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Attentional-shaping as a means to improve emotion perception deficits in schizophrenia

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Abstract

Inability to recognize emotional expressions of others (emotion perception) is one of the most common impairments observed among individuals with schizophrenia. Such deficits presumably contribute much to the social dysfunction characteristic of schizophrenia. This study examined the efficacy of a novel attentional-shaping intervention to improve emotion perception abilities. Sixty participants with schizophrenia were randomly assigned to one of three intervention conditions: 1) attentional-shaping, 2) contingent monetary reinforcement, or 3) repeated practice. Participants completed the Face Emotion Identification Test (FEIT) at pre-test, intervention, post-test, and one week follow-up. Participants also completed the Bell-Lysaker Emotion Recognition Test (BLERT) and the Social Behavior Scale at pre-test and follow-up to measure generalization.

The results showed that the attentional-shaping condition had significantly higher scores on the FEIT at intervention, post-test, and follow-up compared to monetary reinforcement and repeated practice. Improvement was also found on the BLERT and a trend was found for improved social behaviors at one-week follow-up. Results will be discussed in terms of face scanning and attentional deficits present in schizophrenia and potential uses of this intervention in the remediation of emotion perception deficits.

Keywords: Social cognition; Emotion perception; Attention; Shaping; Social behaviors

1. Introduction

Impairments in social functioning are among the hallmark characteristics of schizophrenia (American Psychiatric Association, 2000) and these impairments are more pronounced in schizophrenia than in any other psychiatric disorder (Mueser and Bellack, 1998). Unfortunately, the reasons for these problems are not well understood. One area of promise has been in the study of social cognition, which is defined as the way we understand, perceive, and interpret our social world (Penn et al., 1997). Social cognition appears to have a stronger relationship with functional outcome than neurocognition (Penn et al., 1996; Pinkham and Penn,

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2006) and may serve as a direct predictor (Brune et al., 2007) or mediator (Addington et al., 2006 Sergi et al., 2006) of functional outcome. Taken as a whole, this body of research strongly supports the importance of social cognition in schizophrenia (Couture et al., 2006).

One of the most consistent social-cognitive deficits in schizophrenia is the impaired recognition of emotional expressions in others (emotion perception; Edwards et al., 2002; Mandal et al., 1998; Penn et al., 2006). Deficits in emotion perception appear to be stable, and occur across different phases of the disorder (Gaebel and Wölwer, 1992; Penn and Combs, 2000; Penn et al., 2000). They are also thought to contribute heavily to the social impairments found in schizophrenia (Hooker and Park, 2002; Ihnen et al., 1998, Kee et al., 2003; Mueser et al., 1996). If emotion perception could be improved, it may lead to improved social functioning and a better quality of life for persons with the disorder.

Researchers have become increasingly interested in the role of cognition as a possible underlying cause of emotion perception deficits (Green, 1993; Green et al., 2000; Penn et al., 2001). Even though persons with schizophrenia have a wide-variety of cognitive impairments (Heinrichs, 2005), it appears that emotion perception largely depends on intact attentional abilities (Bruce and Young, 1986; Pinkham et al., 2003) (Although there are findings from the autism literature which demonstrate that social perception can be impaired in the presence of intact cognitive and attentional abilities; Sasson et al., 2007). Despite this issue, emotion perception requires that the perceiver select parts of the person's face upon which to attend, and then sustain attention in order to collect important information about the person's emotional state (Morrison et al., 1988b). Finally, the brevity of emotion expressions during social interactions places a high demand on the already impaired attentional system in schizophrenia (Bellack et al., 1996). Quite simply, if a person cannot fully attend to facial stimuli, then his or her capacity to recognize emotional expressions will be impaired.

Several areas of clinical research have supported the role of attentional processes in emotion perception. First, studies have demonstrated a consistent positive correlation between neuropsychological measures of attention and emotion perception. In particular, vigilance, attentional span, and the ability to shift attention are most predictive of emotion perception scores as compared to language, memory, and executive functioning (Addington and Addington, 1998; Combs and Gouvier, 2004; Kee et al., 1998; Morrison et al., 1988a). Second, persons with schizophrenia show evidence of abnormal or restricted visual scan paths on face and emotion recognition tasks in which they tend to focus on non-essential areas of the face or even peripheral aspects of the face (Phillips and David, 1997; Streit et al., 1997). There is also evidence for a reduction in the amount of time they view relevant facial features such as the eyes and mouth, which is especially important since emotions are recognized during the early stages of the perceptual process (Gordon et al., 1992; Loughland et al., 2002; Swartz et al., 1999; Williams et al., 2003). In schizophrenia, it has been hypothesized that problems in facial scanning reflect a data gathering bias in which important facial information is not attended to or even missed (Green et al., 2001). In terms of neural activity, the Fusiform Gyrus, a key part of the social cognitive network, tends to be activated when viewing faces (see Dalton et al., 2007; Morris et al., 2007). Overall, there seems to be converging evidence from neuropsychological, visual scanning, and imaging studies for the importance of visual attention to the face in emotion perception (see Adolphs et al., 2005; Combs and Gouvier, 2004).

In terms of intervention strategies, it has only been recently that social cognition has been considered an important treatment target (Combs et al., 2007). Typically, interventions for social cognition are categorized as either "broad-based" or "targeted" strategies (Penn et al., 2007). Broad-based interventions, such as cognitive remediation, focus on restoring the core cognitive deficits in schizophrenia with the expectation that an improvement in lower level cognitive abilities will lead to an improvement in emotion perception (Spaulding et al., 1999; Van der Gaag et al., 2002). However, because these interventions use a large number of techniques, it becomes difficult to discern what treatment components exert beneficial effects (Kurtz et al., 2001; Twamley et al., 2003). Also, these interventions can be time consuming and expensive to conduct, thereby imposing practical limitations on their use.

In contrast, targeted interventions focus on improving a single area of social cognition such as emotion perception or theory of mind. In one of the first studies on emotion perception remediation, Penn and Combs (2000) found that a single session intervention of either facial mimicry, monetary reinforcement, or a combination of mimicry and reinforcement led to improved emotion perception, but the gains for each intervention were poorly maintained at a one-week follow-up. More recent studies have found that emotion perception can in fact be improved (Choi and Kwon, 2006; Frommann et al., 2003; Russell et al., 2006; Silver et al., 2004; Wölwer et al., 2005), but generalization and maintenance

of the improvements has proven more elusive (Combs et al., 2007; see Horan et al., in press for a review). Also, little data exist to indicate whether improved emotion perception leads to enhanced social functioning. Moreover, none of these interventions directly address problems in facial scanning, which may in fact be the core substrate of poor emotion perception.

Based on the limitations of previous research and the role of problematic scanning of facial features found in schizophrenia, we propose that remedation of emotion perception deficits may be achieved by directing attention to key areas of the face. To this end, we developed a novel attentional-shaping intervention that uses computerized attentional prompts along with monetary reinforcement as a means to shape attention to portions of the face (eyes and mouth) which are most salient to emotional expressions. Thus, by keying visual attention to these areas of the face, we might be able to foster an alternative viewing strategy for recognizing emotional expressions. Attentional-shaping methods have been successful in improving attention on gross motor tasks and in psychosocial group settings and may be useful for social cognitive tasks as well (Menditto et al., 1991; Silverstein et al., in press, 2001, 2005).

In this study, we examined the efficacy of the attentional-shaping intervention with two comparison intervention methods used in previous research to improve emotion perception skills (see Combs et al., 2006b; Penn and Combs, 2000). Participants were randomly assigned to one of three intervention conditions: 1) attentional-shaping (use of attentional prompts with monetary reinforcement), 2) contingent monetary reinforcement only, or 3) repeated practice. Participants completed the same version of the Face Emotion Identification Test (FEIT; Kerr and Neale, 1993) at four time periods: pre-test, intervention, post-test, and at a one-week follow-up to measure efficacy of the interventions in improving emotion perception. A unique aspect of the current study was the integration of the FEIT into each intervention (see Section 2.2. *Intervention Conditions and Procedures*). We predicted that participants in the attentional-shaping condition would show significantly higher FEIT scores during the intervention, post-test and follow-up phases compared to conditions using monetary reinforcement and repeated practice. Additionally, a second measure of emotion perception (Bell-Lysaker Emotion Recognition Test; Bell et al., 1997) that was not used in the interventions was completed at pre-test and follow-up to examine generalization. To determine if the intervention generalized to social functioning, blinded staff completed the Social Behavior Scale (SBS) at pre-test and follow-up. We predicted that participants in the attentional-shaping condition would show higher emotion perception scores on the BLERT and have higher levels of observer-rated social behaviors. Finally, because there are a number of variables that are important in emotion perception, we collected demographic (gender, ethnicity), pre-morbid social functioning, medication (atypical vs. typical, dosage), diagnostic (paranoid vs. non-paranoid), symptom (thought disorder, negative symptoms), and neuropsychological data (e.g. attention, face and visual form perception) to examine the role of these variables in the intervention (Addington and Addington, 1998; Brekke et al., 2005; Combs et al., 2006a; Herbener et al., 2005; Kee et al., 1998; Loughland et al., 2002; Scholten et al., 2005).

2. Methods

2.1. Participants

Participants comprised sixty persons with schizophrenia who were recruited from an inpatient psychiatric hospital (see Table 1). The sample included more males ($n=39$) than females ($n=21$), χ^2 ($N=60$)=5.4, $p<.05$, and more Caucasian-Americans ($n=26$) and African Americans ($n=29$) than Native Americans ($n=3$), Hispanics ($n=1$), or Asians ($n=1$), χ^2 ($N=60$)=67.3, $p<.0001$. All participants were required to have a diagnosis of schizophrenia ($n=42$) or schizoaffective disorder ($n=18$) based on the Structured Clinical Interview for DSM-IV (SCID-I/P; First et al., 2001). Exclusion criteria consisted of a history of brain injury or neurological disease other than schizophrenia, or if they met DSM-IV diagnostic criteria for substance

Table 1
Summary of participant demographics

Variable	Mean (SD)
N	60
Age (years)	38.7 (13.7)
Educational level (years)	12.1 (2.7)
% Male	65%
% White	43%
% Schizophrenia	70%
Length of illness (years)	14.6 (12.4)
% On atypical antipsychotics	88%
CPZ equivalents (mg/day)	646.2 (435.0)
BPRS Total Score (range 24–168)	54.7 (12.5)
Affect (range 5–35)	10.1 (3.8)
Anergia (range 4–28)	8.5 (3.4)
Disorganization (range 3–21)	5.2 (1.6)
Thought Disorder (range 4–28)	15.7 (5.4)

Note. CPZ = chlorpromazine equivalents (see Woods, 2003); BPRS = Brief Psychiatric Rating Scale.

dependence within the last three months based on the SCID-P (to rule-out substance-induced conditions).

2.2. Intervention conditions and procedures

Participants were randomly assigned to one of three emotion perception intervention conditions: attentional-shaping, monetary reinforcement only, or repeated practice. The interventions used a computerized version of the FEIT, which was administered at pre-test, intervention, immediate post-test, and at a one-week follow-up for a total of four times (see Penn and Combs, 2000, for a similar procedure). The pre-test, intervention, and post-test occurred in the same session (conditions immediately followed each other with a 2 minute rest period between administrations) and the follow-up occurred one week later. The intervention condition occurred during the second administration of the FEIT and differed as follows. In the attentional-shaping condition, a large cross appeared over the center of the each image from the FEIT (DirectRT software was used to program the time and location of the prompts) to direct attention to the eye and mouth areas of the face. The cross appeared for 3 s and then gradually faded from view. Participants were not told to fixate on the cross when it appeared, thus making the prompt a passive intervention. The three-second prompt time was selected based on research that problems in emotion perception occur early in the perceptual process (Gordon et al., 1992; Swartz et al., 1999; Turetsky et al., 2007). In the shaping condition, if the participant correctly identified the emotional expression, they were reinforced with ten cents that was placed in a cup in front of the participant; incorrect responses were not reinforced (Penn and Combs, 2000). In the monetary reinforcement only condition, each correct response was reinforced in the same manner as the shaping condition, but no attentional prompts were used. The repeated practice condition had no active intervention and served as the control group.

2.3. Measures

2.3.1. Demographic, diagnostic and symptom measures

Demographic data (e.g., age, education, medication type and dosage) was collected using chart information. The SCID-P was used to derive a DSM-IV-TR psychiatric diagnosis. Current severity of psychiatric symptoms for the previous one week period was assessed with the Expanded Brief Psychiatric Rating Scale (BPRS Version 4.0; Lukoff et al., 1986) and we examined the BPRS total score (overall level of symptom severity), thought disorder (positive symptoms) and anergia (negative symptom) subscales score due to their importance in emotion perception (Combs et al., 2007; see Green et al., in press for a discussion of symptoms and social cognition). The SCID and BPRS were administered by a doctoral student in clinical psychology who demonstrated good inter-rater reliability with a criterion-trained rater (Intra-class correlations = .80+). To reduce the effects of rater drift and bias, 20% of SCID and BPRS administrations were co-rated by one of the researchers (DC); feedback was provided for discrepant ratings. Level of pre-morbid social competence was measured by using the Zigler–Glick Social Competence Index (Glick et al., 1985) obtained from chart and interview data.

2.3.2. Neuropsychological measures

Neuropsychological functioning was measured with the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS; Randolph, 1998). For this study, we only report scores from the RBANS Total Score to provide information on global level of cognitive functioning and from the RBANS Attention Index score due to the potential importance in emotion perception (Combs and Gouvier, 2004). The Wechsler Test of Adult Reading (WTAR, Wechsler, 2001) was used to derive an estimate of the person's reading level. The Benton Test of Facial Recognition-short form (TFR; Benton et al., 1994) and the Visual Form Discrimination Task (VFDT; Benton et al., 1994) were used as measures of face and general visual perception, respectively (see Penn et al., 2000).

2.3.3. Emotion perception measures

The Face Emotion Identification Test (FEIT; Kerr and Neale, 1993) served as the primary measure of emotion perception in the study and integrated into the intervention procedures described above. The FEIT is a 19 item presentation of six different emotional states: happiness, sadness, anger, surprise, afraid, and ashamed (each image shown for 15 s) and has been widely used in schizophrenia research (Penn et al., 2000). Participants used a large button response box to select the emotional label they felt was correct. The Bell-Lysaker Emotion Recognition Test (BLERT; Bell et al., 1997) served as a measure of generalization and was administered at pre-test and follow-up only. The BLERT is a 21 item videotaped presentation of seven different emotional states: happiness, sadness, anger, fear, disgust, surprise, and no emotion (each image shown for 10 s). Participants circled the correct emotional label on an answer sheet. For both the FEIT and BLERT, higher scores reflect better emotion perception abilities.

2.3.4. Social functioning measure

Social functioning was assessed using the Social Behavior Scale (SBS; Wykes and Stuart, 1986), which was completed by a minimum of 2 staff members (from a pool of 6 available trained raters) at pre-test and follow-up. The SBS is a semi-structured interview completed by the researcher based on staff observations of 21 social behaviors. The SBS comprised four factors (social mixing, inappropriate behaviors, reduced activity, and personal hygiene; see Penn et al., 1995). For this study, we report data for the social mixing subscale as these items measure the ability to interact appropriately with others and to engage in meaningful social conversation and likely to be related to improved emotion perception (Combs et al., 2007). The social mixing scale contains 6 items which are rated on a scale of 0–4 and lower scores on the SBS indicate better social mixing (Penn et al., 1995). SBS scores were averaged across raters to account for fluctuations in observed behaviors. Both the treatment staff informants and researchers underwent training on the SBS prior to rating participants and showed good levels of inter-rater reliability (ICC's ICC's=.70+). To reduce the effect of rater drift and bias, 20% of SBS administrations were co-scored by one of the researchers (DC); feedback was provided for discrepant scores.

2.4. Procedures

A doctoral-level clinical psychology student administered the study protocol, which was approved by the relevant Institutional Review Boards (IRB). Participants with schizophrenia were recruited for the study by referral from treatment staff and admission diagnoses. Following informed consent, participants completed the demographic, clinical, diagnostic, and neuropsychological measures. Upon entry in the study, participants were randomized into one of the three intervention conditions (shaping, monetary reinforcement, or repeated practice). During the intervention, all participants completed the FEIT at pre-test, intervention, and post-test in a single session and completed the BLERT as well. At the one-week follow-up, participants completed the FEIT and BLERT for the final time. Staff raters completed the SBS at pre-test and follow-up.

3. Results

Prior to examining the intervention effects, we conducted a series of one-way ANOVA's on the neuropsychological, social, and clinical symptom scores to determine if the intervention groups differed on these measures at pre-test (see Table 2). Significant differences were treated as covariates in the primary analyses (corrected alpha level=.005 adjusted for number of comparisons). We found no significant differences on any of the measures. Specifically, the groups did not differ on the RBANS Total Score, F (2, 57)=.24, p=.78, η_p^2=.01, R-BANS Attention Index score, F (2, 57)=.60, p=.55, η_p^2=.02, Wechsler Test of Adult Reading, F (2, 27)=2.9, p=.07, η_p^2=.18, Benton Test of Facial Recognition, F (2, 57)=1.3, p=.27, η_p^2=.04, Benton Visual Form Discrimination Test, F(2, 57)=.95, p=.39, η_p^2=.03, Zigler–Glick Pre-Morbid Social Competence index, F (2, 34)=.45, p=.64, η_p^2=.02, BPRS total score, F (2, 54)=2.9, p=.14, η_p^2=.10, BPRS thought disorder subscale score, F(2, 56)=1.9, p=.15, η_p^2=.06, BPRS anergia subscale score, F (2, 55)=1.1, p=. 32, η_p^2=.04, or medication dosage in chlorpromazine equivalents, F (2, 57)=.83, p=.44, η_p^2=.02. Furthermore, we did not find any significant differences according to gender, (all t's<1) or ethnicity (All F's<1) on the pre-test FEIT, BLERT, or SBS social mixing subscale. Finally, there were no differences according to medication type (atypical vs. typical, all t's <1) or diagnostic classification (paranoid schizophrenia vs. non-paranoid schizophrenia, all t's<1) on the pre-test FEIT, BLERT, or SBS social mixing subscale. Thus, the groups appear to be relatively equivalent in terms of cognitive, pre-morbid social functioning, and symptom status before the intervention training.

Table 2
Summary of cognitive, social, and clinical scores by intervention condition

Variable	Shaping	Money	Repeated
Wechsler test of adult reading (0–50)	26.9 (11.5)	31.6 (8.5)	17.8 (13.3)
RBANS total score[a]	67.9 (12.4)	65.4 (14.6)	65.1 (14.0)
RBANS attention index[a]	77.0 (18.3)	71.1 (20.0)	70.9 (20.7)
Test of facial recognition (0–27)	21.2 (3.0)	20.6 (2.5)	19.8 (2.6)
Visual form discrimination test (0–32)	23.2 (7.4)	23.4 (7.7)	26.0 (5.9)
Pre-morbid social competence (0–10)	3.4 (2.0)	3.2 (2.0)	2.5 (2.2)
BPRS total score (24–168)	58.7 (14.4)	49.6 (10.4)	56.2 (11.1)
BPRS anergia (4–21)	9.1 (4.0)	7.6 (2.5)	9.0 (3.6)
BPRS Thought Disorder (4–28)	17.7 (5.4)	14.9 (5.2)	14.8 (4.9)
CPZ equivalents (mg/day)	697.9 (445.2)	543.5 (314.4)	697.2 (524.5)

Note. RBANS = Repeatable Battery for the Assessment of Neuropsychological Status; BPRS = Brief Psychiatric Rating Scale; CPZ = chlorpromazine equivalents (see Woods, 2003); [a] RBANS scores are standard scores (M = 100, SD = 10).

3.1. Intervention effects on emotion perception and social functioning

The primary statistical analyses focused on changes in emotion perception scores (FEIT and BLERT) and social behaviors (SBS social mixing) resulting from the intervention conditions. Thirteen participants (21%) out of 60 did not complete the one-week follow-up test due to being discharged from the hospital. However, there were no differences between those that completed the study and those that were lost at follow-up on the demographic, social, cognitive, or clinical symptom measures (all t's <1, *ns*). There were also no differential rates of attrition between the three intervention groups, χ^2 ($N=13$)=2.2, $p=.32$. To account for attrition, data for the FEIT and BLERT were analyzed using intention-to-treat procedures using last observation carried forward (Montori and Guyatt, 2001).

Intervention efficacy on the FEIT was examined using a mixed-factor ANOVA with Group as the between groups variable (Group: shaping, money, repeated practice) and Time as the within-subjects variable (Time: pre-test, intervention, post-test, and follow-up). Mean scores on the FEIT are presented in Table 3. There was a significant main effect for group, $F(2, 57)=26.7$, $p=.0001$, $\eta_p^2=.48$ and time, $F(3, 171)=3.5$, $p=.01$, $\eta_p^2=.06$. The simple effects of time using Sidak's test for post-hoc differences showed that participants in the attentional-shaping condition had a significant increase in FEIT at each time period scores from pre-test levels, $F(3, 17)=12.6$, $p=.0001$, $\eta_p^2=.69$, and the repeated practice group, $F(3, 17)=7.8$, $p=.002$, $\eta_p^2=.58$ showed a decrease in scores from pre-test to intervention; there was no change over time for the money condition, $F(3,17)=.48$, $p=.70$ $\eta_p^2=.07$. In addition, a significant Group X Time interaction effect was found, $F(6, 171)=15.3$, $p=.0001$, $\eta_p^2=.35$. To probe the interaction effect, simple effects of group at each time interval were analyzed. There were no significant difference on pre-test FEIT score, $F(2, 57)=.05$, $p=.94$, but there were significant differences were found on the FEIT at intervention, $F(2, 57)=52.3$, $p=.0001$, post-test, $F(2, 57)=26.7$, $p=.0001$, and follow-up, $F(2, 56)=36.1$, $p=.0001$. In all cases, the attentional-shaping group performed significantly better on the FEIT than both the monetary reinforcement and repeated practice group based on Sidak's test for post-hoc differences.

Intervention generalization to the BLERT was examined using a mixed factor ANOVA with Group as the between groups variable (Group: shaping, money, repeated practice) and Time as the within-subjects variable (Time: pre-test vs. follow-up). There was a significant main effect for group, $F(2, 56)=3.3$, $p=.04$, $\eta_p^2\eta_p^2=.10$, but no effect for time, $F(1, 56)=1.2$, $p=.26$, $\eta_p^2=.02$. There was a significant Group X Time interaction found, $F(2, 56)=3.2$, $p=.04$, $\eta_p^{2\,=}.10$. The simple effect of group at each time interval showed no differences on the BLERT scores at pre-test, $F(2, 56)=.85$, $p=.42$, but there was a significant difference in BLERT scores at one-week follow-up, $F(2,56)=5.8$, $p=.005$. Similar to the FEIT results, persons in the attentional-shaping group showed significantly higher BLERT total scores at follow-up compared to the monetary reinforcement and repeated practice groups based on Sidak's test for post-hoc differences (see Table 3 for BLERT mean scores). Finally, because some emotions on the BLERT, such as disgust and no emotion, were not part of the FEIT, we wanted to see if the interventions improved the recognition of these unique emotions (scores ranged from 0–6 for these emotional expressions). At follow-up, significant differences were found between the groups, $F(2, 56)=6.5$, $p=.003$. The attentional-shaping condition ($M=3.7$) showed higher scores for than the repeated practice condition, but not the monetary reinforcement condition ($M=3.1$) based on Sidak's test for post-hoc differences.

Intervention effects on social behaviors using the SBS social mixing subscale (data was included only if the participant had complete SBS ratings for both time

Table 3
Intervention effects on emotion perception and social behavior

Variable	Shaping	Money	Repeated
N	20	20	20
FEIT pre-test (0–19)	9.2 (3.4)	9.0 (4.1)	9.4 (1.9)
FEIT intervention (0–19)	13.7 (1.4) [a, b]	8.9 (2.2)	6.7 (2.6) [b]
FEIT post-test (0–19)	13.5 (1.7) [a, b]	8.8 (2.6)	8.4 (2.7)
FEIT follow-up (0–19)	13.7 (2.3) [a, b]	8.2 (2.4)	8.5 (2.0)
BLERT pre-test (0–21)	11.9 (4.1)	10.2 (3.4)	9.6 (4.6)
BLERT follow-up (0–21)	13.3 (3.6) [a]	10.0 (3.7)	9.3 (4.2)
SBS social mixing pre-test (0–24)	3.5 (2.4)	2.7 (2.7)	3.2 (2.2)
SBS social mixing follow-up (0–24)	1.3 (1.0)	2.8 (1.8)	3.9 (2.4)

Note. FEIT = Face Emotion Identification Task; BLERT = Bell-Lysaker Emotion Recognition Test; SBS = Social Behavior Scale.

[a] Significant post-hoc difference at $p<.05$ from money and repeated practice condition at same time interval (Group X Time interaction effect).

[b] Significant post-hoc difference from pre-test FEIT score at $p<.05$ (time effect).

periods; $n=35$) was examined using a mixed factor ANOVA with Group as the between group variable (Group: shaping, money, repeated practice) and Time as the within-subjects variable (Time: pre-test vs. follow-up). There was no main effect for group, $F(2, 32)=1.4$, $p=.22$, $\eta_p^2=.08$ or time, $F(1, 32)=.89$, $p=.35$, $\eta_p^2=.01$. There was a marginally significant trend for a Group X Time interaction, $F(2, 32)=2.7$, $p=.08$, $\eta_p^2=.14$, with persons in the attention-shaping condition showing better observer-rated social mixing at follow-up, but the difference was not found to be statistically significant (see Table 3 for SBS mean scores).

4. Discussion

Researchers have begun to look more closely at methods to improve emotion perception abilities in schizophrenia (Combs et al., 2007; Green et al., in press; Penn et al., 2007). If emotion perception can be reliably improved it may lead to better interpersonal relationships, social competence, and community functioning (Penn et al., 2001). In the present study, we developed a novel intervention that used attentional-shaping procedures to direct attention to the center of the face (eyes, nose, and mouth area) in order to possibly improve emotion perception. The study utilized a randomized controlled design (RCT) to provide data on intervention efficacy. Also, the intervention was theoretically-derived based on deficits in facial scanning found in schizophrenia. All participants underwent a neuropsychological, social, and symptom battery, but we did not find significant differences between the groups on these variables. Consequently, observed differences in emotion perception and social functioning are unlikely due to these confounds. Rather, they seem attributable to the novel treatment.

As expected, the attentional-shaping intervention showed improvements in FEIT scores over time (at intervention, post-test and one-week follow-up) Not only were their improvements over time, but the shaping intervention showed higher scores than both monetary reinforcement and repeated practice at each time interval as well. This finding is especially impressive given that the groups were relatively equivalent at pre-test on the FEIT. The attentional-shaping condition also led to higher total scores at follow-up on a second measure of emotion perception (BLERT) not used in the intervention. The improvement to unique emotional expressions such as disgust and no emotion on the BLERT was significant, but less impressive and suggests the intervention was stronger for emotions that were part of the training. The BLERT was chosen as a measure of generalization because it contains both visual and auditory cues and is considered a more ecologically valid measure of emotion perception (Bellack et al., 1996). There was no change in FEIT scores over time for the monetary reinforcement condition and the repeated practice scores actually showed a decrease in FEIT scores from pre-test to intervention, although monetary reinforcement has led to improved emotion perception scores in our earlier study (Penn and Combs, 2000). The lack of success for monetary reinforcement alone may be due to a lack of motivating incentives regarding the amount of money offered (10 cents for each correct answer) or perhaps the participants were distracted by the money and not attending to the facial expressions as in the attentional-shaping condition. Based on the results of the study, we speculate that the crucial factor may be drawing attention to salient facial features. Unfortunately, there was less evidence for improved social behaviors as a result of the intervention. The attentional-shaping condition produced a non-significant trend for more appropriate and frequent social interactions at follow-up based on blinded staff observational ratings. Given that the intervention was a one-time treatment it may be unrealistic to expect wide-spread changes in social functioning, but we are encouraged of the effects of this intervention.

The attentional-shaping intervention can be considered a compensatory type of intervention in which the person may be learning a strategy for recognizing emotions rather than restoring their attentional skills as in cognitive remediation (Bellack et al., 1999; Green et al., 2000; Van der Gaag et al., 2002). The possible function of the attentional prompts may be to quickly orient the person where to look and when the prompt fades from view, the person is looking at the most important areas of the face. Thus, the use of attentional prompts may provide the participant with better "data" upon which emotions can be recognized (Green et al., 2001). The repetitive shaping and strengthening of proper face viewing strategies may be why the intervention was successful in improving emotion perception.

As with any new intervention, continued research into refining and strengthening the methods is needed. There are three primary avenues for future research based on limitations of the current study. First, given the lack of clear improvement in social behaviors, it may be possible to increase the strength of the training by having the person complete the attentional-shaping condition several times a week or for longer periods of time. It is important to determine the correct "dose" or intensity of the treatment that may lead to more consistent changes in social functioning (Brekke et al., 2007; Medalia and Richardson, 2005). Currently, we are

enhancing the shaping intervention by adding more faces which will allow repeated administration of the intervention. Second, having longer-follow-up periods would provide additional data on the maintenance of the gains, and if, as we suggest, we are teaching the person a strategy for emotion perception the gains should be consistently maintained regardless of time duration. Thirdly, although the treatment is effective in modifying emotion perception, we do not know if there are actually any changes in visual scanning following the use of attentional-shaping. It is important to know if the shaping intervention normalizes visual scanning behavior for emotional expressions or directly activates areas of the brain involved in social cognition (e.g., amygdala, medial pre-frontal, superior temporal, and fusiform gyrus; Pinkham et al., 2003). If successful, the attentional prompt intervention could be easily incorporated into a computerized training program for improving emotion perception, or added to existing treatments to enhance their effectiveness. In closing, we hope that this study will further stimulate methods to enhance emotion perception as this skill impacts many areas of social functioning that are important in helping our clients recover from the effects of schizophrenia.

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Contributors

Dennis R. Combs served as the principal investigator (PI) for the study. David L. Penn and Michael R. Basso assisted with the study design, statistical analyses, and preparation of the manuscript. Aneta Tosheva, Jill Wanner, and Kristen Laib assisted with the study design, participant recruitment and tracking, staff training, and administration of the research protocol.

Conflict of interest

Dennis R. Combs and David L. Penn have received consulting funds from Johnson and Johnson Pharmaceutical Research Division.

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