declaration of Helsinki.

Stimuli and procedure

Stimuli and procedure were the same as in Experiment 1.

Results

We ran a preliminary analysis to verify the amount of intrusions across continua. We collapsed the seven levels, and for each of the two possible emotion intrusions in each continuum we compared the results of the two groups by means of Independent Samples t Tests (level of significance $p < 0.05$). For all the continua the amount of the emotion intrusions in each continuum was comparable in the two groups (all $t_{(24)} < 1.92$ and all $p > 0.07$), except for the sadness intrusion in the angry-fear continuum which was greater in patients than in theater-patients (13.87% patients, 5.49% theater, $t_{(24)} = -2.5$, $p = 0.03$).

Fig. 3 shows the percentage of the average emotion recognition responses related to each of the two morphed emotions for each continuum. Below we present the results of ANOVAs performed on emotion recognition responses relative to each emotion, separately for each

continuum.

Angry-Fear continuum

The two-way ANOVA performed on the anger responses revealed that the main effect of group ($F_{1,24} = 0.07$, $p = 0.792$, $\eta_p^2 = 0.002$), and the 2-way interaction group \times level ($F_{6,144} = 1.706$, $p = 0.123$, $\eta_p^2 = 0.066$) were not significant. The main effect of level ($F_{6,144} = 63.932$, $p < 0.0001$, $\eta_p^2 = 0.727$) was significant indicating that at the increase of the presence of the expression in the image corresponded an increase of the identification rate of that expression. At the post-hoc analysis each level differed from each other (all $p < 0.001$), except level 1, level 2, and level 3 from each other (all $p > 0.131$), level 4 from level 5 ($p = 0.30$), and level 6 from level 7 ($p = 0.131$).

The two-way ANOVA performed on the fear responses revealed that the group main effect was significant ($F_{1,24} = 6.836$, $p = 0.015$, $\eta_p^2 = 0.221$) since for theater-patients the identification rate was higher than for patients. The 2-way interaction group \times level ($F_{6,144} = 1.951$, $p = 0.076$, $\eta_p^2 = 0.075$) was not significant. The main effect of level ($F_{6,144} = 41.690$, $p < 0.0001$, $\eta_p^2 = 0.643$) was significant indicating that at the increase of the presence of the expression in the image corresponded an increase of the identification rate of that expression. At the post-hoc analysis each level differed from each other (all $p < 0.03$), except level 1 from level 2 ($p = 0.438$), level 2 from level 3 ($p = 0.08$), level 4 from level 5 ($p = 0.262$), and level 6 from level 7 ($p = 0.388$). The 2-way interaction group \times level was not significant ($F_{6,144} = 1.951$, $p < 0.076$, $\eta_p^2 = 0.075$).

Happy-fear continuum

The two-way ANOVA performed on the happiness responses revealed that the main effect of group ($F_{1,24} = 0.246$, $p = 0.624$, $\eta_p^2 = 0.010$) and the 2-way interaction group \times level ($F_{6,144} = 1.907$, $p = 0.083$, $\eta_p^2 = 0.073$) were not significant. The main effect of level ($F_{6,144} = 135.604$, $p < 0.0001$, $\eta_p^2 = 0.849$) was significant. At the post-hoc analysis each level differed from each other (all $p < 0.04$), except level 1 from level 2 ($p = 0.467$), and level 6 from level 7 ($p = 0.467$).

The two-way ANOVA performed on the fear responses revealed that the main effect of group was significant ($F_{1,24} = 5.197$, $p = 0.031$, $\eta_p^2 = 0.178$) indicating that for theater-patients the identification rate was higher than for patients. The main effect of level ($F_{6,144} = 79.436$, $p < 0.0001$, $\eta_p^2 = 0.767$) was significant. At the post-hoc analysis each level differed from each other (all $p < 0.01$), except level 1 from level 2 ($p = 1$), and level 6 from level 7 ($p = 0.437$). The 2-way interaction group \times level was significant ($F_{6,240} = 3.097$, $p = 0.006$, $\eta_p^2 = 0.071$) and the post-hoc analysis revealed that the identification rate was higher for theater-patients than for patients at level 3 (patients: 45.19% \pm 7.42, theater-patients: 69.23% \pm 7.43 $p = 0.027$), and at level 4 (patients: 21.15% \pm 5.90, theater-patients: 47.11% \pm 9.51 $p = 0.014$).

Happy-sad continuum

The two-way ANOVA performed on the happiness responses revealed that the main effect of group ($F_{1,24} = 0.015$, $p = 0.901$, $\eta_p^2 = 0.000$) and the 2-way interaction group \times level ($F_{6,144} = 1.466$, $p = 0.193$, $\eta_p^2 = 0.057$) were not significant. The main effect of level ($F_{6,144} = 135.590$, $p < 0.0001$, $\eta_p^2 = 0.849$) was significant. At the post-hoc analysis each level differed from each other (all $p < 0.001$), except level 1 from level 2 ($p = 0.668$), and level 6 from level 7 ($p = 0.068$).

The two-way ANOVA performed on the sadness responses revealed that the main effect of group ($F_{1,24} = 3.894$, $p = 0.060$, $\eta_p^2 = 0.139$) and the 2-way interaction group \times level ($F_{6,144} = 1.775$, $p = 0.108$, $\eta_p^2 = 0.068$) were not significant. The main effect of level ($F_{6,144} = 117.629$, $p < 0.0001$, $\eta_p^2 = 0.830$) was significant. At the post-hoc analysis each level differed from each other (all $p < 0.001$), except

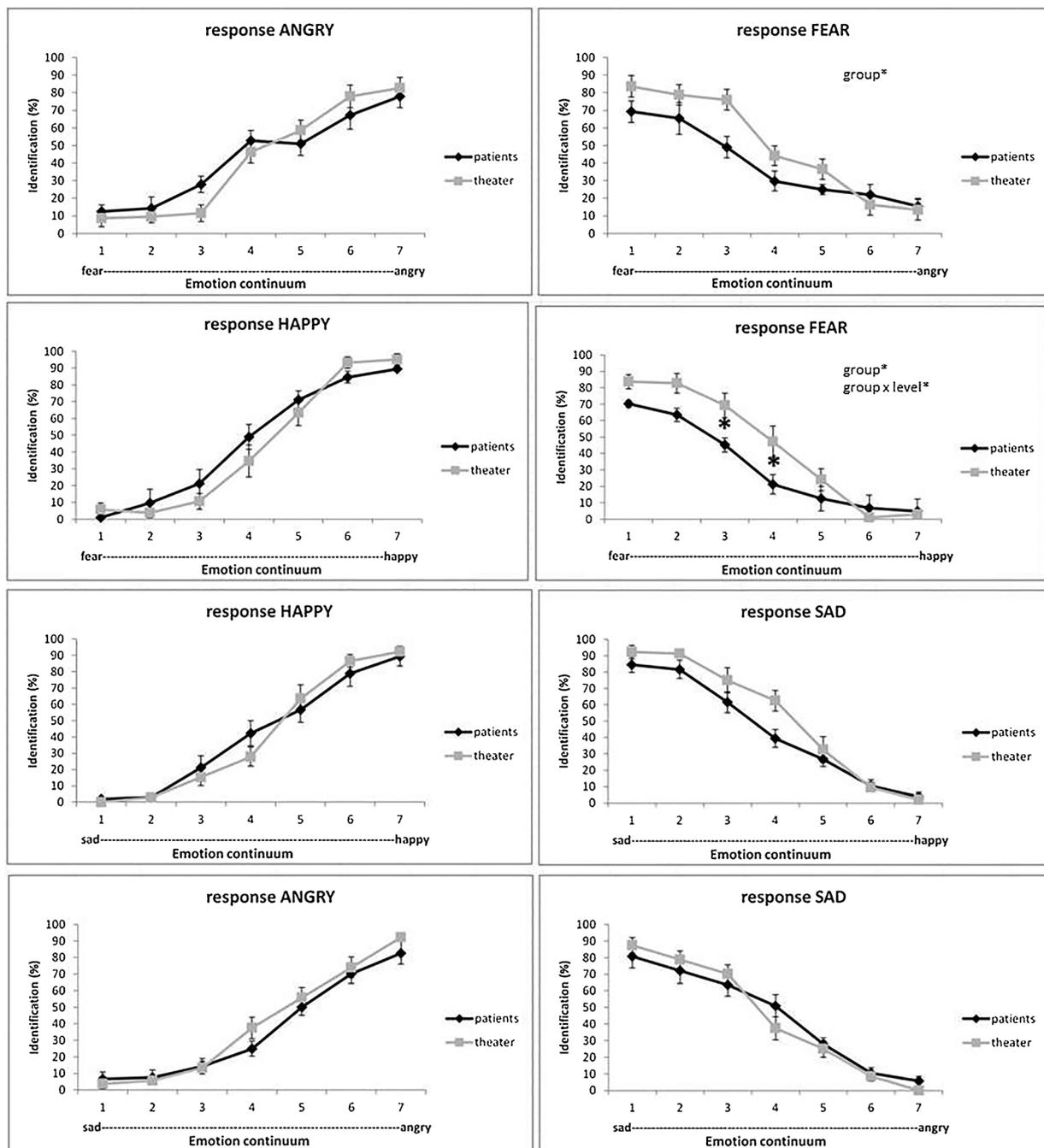


Fig. 3. Experiment 2. The figure shows the percentage of average responses for each emotion relative to each continuum, for patients and theater-patients. From top to bottom: angry-fear, happy-fear, happy-sad, angry-sad. The x-axes indicate each level of the image on the morphed continuum (1–7). Error bars represent the standard errors of the means. The labels group* and group x level* indicate, respectively, the presence of a statistically significant main effect of group and of a statistically significant 2-way interaction group \times level. Asterisks indicate statistically significant comparisons.

level 1 from level 2 ($p = 0.673$), and level 6 from level 7 ($p = 0.113$)

Angry-sad continuum

The two-way ANOVA performed on the anger responses revealed that the main effect of group ($F_{1,24} = 0.752$, $p = 0.394$, $\eta_p^2 = 0.030$) and the 2-way interaction group \times level ($F_{6,144} = 1.021$, $p = 0.413$, $\eta_p^2 = 0.040$) were not significant. The main effect of level ($F_{6,144} = 124.583$, $p < 0.0001$, $\eta_p^2 = 0.838$) was significant. At the post-hoc analysis each level differed from each other (all $p < 0.001$), except level 1, level 2, and level 3 from each other (all $p > 0.083$).

The two-way ANOVA performed on the sadness responses revealed

that the main effect of group ($F_{1,24} = 0.017$, $p = 0.896$, $\eta_p^2 = 0.000$) and the 2-way interaction group \times level ($F_{6,144} = 1.339$, $p = 0.243$, $\eta_p^2 = 0.052$) were not significant. The main effect of level ($F_{6,144} = 93.702$, $p < 0.0001$, $\eta_p^2 = 0.796$) was significant. At the post-hoc analysis each level differed from each other (all $p < 0.001$), except level 1 from level 2 ($p = 0.067$), level 2 from level 3 ($p = 0.067$), and level 6 from level 7 ($p = 0.155$).

Summary of results

The results show a very specific influence of theatre activities on the facial expression categorization task. Specifically, patients participating

in theater activities were less impaired in trials requiring the fear emotion as response. The main effect of group was significant for both angry-fear, and happy-fear continua.

Discussion

The aim of the study was to verify the efficacy of theatre activities in patients affected by schizophrenia, while trying to avoid bias relative to randomization and experimenter's blindness, which are quite commonly present in literature investigating similar issues, as reported by a Cochrane Review (Ruddy & Dent-Brown, 2007). To this purpose we considered the effects of this Mind-Body approach on face emotion recognition impairment in schizophrenia which is present early and is consistent in magnitude across the phases of illness. Consequently, we firstly verified if and how the performance of SSD patients in a facial expression categorization test was different from that of normal matched controls, and, subsequently, we investigated whether the experience of theatre activities was able to improve the performance in a group of SSD patients, with respect to that of a matched group of SSD patients with no experience of theater activities. The results of Experiment 1 indicated that only the identification rates for the responses fear and sadness were lower for patients than for controls. Specifically, the main effect of group was significant for angry-fear, happy-fear, and happy-sad continua, but not for the angry-sad one. These findings are not inconsistent with those of Kee et al. (Kee, Horan, Wynn, Mintz, & Green, 2006) who also used the pool of stimuli taken from Pollak and Kistler (2002), even if a direct comparison is not possible for multiple differences in the experimental paradigm and in the analysis of the data. Specifically, in Kee et al. (2006) i) the facial image remained in view until a response was made, a type of presentation not excluding the possibility of a deep cognitive evaluation of the stimuli; ii) participants were submitted to a dichotomous-choice task, a situation in which usually individuals with schizophrenia perform as well as other groups (Archer, Hay, & Young, 1994; Gessler, Cutting, Frith, & Weinman, 1989); iii) the patients and the control groups were not matched for age and sex; iv) instead of considering group differences in the percentage of responses relative to each emotion for each continuum and for each level, they evaluated group differences in the overall profiles in emotion classification across levels. In fact, they collapsed the responses at each level into a summary score representing the proportion of times the picture was classified into the higher emotional category, and derived slope (i.e., a high slope value indicated an abrupt shift from classifying photos as being at one emotional pole rather than the other), and shift point (i.e., the level of the continuum at which the most likely choice of emotion shifted from one emotion to other) parameters from generalized linear mixed model regressions. Results indicated that the schizophrenia group showed significantly smaller slopes than controls across all four emotional continua, suggesting that the patients perceived emotion in a less discrete, more continuous fashion. Interestingly, even if the groups did not significantly differ on the shift points for any of the emotional continua, a non-significant trend for the angry-fear continuum was present in which patients diagnosed with schizophrenia displayed a tendency to under-identify fear versus anger expressions. This last result is consistent with the evidence reported in the present paper that, for the angry-fear continuum, the identification rate for the response fear was lower for patients than for controls. Research into facial emotion perception in schizophrenia has burgeoned over the past several decades, as documented by numerous reviews (Chan, Li, Cheung, & Gong, 2010; Edwards et al., 2002; Kohler et al., 2010), and a consistent indication suggests that schizophrenia may be associated with a specific deficit in the processing of a subset of negative emotions including sadness and fear (Archer, Hay, & Young, 1994; Bellack, Blanchard, & Mueser, 1996; Gaebel & Wölwer, 1992; Schneider, Gur, Gur, & Shtasel, 1995). Furthermore, specific deficits in the recognition of fear and sadness have been demonstrated in individuals with first-episode psychosis

(Edwards, Pattison, Jackson, & Wales, 2001), and in individuals who are "at risk" for psychosis (Aminger et al., 2012), suggesting that they may serve as markers of risk (Comparelli et al., 2013).

Some authors have proposed different neurocognitive explanations for this specific deficit. Edwards et al. (2001) claimed that this pattern of results is consistent with amygdala dysfunction in schizophrenia, since this region of the limbic system plays an important role both in the recognition of fear (Adolphs et al., 1999; Whalen, 1998), and in the pathogenesis of schizophrenia (Fudge, Powers, Haber, & Caine, 1998). A study using event-related functional neuroimaging indicated that errors in fear detection in schizophrenia are associated with paradoxically higher activation in the amygdala and an associated network implicated in threat detection. Furthermore, this exaggerated activation to fearful faces correlated with severity of flat affect, suggesting that abnormal threat detection processing may reflect disruptions between nodes that comprise the affective appraisal circuit (Gur et al., 2007). Instead, Popov et al. (Popov, Rockstroh, Popova, Carolus, & Miller, 2014) showed that schizophrenia patients exhibited less induced alpha power modulation than healthy subjects during the period prior to affect recognition, corresponding to poorer behavioral performance, when observing videos of dynamic facial stimuli that changed from neutral to fear or to happiness expressions. Finally, Wible (Wible, 2012), by reviewing preliminary evidence of an over activation of the temporal-parietal occipital junction (TPJ) in schizophrenia, and by indicating that neurons in TPJ are tuned to rapidly detect emotionally negative or socially threatening gestures, consequently proposed a specific role of this region in altering the perception of fear-related stimuli.

Critically, the results of Experiment 2 indicated that the identification rate for the response fear was higher for the group of SSD patients with experience of theatre activities than for the group of matched patients. The main effect of group was significant for both angry-fear, and happy-fear continua. Therefore, the present study, in the absence of bias relative to randomization and experimenter's blindness, indicated the efficacy of theatre activities as remediation of impairments in facial affect recognition, able of improving the recognition of fear expression, which appears to be the most deficient in patients affected by schizophrenia. However, it has to be noted that the magnitude of the improvement is limited and evident only after a statistical analysis, avoiding the possibility that dramatic stimuli could enhance psychopathology inducing over reception of threat.

Many researchers have developed interventions that attempt to ameliorate deficits in social cognition in clients with schizophrenia, in particular, the main purpose of cognitive remediation is to enhance cognitive performance and, by this means, to promote social and occupational functioning. Multiple approaches have been taken in these remediation programs that vary across several dimensions. "Targeted" interventions train clients on aspects of one specific domain of social cognition, while "broad-based" interventions incorporate multiple domains to create more complex, eclectic programs. Three literature reviews (Horan, Kern, Green, & Penn, 2008; Hwan Choi, Hun Kim, Lee, & Green, 2009; Wölwer, Combs, Frommann, & Penn, 2010) showed that "targeted" social cognitive training programs produced improvements in the respective domains of social cognition upon which they focused. "Broad-based" interventions also reportedly produced improvement on social cognitive measures, however, their multi-faceted natures have prevented researchers from ascertaining whether these programs directly affected social cognition. Among the "targeted" interventions, the "Training of affect recognition" (TAR) of Wolwer et al. (Wölwer & Frommann, 2011; Wölwer et al., 2005) significantly improves the recognition of facial affect in schizophrenia, and it may be considered the most representative one. It is a manualized, computer-aided 12-session program that primarily targets impairments in facial affect recognition. It is applied in a small group setting of two patients and one therapist. It comprises both restitution and compensation methods, it tries to establish alternative strategies of information processing, it is based on errorless learning, over-learning, and immediate positive feedback and

feature abstraction. However, despite the evidence that TAR has enhancing effects on facial affect recognition (Frommann, Streit, & Wölwer, 2003; Wölwer & Frommann, 2011; Wölwer et al., 2005), due to the triadic group setting, the personnel expense of the TAR is high. Since intensive coaching and modeling by the therapist is necessary, working with larger groups comprising more than two patients does not seem to be feasible.

In conclusion, the results of the present study suggest that theatre activities, even if not specifically used as a therapeutic method but simply as a staging of a theatrical piece, may act as a social cognitive remediation program, and that its effects may be assessed by controlled psychophysical testing. Furthermore, it is less expensive in terms of personnel than the most accredited intervention, given that it is typically done in groups or community settings. Acting involves learning a broad range of skills, including imagination, physical expressivity, and clarity of speech. It further requires an ability to impersonate characters and represent their emotions which, in turn, creates the possibility of experiencing the same feelings—a core difficulty in patients affected by schizophrenia. In addition, the necessity to continuously interact with the other actors and with the director is a good training for socialization, within a protected environment, and in a very motivating context. Yotis (2006) argues that drama therapy helps patients get greater awareness of one's emotions. The patients are invited and helped to use facial expressions, gestures, the overall expression of the body and the modulation of the voice tones in order to identify themselves through the imitation of the various states of mind submitted to their attention. Furthermore, the complexity of the characters can help them in the reconciliation of contradictory emotions since threatening emotions can be dealt within the safety of the group and the director (Yotis, 2006). More critically, the necessity to act on the scene in a way specified by the script may operate on patients' sense of agency, which is disturbed in schizophrenia, by overcoming the commonly imprecise predictions about the sensory consequences of their own actions (Blakemore, Smith, Steel, Johnstone, & Frith, 2000; Frith, 1987; Frith, Blakemore, & Wolpert, 2000; Synofzik, Thier, Leube, Schlotterbeck, & Lindner, 2010; Voss et al., 2010). Moreover, the fact that others' actions don't need to be predicted in scenes, since they are predetermined by the theatrical piece, may increase confidence in the individual's ability to more accurately predict emotional responses relative to not only their own actions, but also to others' actions. This possibility is in line with “predictive processing” theories of mind and cognitive function which postulate that top-down predictions about the sensory consequences of events shape their perception, the generation of selfhood and the general cognitive framework for perceiving and acting within the environment (Allen & Friston, 2016). Furthermore, considering these assumptions, theatre activities and the possibility that it may reinforce the sensorimotor representations at the base of perception and production of goal-directed actions, may influence the mirror neuron system in a positive way, whose dysfunction is considered to underlie diverse symptoms of schizophrenia (Enticott et al., 2008; Mehta et al., 2014; Möhring et al., 2015).

Therefore, according to present results and considerations, theatre activities may be included in the “broad-based” social cognitive training programs, and, given the experimental evidence that it improves facial expression recognition, it may be considered an intervention affecting social cognition, even if further controlled psychophysical studies are necessary to verify its effects on other domains of this basic human ability.

Declaration of interest

The authors have no competing interests to report.

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