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Communication Disturbances, Working Memory, and Emotion in People with Elevated Disorganized Schizotypy

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Abstract

This study examined whether people with elevated disorganized schizotypy would differ from control participants on characteristics associated with disorganization symptoms in schizophrenia and also whether disorganized schizotypy was associated with problems processing emotion. People with disorganized schizotypy ($n = 32$) exhibited greater communication disturbances (CD) than control participants ($n = 34$) for emotionally negative topics but not for positive topics. In addition, the disorganized group exhibited poorer performance on a working memory task but not on a psychometrically matched verbal intelligence task. In addition, poor working memory was associated with increased CD for negative topics and, after controlling for group differences in working memory, group differences in CD were not significant. Moreover, the disorganized group exhibited greater emotional ambivalence and ambivalence was associated with increased CD in the disorganized group. These results suggest that people with disorganized schizotypy exhibit some similar characteristics to people with schizophrenia who have disorganization symptoms and that disorganized schizotypy is also associated with poor emotion processing.

Keywords

schizotypy; disorganization; formal thought disorder; cognitive slippage; working memory; emotion

1. Introduction

Formal thought disorder, or communication disturbances (CD; Andreasen, 1982), is a common symptom of schizophrenia (Andreasen, 1979; Docherty et al., 1996; Kerns & Berenbaum, 2002) and CD has figured prominently in previous descriptions of people at-risk for schizophrenia (Bleuler, 1911/1950). For example, Hoch and Cattell (1959) described people with pseudoneurotic schizophrenia as having a disturbance of thought process (separate from thought content), including disturbances in goal-directed thought and thought continuity. In addition, Meehl posited that associative loosening or what he called cognitive slippage was the most dependable indicator of schizotypy (Meehl, 1964) and that it was a primary manifestation of a schizophrenia diathesis (Meehl, 1962, 1990). Moreover, previous research has found that relatives of people with schizophrenia exhibit increased CD (e.g., Docherty et al., 2004). Therefore, it appears that disorganized speech symptoms might reflect an increased risk for schizophrenia. However, few studies have examined the nature of increased disorganization symptoms in individuals with schizotypy who may be at-risk for schizophrenia, which we will

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refer to as disorganized schizotypy (Kerns, 2006; which has also been referred to as schizotypal disorganization; e.g., Moritz et al., 1999; Reynolds et al., 2000; Suhr & Spitznagel, 2001).

Schizotypy refers to traits that are similar to symptoms of schizophrenia but often in a less severe form (Chapman, Chapman, Raulin, & Edell, 1978; Meehl, 1962). Therefore, disorganized schizotypy refers to disorganized speech and behavior traits that are similar to the disorganization symptoms of schizophrenia (Kerns, 2006). In general, schizotypy traits are thought to reflect liability for schizophrenia (Meehl, 1962) and schizotypy research might provide evidence about the nature of liability for schizophrenia (Lenzenweger, 1999). Similarly, understanding the nature of schizotypy traits might contribute to an explanation for the development of schizophrenic symptoms. At the same time, schizotypy research does not involve some confounds present in research on people with schizophrenia (e.g., effects of antipsychotic medication; Oltmanns & Neale, 1980) and therefore can provide important converging evidence to research on schizophrenia. In addition, some schizophrenia symptoms such as CD can be time consuming to measure. Valid self-report questionnaire measures of disorganized schizotypy could have the potential to more easily identify people who might be at-risk for schizophrenia. Previous research suggests that the symptoms of schizophrenia and of schizotypy are multifaceted (Bannister, 1968; Kerns, 2006). The current research focused specifically on disorganized schizotypy.

There is some evidence that disorganized schizotypy might be a distinct facet of schizotypy. For example, a number of factor analytic studies have found evidence for a disorganization factor distinct from other facets of schizotypy (e.g., Reynolds et al., 2000). In particular, in a recent study involving confirmatory factor analysis, a three-factor model including disorganized, positive, and negative factors exhibited good overall model fit and fit statistically better than two-factor models that did not include a disorganization factor (Kerns, 2006). Moreover, in that study and in at least one other study, only disorganized schizotypy but not positive or negative schizotypy was associated with poor cognitive control task performance (Kerns, 2006; Moritz et al., 1999). Cognitive control refers to processes involved in carrying out goal-directed behavior in the face of conflict (Rougier et al., 2005) and poor cognitive control has been associated with disorganization symptoms in people with schizophrenia (e.g., Cohen et al., 1999; Kerns & Berenbaum, 2002). Hence, it appears that disorganized schizotypy might be a unique facet of schizotypy distinct from both positive and negative schizotypy. Nevertheless, few studies have examined the nature of disorganized schizotypy. In particular, it is unclear whether people with elevated disorganized schizotypy exhibit some of the same characteristics as people with schizophrenia who have increased disorganization symptoms.

In people with schizophrenia, CD is the most common disorganization symptom of schizophrenia (Andreasen et al., 1995). Moreover, CD is greater when people discuss emotionally negative topics than positive topics, with this pattern of results being labeled affective reactivity (Docherty & Hebert, 1997; Docherty et al., 1998). Therefore, it is expected that people with disorganized schizotypy would also exhibit increased CD, especially for emotionally negative topics. However, this has not been examined in previous research. It is true that on self-report questionnaires that people with elevated disorganized schizotypy report increased disorganized speech symptoms. However, given limits in the accuracy of self-report (Schwarz, 1999), it is important to examine whether people identified as exhibiting elevated disorganized schizotypy via self-reported questionnaire actually in fact exhibit increased behavioral disorganization (i.e., CD). This might be especially important for disorganized schizotypy because other traits and conditions associated with increased disorganization (e.g., frontal lobe damage) are associated with poor self-monitoring (Banich, 1997). Self-monitoring deficits might make questionnaire assessments of traits less reliable and valid (Schwarz, 1999). If questionnaire measures of disorganized schizotypy identify people with traits similar

to the disorganization symptoms of schizophrenia, then people with elevated disorganized schizotypy should exhibit increased CD, especially for negative emotional topics.

In people with schizophrenia, CD has been associated with poor cognitive control, both for emotionally neutral (Kerns & Berenbaum, 2002) and for emotionally negative speech (Burbridge & Barch, 2002). However, cognitive control is a broad construct involving multiple components (Rougier et al., 2005). CD has been strongly associated with at least one aspect of cognitive control, working memory (i.e., the temporary maintenance of information for ongoing processing; Cowan, 2005). In particular, two recent studies have found strong associations between poor N-Back working memory task performance in people with schizophrenia and increased CD (Kerns, 2007a; Kerns & Berenbaum, 2003). Moreover, it has been found that an experimental increase of working memory demands while someone is speaking can actually cause an increase of disorganized speech (Kerns, 2007b; Kerns & Berenbaum, 2003). However, previous research has not examined whether people with elevated disorganized schizotypy exhibit poor working memory task performance or whether their poor working memory is associated with their level of CD. If questionnaire measures of disorganized schizotypy identify people with characteristics similar to people with schizophrenia who have disorganization symptoms, then compared to control participants people with elevated disorganized schizotypy should exhibit poor N-Back working memory task performance which should also be associated with their increased level of CD.

In addition to examining whether people with elevated disorganized schizotypy differ from controls on characteristics associated with disorganization symptoms in people with schizophrenia, the current research also examined whether disorganized schizotypy was associated with emotional traits. In one previous study (Kerns, 2006), disorganized schizotypy has been found to be associated with increased emotional ambivalence. Ambivalence has been defined as reporting simultaneously conflicting emotions about something (Raulin & Brenner, 1993) and ambivalence has long been thought to be an important feature of schizophrenia (Bleuler, 1911/1950; Meehl, 1962). Importantly, conceptually ambivalence appears to be distinct from anhedonia, as anhedonia refers to a paucity of positive feelings whereas ambivalence refers to simultaneous positive and negative feelings. Consistent with this, in a confirmatory factor analysis (Kerns, 2006), ambivalence has been found to load on a factor involving problems identifying feelings and emotional confusion that was separate from a negative schizotypy factor (that included social anhedonia). At the same time, disorganized schizotypy has been found to be associated with ambivalence even after removing variance shared with anhedonia (Kerns, 2006). The current research further examined whether disorganized schizotypy was associated with increased ambivalence. In addition, the current research examined whether CD for negative topics in disorganized schizotypy was associated with increased ambivalence.

In this study, participants completed a speech task that allowed for the assessment of CD for both negative and positive speech topics. At the same time, the current study assessed performance on cognitive tasks and measured the level of emotion traits. The current research examined whether (a) an elevated disorganized schizotypy group identified through self-report questionnaire would exhibit increased CD, especially for emotionally negative material; (b) disorganized schizotypy would be associated with a specific deficit in working memory; (c) disorganized schizotypy would be associated with increased ambivalence; and (d) whether CD in disorganized schizotypy would be associated with poor working memory and/or with increased ambivalence.

2. Method

2.1. Participants

Participants were college students attending a large Midwestern public university who received credit for an Introduction to Psychology course for their participation. They were selected from among a group of students ($n = 2,081$) who participated in departmental mass testing sessions in which they completed 15 items from the Cognitive Slippage Scale, which was used as a measure of disorganized schizotypy (Kerns, 2006). Individuals who scored either 2 standard deviations above or 0.5 standard deviations below the mass testing same-sex gender mean were recruited for an individual testing session. At the individual testing session, participants completed the full version of the Cognitive Slippage Scale. Participants for this current study were selected based on their scores for the full version of the scale. Means and standard deviation cut-offs for the Cognitive Slippage Scale were based on data obtained from a previous large sample study (Kerns, 2006). This study received IRB approval and all participants gave written informed consent. Every subject who participated in an individual testing session completed the session, which lasted up to 2 hours.

There were 32 people in the disorganized schizotypy group (18 females and 14 males, mean age = 18.5, $SD = 1.1$; 29 Caucasian, 2 African-American, 1 Asian-American) who, following previous research (Chapman et al., 1994), scored at least 1.96 SD above the same-sex mean on the Cognitive Slippage Scale. There were 34 people in the control group (19 females and 15 males, mean age = 18.8, $SD = 1.3$; 30 Caucasian, 3 African-American, 1 Asian-American) who scored less than 0.5 SD above the mean on the Cognitive Slippage Scale, and on several other psychosis proneness scales (the Magical Ideation, Perceptual Aberration, and Social Anhedonia scales; Chapman et al., 1994).

2.2. Disorganized Schizotypy and Emotion Trait Questionnaires

Participants completed one measure of disorganized schizotypy, the Cognitive Slippage scale (Miers & Raulin, 1987), a 35-item true/false questionnaire that measures speech deficits and confused thinking (e.g., “I often find that people are puzzled by what I say.” “My thoughts are so vague and hazy that I wish I could just reach up and pull them into place.” “I can usually keep my thoughts going straight.” – reverse scored). Cronbach’s α in this study was .94. In previous research (Kerns, 2006), the Cognitive Slippage Scale has been found to be highly associated with another measure of disorganized schizotypy, the Odd Speech subscale of the Schizotypal Personality Questionnaire (Raine, 1991), but the Cognitive Slippage Scale has much higher reliability than the Odd Speech subscale. In addition, as expected the Cognitive Slippage Scale has been associated with poor cognitive control task performance (Gooding et al., 2001; Kerns, 2006).

Emotional ambivalence was measured with the Schizotypal Ambivalence Scale (Raulin, 1986; $\alpha = .82$), which consists of 19 true/false items (e.g., “My thoughts and feelings always seem to be contradictory.” “My feelings about my worth as a person are constantly changing back and forth.” “Love and hate tend to go together.”). Ambivalence has long been conjectured to be an important characteristic of people with schizophrenia (Raulin & Brenner, 1993). It is strongly related to decreased emotional clarity (i.e., problems identifying feelings, Kerns, 2006).

Importantly, previous research has found that a moderate association between disorganized schizotypy and increased neuroticism (Kerns, 2006). To examine whether results for ambivalence would be accounted for by the personality trait neuroticism, Neuroticism ($\alpha = .86$) was measured using the 10-item scale from the International Personality Item Pool (IPIP; Goldberg, 1999). The items reflect chronic negative affect and lack of emotional stability (e.g.,

“Get stressed out easily.” “Am relaxed most of the time.” – reverse scored). Responses are made with a 5-point scale indicating amount of agreement.

2.3. Speech Task and CD Assessment

In order to collect a speech sample with a structured interview where the interview included both negative and positive emotional speech topics, participants completed a modified version of the Autobiographical Memory Test (AMT; Williams & Broadbent, 1986). Participants were given a cue and asked to recall a specific memory that was related to that cue (“Tell me a specific memory about a time you were ...”). All participants provided memories that matched the emotional content of the cues. Participants were encouraged to speak for at least 45–60 seconds for each memory and were prompted to try to continue speaking when they spoke too little. Following research by Docherty and colleagues (e.g., Docherty & Hebert, 1997), participants first talked about a number of neutral topics (e.g., a time they were at a restaurant) to familiarize them with the task and with being tape recorded. Then, participants spoke about six negative memories in a row (sad, angry, clumsy, emotionally hurt, lonely, nervous; with all of these negative terms but sad and nervous being used in the original AMT; Williams & Broadbent, 1986). Then they spoke about six positive memories (happy, successful, safe, interested, pleasantly surprised, content). Positive memories were discussed last to insure that participants had at least returned to their baseline mood at the completion of the AMT. At the same time, having positive memories discussed last cannot account for an increase in disorganized speech for negative memories in people with disorganized schizotypy.

Speech was audiotaped and typed transcripts were made. Seven research assistants, using the same rating procedures as in previous research (Kerns, 2007b), rated the typed transcripts using the Communication Disturbances Index (CDI; Docherty, 1996; Docherty et al., 1996). The CDI rates the number of speech unclarities, with an unclarity being any speech passage in which the meaning is sufficiently unclear to impair the overall meaning of the speech passage. Interrater reliability in this study using an intraclass correlation (Shrout & Fleiss, 1979), treating the raters as random effects and the mean of the 7 raters as the unit of reliability was .94. Following Docherty and colleagues (Docherty et al., 1996; Docherty, 2005), CDI scores were corrected for total amount of speech; reported CDI scores are the number of speech unclarities per every 100 words of speech. Compared to two other studies in which control participants spoke in relatively open-ended speech contexts, mean CDI scores for control participants in the current study were within the range of these previous two studies (mean = 0.86 in Docherty et al., 1996 and mean = 0.34 in Kerns, 2007).

2.4. Cognitive Tasks

Participants completed one working memory task, the 3-Back. On this task, participants saw a series of single letters on a computer screen. For every letter, participants decided if it was the same or different from the letter they saw 3 letters previously. Each letter was preceded by a fixation cross for 0.5 sec. Each letter then appeared for 2 sec and was followed by a blank screen for 2.5 sec. Participants completed 3 blocks of 20 trials each. On 50% of the trials, the current letter was different from the letter presented 3 letters previously (i.e., negative trials). On half of these negative trials, the current letter was the same as the letter either 2 or 4 letters previously (i.e., ‘distraction trials’). Previous research has found that performance of these distraction trials increases prefrontal cortex activity and is strongly related to other cognitive control tasks (Gray et al., 2003). The dependent variable was overall accuracy for the 30 positive trials (i.e., current letter same as letter 3 letters previously) and the 15 distraction trials (i.e., excluding the 15 negative non-distraction trials).

To assess whether increased CD in people with disorganized schizotypy was due to a specific deficit in working memory or instead due to lower verbal intelligence, participants also

completed the Peabody Picture Vocabulary Test (PPVT), Third Edition, Form III-A (Dunn & Dunn, 1997), which has been used in hundreds of previous studies as a measure of verbal ability. On this task, participants see a set of four pictures. They are given a word and then select the one picture that is closest to the word. Overall, comparing the PPVT and the 3-Back in all participants, the PPVT was more reliable ($\alpha = .88$ vs. $.76$), had equal variance (0.0216 vs. 0.0203), and was at least as difficult (mean accuracy = $.60$ vs. $.69$). Therefore, if the 3-Back but not the PPVT is associated with disorganized schizotypy, then this is not likely due to either generalized poor cognitive performance or to poor verbal intelligence (Chapman & Chapman, 1973).

2.5. Procedure

Participants completed the study in the following order: questionnaire measures, AMT, 3-Back, and PPVT.

3. Results

3.1. Amount of CD on the Speech Task

CD was analyzed in a 2 (group: disorganized versus control) by 2 (valence: negative versus positive) ANOVA. As can be seen in Table 1 and in Figure 1, overall as expected there was a significant effect of valence, $F(1, 62) = 12.69, p < .01$, effect size $r = .41$ (for r as an effect size, see Rosenthal, 1991), as CD was greater for negative topics than for positive topics. In addition, there was a significant group by valence interaction, $F(1, 62) = 4.69, p < .05, r = .26$; as can be seen in Figure 1, the difference in CD between negative and positive conditions was larger in the disorganized group, $t(31) = 3.77, p < .01, r = .56$, than in the control group, $t(33) = 1.07, p = .29, r = .18$. Moreover, for the negative speech condition, the disorganized schizotypy group exhibited significantly greater CD than controls, $t(64) = 2.69, p < .01, r = .32$. In contrast, the disorganized schizotypy group did not differ from controls in amount of CD for positive topics, $t(64) = -0.28, p = .78, r = -.03$. In addition, there were no differences in amount of speech between the two groups in either speech condition, all p 's $> .47$.

3.2. Cognitive Task Performance and Emotion Traits

As can be seen in Table 1, the disorganized schizotypy group exhibited significantly poorer performance on the 3-Back working memory task than the controls, $t(64) = 2.31, p < .05, r = .28$. However, the groups did not differ in performance of the PPVT measure of verbal intelligence, $t(64) = 0.14, p = .89, r = .02$, with the two groups exhibiting virtually identical performance. This suggests that the association between disorganized schizotypy and poor working memory is not due to low verbal intelligence or to generalized poor task performance. In addition, as can be seen in Table 1, the disorganized schizotypy group exhibited significantly greater ambivalence, $t(64) = 8.57, p < .01, r = .73$, and neuroticism, $t(64) = 5.34, p < .01, r = .56$, than the control group.

3.3. Associations between Working Memory, Ambivalence, and CD

Next, it was examined whether either working memory or ambivalence were associated with CD in the negative speech condition. Within all participants (i.e., collapsing across the two groups), working memory was significantly associated with CD in the negative speech condition, $r = -.39, p < .01$. In contrast, ambivalence was not associated with amount of CD, $r = .08, p = .53$.

Next, in a hierarchical regression analysis, it was first examined whether group differences in working memory could account for the group difference in CD in the negative speech condition. As can be seen in Table 2, in the first regression analysis, or Step 1, three predictor variables

(working memory, ambivalence, and group) were included with amount of CD in the negative speech condition as the dependent variable. With group membership in the analysis, poor working memory performance still predicted amount of CD in the negative speech condition. In contrast, in Step 1 with working memory entered in the analysis, group membership no longer predicted amount of CD. We obtained similar results if we entered working memory first and then entered group membership in the model or vice versa. Hence, working memory added significantly to prediction of CD after having already entered group membership, but group membership did not add significantly to predicting CD after having already entered working memory.

Next, as can be seen in Table 2, in the second regression analysis or in Step 2, it was examined whether adding the interaction between ambivalence and group as a fourth predictor variable significantly increased prediction of CD in the negative speech condition. Hence, Step 2 examined whether the effect of emotional ambivalence on speech would be greater in the disorganized group than in the control group. In Step 2, the two-way interaction between ambivalence and group was significant. In the control group, ambivalence was associated with decreased CD, $r = -0.45$ (nonparametric Spearman's $\rho = -0.43$), $p < .01$. In contrast, in the disorganized group, ambivalence was associated with increased CD, $r = 0.67$ ($\rho = 0.64$), $p < .01$ (the interaction was still significant even with neuroticism in the analysis).

4. Discussion

This study examined whether people with elevated disorganized schizotypy would differ from control participants on characteristics associated with disorganization symptoms in schizophrenia and also whether disorganized schizotypy was associated with problems processing emotion. In this study, an elevated disorganized schizotypy group identified through self-report questionnaire exhibited increased CD, especially for emotionally negative material. In addition, people with disorganized schizotypy exhibited a specific deficit in working memory as they performed more poorly on the N-Back working memory task but not on a psychometrically matched verbal intelligence task. At the same time, people with disorganized schizotypy reported increased emotional ambivalence. Furthermore, CD for negative speech topics in disorganized schizotypy was associated with poor working memory and with increased ambivalence. Hence, this study found evidence that people with elevated disorganized schizotypy differ from control participants on characteristics associated with disorganization symptoms in schizophrenia and also that disorganized schizotypy is associated with problems processing emotion.

In this study, people with elevated disorganized schizotypy differed from controls on characteristics associated with disorganization symptoms in people with schizophrenia. As has been found for disorganization in schizophrenia (e.g., Docherty et al., 1998), people with elevated disorganized schizotypy exhibited increased CD specifically for negative emotional topics. In addition, as has been found for disorganization in schizophrenia, people with elevated disorganized schizotypy exhibited poor performance on a working memory task. Moreover, as found for disorganization in schizophrenia (Kerns & Berenbaum, 2003), poor working memory in disorganized schizotypy appears to be a specific and not a generalized cognitive deficit, as people with disorganized schizotypy did not perform poorly on a psychometrically matched measure of verbal intelligence. Furthermore, as has been found for disorganization in schizophrenia (e.g., Kerns, 2007a; Kerns & Berenbaum, 2003), poor working memory was associated with increased CD in disorganized schizotypy, with group differences in working memory seeming to account for significant group differences in CD. Hence, it appears that people with elevated disorganized schizotypy differ from control participants on some characteristics associated with disorganization symptoms in people with schizophrenia. Overall, these results further support the validity of disorganized schizotypy as a construct and

of the Cognitive Slippage Scale as a measure of disorganized schizotypy. This also suggests that future research on disorganized schizotypy could potentially help to complement and provide converging evidence to research on disorganization symptoms in people with schizophrenia.

In addition, consistent with previous research (Kerns, 2006), in this study people with elevated disorganized schizotypy reported increased emotional ambivalence. Ambivalence has long been thought to be a potentially important aspect of schizophrenia and schizotypy (Bleuler, 1911/1950; Meehl, 1962, 1990; Raulin & Brenner, 1993) and ambivalence has been strongly associated with decreased emotional clarity and problems identifying feelings (Kerns, 2006). The current results suggest that in addition to being associated with poor working memory that disorganized schizotypy is also associated with increased ambivalence and with decreased ability to identify emotions.

Furthermore, in people with disorganized schizotypy, ambivalence was associated with increased CD for negative topics. Hence, for people with disorganized schizotypy, it appears that people with high ambivalence became particularly disorganized when processing negative emotions. In contrast, for controls, ambivalence was negatively associated with amount of CD. This suggests that when talking about negative topics that control participants with higher levels of ambivalence were able to minimize the influence of negative emotions, perhaps by avoiding the most emotionally charged material or by increased monitoring of their speech when discussing negative topics. Therefore, overall, these results suggest that people with disorganized schizotypy, especially with high levels of ambivalence, might be less able than control participants to minimize the influence of negative emotions on their behavior.

The current results suggesting problems with emotion processing in disorganized schizotypy are consistent with some previous research on CD and emotion. For example, it has been found that increased CD for negative stimuli is associated with negative emotional arousal (Burbridge et al., 2005). In addition, in people with schizophrenia it has been found that increased physiological reactivity is associated with increased CD for negative topics (Docherty et al., 2001). One issue for future research might be to more directly examine whether in disorganized schizotypy there is an increased effect of emotion on cognition (Martin & Clore, 2001), or more specifically of emotion on working memory (e.g., Shackman et al., 2006).

There are several ways that future research could further examine the nature of disorganized schizotypy. One is to examine relatives of people with schizophrenia. Previous research has found that relatives of people with schizophrenia exhibit increased CD (e.g., Docherty et al., 2004). Moreover, relatives have also been found to exhibit poor performance on working memory tasks (Snitz et al., 2006). Future research could examine whether in relatives there is a relationship between increased disorganized schizotypy, CD, and poor working memory. Another way to examine the nature of disorganized schizotypy would be to examine whether people with schizophrenia who have increased disorganization symptoms have relatives with increased disorganized schizotypy.

Another way future research could examine disorganized schizotypy would be to use experimental speech tasks. For example, previous research has found that experimental manipulations of working memory demands during speech cause an increase in CD (Kerns & Berenbaum, 2003). Future research could examine whether manipulations of working memory demands during speech have a greater effect on people with disorganized schizotypy than on control participants. Moreover, given that experimental speech tasks can use pictures as speech stimuli (e.g., Kerns, 2007b), future research could use controlled emotional stimuli (e.g., IAPS slides; Lang et al., 2005) to further examine the influence of emotion on disorganized speech. For example, future research using IAPS slides could examine whether it is specifically

negatively valenced stimuli that increases communication disturbances or whether it is high arousal.

Another issue for future research is whether the association between disorganized schizotypy and increased CD is specific to disorganized schizotypy or whether other aspects of schizotypy also exhibit increased CD. The current research is the first study to our knowledge to examine disorganized speech in people with disorganized schizotypy. In some previous studies using the Rorschach, people with elevated positive schizotypy (specifically Perceptual Aberration) have been found to exhibit higher delta index scores (a forerunner of the Thought Disorder Index, TDI; Edell & Chapman, 1979) and higher TDI scores (Coleman et al., 1996). However, it has been argued that elevated scores on the TDI can reflect disturbances in speech content (e.g., discussion of unusual perceptions and unusual ideas; Berenbaum & Barch, 1995). Hence, it is possible that previous associations between positive schizotypy and Rorschach thought disorder measures might reflect discussion of unusual perceptions and ideas rather than increased speech disorganization (Andreasen, 1982). In any event, future research could examine whether people with elevated disorganized schizotypy exhibit greater CD than people with either positive or negative schizotypy.

One other issue for future research is to examine whether people with schizophrenia who have disorganization symptoms also exhibit poor emotion processing. For example, it is unknown whether disorganization in schizophrenia is associated with emotional ambivalence. On the other hand, there is some evidence that speech disorganization is associated with emotion in schizophrenia (e.g., increase in CD for negative topics; Burbridge & Barch, 2002). At the same time, inappropriate affect is also often considered a disorganization symptom (Andreasen et al., 1995). Future research could examine whether disorganization symptoms in people with schizophrenia are associated with emotion traits and perhaps also associated with an increased effect of emotion on cognitive task performance (Burbridge et al., 2005).

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Figure 1.

Amount of formal thought disorder as measured by the Communication Disturbances Index (CDI) for negative and positive speech topics for people with disorganized schizotypy and control participants.

Table 1
Means and Standard Deviations for Disorganized Schizotypy and Control Groups

Measure	Disorganized	Control	<i>p</i> -value
<i>Disorganized Schizotypy</i>			
Cognitive Slippage	26.6 (2.7)	5.2 (2.9)	< .01
<i>Communication Disturbances</i>			
Negative	0.78 (0.31)	0.61 (0.25)	< .01
Positive	0.53 (0.27)	0.55 (0.27)	.78
<i>Number of Words per Memory</i>			
Negative	131.2 (66.3)	144.8 (71.9)	.58
Positive	117.0 (54.1)	131.2 (66.3)	.95
<i>Cognitive Performance</i>			
3-Back Accuracy Proportion	0.65 (0.15)	0.73 (0.12)	< .05
PPVT Accuracy Proportion	0.60 (0.16)	0.60 (0.14)	.89
<i>Emotion Traits</i>			
Ambivalence (range 0–19)	11.5 (4.1)	3.90 (2.9)	< .01
Neuroticism (range 1–5)	3.66 (0.80)	2.59 (0.82)	< .01

Note. PPVT = Peabody Picture Vocabulary Test

Table 2

Summary of Hierarchical Regression Analyses for Variables Predicting Communication Disturbances for Negative Topics (N = 66)

Variables Entered	B	SE B	β	<i>p</i> -value
Step 1 ($R^2 = .12, p < .05$)				
Working Memory	-.12	.05	-.30	< .05
Ambivalence	.02	.07	.08	.56
Group (Disorganized versus Control)	.03	.12	.06	.64
Step 2 ($\Delta R^2 = .14, p < .01$)				
Working Memory	-.11	.05	-.25	< .05
Ambivalence	.03	.07	.10	.42
Group (Disorganized versus Control)	.02	.13	.04	.78
Ambivalence X Group	.35	.13	.74	< .01