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Towards an Understanding of Anticipatory Pleasure Deficits in Schizophrenia: Memory, Prospection, and Emotion Experience

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Abstract

Anticipatory pleasure deficits have been observed in people with schizophrenia. Less is known about the extent to which interrelated processes that comprise anticipatory pleasure, including memory, prospection and emotion experience are disrupted. We asked people with ($n=32$) and without ($n=29$) schizophrenia or schizoaffective disorder to provide memory and prospection narratives in response to specific cues. Half of the prospectations followed a memory task, and half followed a control task. People with schizophrenia generated memories similar in content and experience as controls even as they described them less clearly. However, people with schizophrenia were less likely to explicitly reference the past in their prospectations, and their prospectations were less detailed and richly experienced than controls, regardless of the task completed before prospectation. People with schizophrenia reported similar levels of positive emotion (current and predicted) in positive prospectations that followed the memory task, but less positive emotion than controls in positive prospectations that followed the control task. Taken together, these results suggest that people with schizophrenia experience difficulties drawing from past experiences and generating detailed prospectations. However, asking people with schizophrenia to recall and describe memories prior to prospectation may increase the likelihood of drawing from the past in prospectations and may help boost current and predicted pleasure.

General Scientific Summary—People with schizophrenia experience difficulty anticipating future pleasure. This study supports the notion that the “feeling” part of anticipatory pleasure is intact when people with schizophrenia are first asked to generate memories. Thus, recalling and describing positive memories before thinking about the future may help people with schizophrenia to *experience* greater anticipatory pleasure.

Keywords

Schizophrenia; Memory; Prospection; Emotion; Narratives

Much of the pleasure we experience in life occurs in anticipation of good things that have yet to come. Drawing from wide swaths of theory and research, we and others have argued that anticipatory pleasure involves a set of interrelated processes, including retrospection and memory (i.e., drawing upon our past experiences), prospection (i.e., simulating mental representations of what the future may look like), current pleasurable emotion experience

(i.e., feeling good now while we think about the future), and predicted pleasure experience (i.e., predicting how good we will feel when the future event actually happens; Gilbert & Wilson, 2007; Kring & Caponigro, 2010; Shacter & Addis, 2007). For example, consider anticipatory pleasure for a slice of apple pie: you may recall the last time you had that pie (i.e., memory), draw from this past experience when envisioning yourself eating pie in the future (i.e., prospection), feel good while thinking about a piece of future pie, and make a prediction about how good you will feel when you actually have the pie. Together, these processes comprise what we refer to as anticipatory pleasure.

A growing body of research indicates that people with schizophrenia have deficits in anticipatory pleasure, both with respect to current pleasure during anticipation and predicted future pleasure (see Kring & Caponigro, 2010; Kring & Elis, 2013 for reviews), even though people with schizophrenia do not exhibit emotion experience deficits in the presence of evocative materials (see Cohen & Minor, 2010; Kring & Moran, 2008 for meta-analysis and review). It may be the case that people with schizophrenia experience difficulties with these aspects of anticipatory pleasure because they are less able to draw from past experiences when prospecting about the future. Further, people with schizophrenia may have difficulty generating detailed and richly experienced prospectations about the future, which may in turn impact current and predicted pleasure. In the present study, we sought to extend our understanding of anticipatory pleasure deficits in schizophrenia by investigating processes that comprise anticipatory pleasure: memory, prospection, and emotion experience (current and predicted).

Memory and Prospection

Theory and research indicates that people's prospectations are related to and draw from personal (autobiographical) memories (see Buckner & Carroll, 2007; Schacter, Addis, & Buckner, 2007; Szpunar, 2010, for reviews). First, similar brain regions (a hippocampal-cortical network; Buckner & Carroll, 2007) are recruited when people think about their personal past and future (e.g., Addis, Wong, & Schacter, 2007; Botzung, Denkova, & Manning, 2008; Okuda et al., 2003; Szpunar, Watson, & McDermott, 2007). Second, people with lesions in hippocampal-cortical regions have trouble generating both memories and prospectations (Hassabis, Kumaran, Vann, & Maguire, 2007; Klein, Loftus, & Kihlstrom, 2002). Third, individual differences in the ways in which memories are recounted are similar to the ways in which people prospect. Finally, Schacter and Addis (2007) have theorized that prospectation requires a system that can "flexibly extract, recombine, and reassemble" details from past experiences (also see Schacter et al., 2007). Thus, prospectations should draw from and even explicitly reference the past (Addis, Pan, Vu, Laiser, & Schacter, 2009; Painter & Kring, 2015).

Other studies suggest that the extent to which memories and prospectations are related varies depending on whether or not they involve emotion. For example, Williams et al. (1996) found that people's positive and negative memories and prospectations were rated as less specific than their neutral memories and prospectations. D'Argembeau and Van der Linden (2004) found that participants rated their negative memories and prospectations as less vivid, less clear, and having less of a sense of (p)re-experiencing compared to their positive

memories and prospectations. Painter & Kring (2015) found that people's prospectations, but not memories, varied by emotion. In sum, memories and prospectations are related to one another, but the relationship between these two processes may vary depending upon emotion.

Memory and Schizophrenia

Several studies report autobiographical memory deficits in schizophrenia (e.g., Danion et al., 2005; McLeod, Wood, & Brewin, 2006; Ranganath, Minzenberg, & Ragland, 2008; Riutort, Cuervo, Danion, Peretti, & Pierre, 2003). Other studies suggest that people with schizophrenia do not have difficulties recalling autobiographical memories per se, but rather have trouble describing these memories clearly. For example, Raffard and colleagues (2010) found that people with schizophrenia did not differ from controls in the number of autobiographical memories recalled, but their descriptions of those memories were less coherent. Difficulties with recalling and describing autobiographical memories may also vary by emotional valence. Gruber and Kring (2008) found that people with schizophrenia recounted positive and negative emotion memories that were less linear, clearly presented, and relevant to the prompted emotion cue word than were the memories recounted by controls. Docherty and colleagues found that people with schizophrenia exhibit greater language disturbance when recounting stressful compared to non-stressful memories (Docherty, Hall, & Gordinier, 1998; Docherty & Hebert, 1997), suggesting that people with schizophrenia have difficulties in the way in which they talk about their emotional memories.

Together, these studies suggest that people with schizophrenia may have difficulties recalling and describing autobiographical memories, which may in turn impact other processes involved in anticipatory pleasure. However, presenting more specific or salient cues may boost recall and descriptive clarity of memories for people with schizophrenia. Indeed, Potheegadoo and colleagues (2014) used specific questions when asking about memories (e.g., "can you describe the sounds in your memory") and found that people with and without schizophrenia included comparable phenomenological details (e.g., sensory, temporal, contextual, emotional, cognitive) in their autobiographical memories. We thus reasoned that people with schizophrenia might provide equally detailed and richly experienced autobiographical memories as controls if they were prompted with specific rather than general cues.

Prospection and Schizophrenia

To our knowledge, only two studies have examined prospection in schizophrenia. Raffard and colleagues (2013) found that people with schizophrenia reported experiencing less sensory, self-referential, and other-referential experience from their positive and negative prospectations in response to emotional pictures compared to people without schizophrenia, and that their prospectations were rated as less specific. D'Argembeau, Raffard, and Van der Linden (2008) asked people with and without schizophrenia to generate memories and prospectations in response to cues depicting feelings in general, non-specific situations (e.g., "a situation in which you feel guilty about something," "a situation in which someone

smiled at you”). Consistent with Raffard & colleagues (2013), the prospecting (and memories) of people with schizophrenia were rated as less specific than those of controls. Moreover, people with schizophrenia provided fewer specific prospecting than specific memories, suggesting that the link between memory and prospecting may not be as strong for people with schizophrenia. Although the cues in these studies contained emotional stimuli (e.g., pictures, words, situations), the authors did not comprehensively assess emotion differences by including neutral comparison conditions; thus, it remains unclear whether prospecting vary by emotion in schizophrenia.

Together, these two studies suggest that people with schizophrenia have difficulty generating detailed and richly experienced prospecting. Because healthy people appear to spontaneously draw from their memories during prospecting (Painter & Kring, 2015), we reasoned that people with schizophrenia might have less difficulty with prospecting if they were first explicitly cued to recall and describe memories (compared to first describing routine task instructions). Further, to the extent that memory and prospecting are part of anticipatory pleasure, we reasoned that people with schizophrenia may be able to experience current and predicted pleasure similarly as do controls if they recall and describe positive memories before generating positive prospecting.

Present Study

Our primary aim was to examine whether people with schizophrenia exhibit difficulties in processes that comprise anticipatory pleasure (memory, prospecting, current, and predicted positive emotion). We also sought to examine whether deficits in current and predicted positive emotion might be minimized when memory is explicitly cued prior to prospecting. A secondary exploratory aim was to examine if memory and prospecting vary depending upon whether they are emotional, and if this varies by group.

We tested two hypotheses related to memory: (1a) Given known difficulties with autobiographical memory, people with schizophrenia will explicitly reference the past in their prospecting less frequently than controls; (1b) Given evidence that people with schizophrenia are better able to recall and describe autobiographical memories when they are given more specific cues, we hypothesized that people with schizophrenia will generate comparable content, clarity, and experience in their memories as controls when they are prompted with specific, salient cues.

We tested two hypotheses related to prospecting: (2a) To the extent that prospecting is associated with memory, both groups will generate more detailed, clearly rendered, and richly experienced prospecting when they first recall and describe memories compared to when they first describe routine task instructions; (2b) Yet, given deficits in autobiographical memory, people with schizophrenia will generate prospecting that are less detailed and richly experienced than controls regardless of whether they first recall and describe memories.

Finally, we tested two hypotheses related to positive emotion experience and positive prospecting: (3a) To the extent that memory is associated with prospecting, people with

schizophrenia will report comparable positive emotion experience (i.e., current and predicted) in their positive prospecting that are preceded by a memory task. That is, by first recalling and describing positive memories, people with schizophrenia may not exhibit deficits relative to controls in pleasurable feelings. (3b) Given prior research showing deficits in the feeling components of anticipatory pleasure, people with schizophrenia will report less positive emotion experience in their positive prospecting compared to controls when prospecting is preceded by describing routine task instructions.

Method

Participants

Thirty-two people with either schizophrenia ($n=20$) or schizoaffective disorder ($n=12$; not in a current mood episode) and twenty-nine people without schizophrenia recruited from community advertisement and referrals participated. Diagnoses were confirmed using the Structured Clinical Interview for DSM-IV (SCID-I/P; First, Spitzer, Gibbon, & Williams, 2002a), and the absence of diagnoses for the control group were confirmed using the SCID non-patient version (SCID-I/NP; First, Spitzer, Gibbon, & Williams, 2002b). Controls with family history of schizophrenia or bipolar disorder and more than two depressive episodes were not invited to participate. People who met any of the following exclusion criteria were not invited to participate: 1) IQ below 70 (Wechsler Test of Adult Reading; Wechsler, 2001); 2) history of severe head trauma, stroke or neurological disease; 3) current mood episode; and 4) SCID confirmed DSM-IV substance abuse within the last month or dependence within the last six months.

All but two people with schizophrenia were taking antipsychotic medications at clinically determined dosages, with 23 receiving atypical antipsychotics, four receiving typical antipsychotics, one receiving both types of antipsychotic medications, one receiving a norepinephrine dopamine reuptake inhibitor, and one receiving a mood stabilizing medication.

Procedure

Participants attended two sessions scheduled one week apart, completing clinical interviews during the first session. During both sessions, participants generated five prospecting narratives. To test our hypothesis about whether participants generated more detailed and richly experienced prospecting if they are prompted to recall and describe personal, autobiographical memories before prospecting, participants completed one of two tasks before each prospecting task: 1) memory task; 2) control task. Participants were randomly assigned to one of two orders such that half the participants completed the control task before the prospecting task during session one, and half completed the memory task before the prospecting task during session one.¹

Control task—Participants generated routine task instructions to help another person complete five commonly experienced activities (e.g., “Tell me each of the steps that Sally

¹Preliminary analyses revealed no order effects.

would need to take in order to get food from a vending machine;" complete cue list is available upon request). Each activity had five distinct steps. These activities were modeled and extended from the Wechsler Individual Achievement Test (Wechsler, 2009). The control task was designed to be similar in complexity and imaginative ability as the memory task, but differed in that it did not require participants to explicitly access personal memories or to generate a narrative story. Each control activity was scored based on the inclusion (or omission) of the five steps necessary to complete each task, with scores thus ranging from 0 – 5 per activity. Performance on the five activities were summed, providing a control task total score ranging from 0 – 25.

Memory and prospection tasks—The memory and prospection tasks followed a standardized interview protocol. The interview contained specific cues referencing common life experiences (e.g., a birthday, an argument; complete cue list is available upon request). We developed three matched cue lists, each containing five cues that varied by emotional valence (2 positive, 2 negative, 1 neutral). The lists were counterbalanced across the three narrative tasks (two prospection tasks, one memory task), so that each participant received each of the cue lists only once throughout the study.

Memory task: During one of the sessions (randomly assigned), participants generated five (2 positive, 2 negative, 1 neutral) memory narratives in response to specific cues. Participants were instructed to think about a specific event in the past that occurred at a particular time and place and lasted no longer than one day. They were then given a practice trial whereby they were asked to generate a narrative about "a specific time in the past you listened to music or the radio." Interviewers provided feedback on the practice trial (e.g., "Exactly, now do the same for the rest of the narratives" or "Good, but for the rest of this task please tell me about a *specific* time in the *past* you experienced the following events") and then began the memory task. For each cue, participants were prompted to "Picture a specific time in the past you [cue]. Tell me about it in as much detail as possible, as if you were telling me a story."

Prospection task: Participants completed the prospection task twice. During both sessions, participants generated five (2 positive, 2 negative, 1 neutral) prospection narratives in response to specific cues. The prospection task followed the control task in one session and the memory task in the other session (order was counterbalanced across participants). Participants were instructed to think about a specific event in the future that will occur at a particular time and place and last no longer than one day. They were then given a practice trial whereby they were asked to generate a narrative about "a specific time in the future you will listen to music or the radio." Participants received feedback as in the memory task and then began the prospection task. For each cue, participants were prompted to "Picture a specific time in the future you will [cue]. Tell me about it in as much detail as possible, as if you were telling me a story."

If participants did not generate a prospection narrative in response to the cue (e.g., they could not think of a future event or they talked about a past or current event), they were prompted with the cue again. If, after the second attempt, participants were unable to generate a prospection narrative, the interviewer went on to the next cue and the prospection

was considered missing. Fourteen prospection narratives (out of 320) from people with schizophrenia were missing, and one prospection narrative (out of 290) from controls was missing.

Narrative experience questionnaire: After participants completed a memory or prospection narrative, they rated their sensory and contextual experience of the narrated event using a 1 (none) to 7 (a lot) Likert scale. Consistent with previous studies (e.g., D'Argembeau & Van der Linden, 2004; 2006), participants were asked to rate the visual, sound, and smell/taste of the event (combined into a composite *sensory experience* index), as well as the clarity of location, spatial arrangement of objects, and spatial arrangement of people (combined into a composite *contextual experience* index). In addition, participants reported on their *current emotion experience*, *predicted emotion experience* (for prospection narratives), and *recalled emotion experience* (for memory narratives) on a 1 (positive) to 7 (negative) scale.

Narrative coding: Memory and prospection narratives were audio recorded, transcribed, and coded by trained research assistants. Variables from the two positive narratives and two negative narratives within each narrative task were averaged into a positive and negative composite score, respectively.²

To assess whether our cues conformed to our *a priori* valence designations, we counted the number of positive and negative emotion words in the transcribed narratives using the Linguistic Inquiry and Word Count (LIWC; Pennebaker, 2001) text analysis program. LIWC checked each word in a narrative against an internal dictionary of more than 2,300 words and word stems (406 positive emotion words and 499 negative emotion words).

To assess the content of memory and prospection narratives, we coded four variables: past reference, time/place, sociality, elaborative detail. To assess the manner in which the narratives were described, we coded one variable: clarity.

Past reference was rated dichotomously (present/absent) and coded only for prospection narratives. This variable assessed whether a prospection narrative included an explicit reference to a personal past experience. For example, a participant who stated, "My husband and I always cook dinner together on Friday nights, so I imagine that next Friday we will go to the grocery store, pick out the ingredients we'll need, and then go home and cook dinner together," is an example of an explicit past experience and thus was coded as containing a past reference. By contrast, "I've always wanted to go to Hawaii, so I hope to take a vacation with my family there in the next year," is not an explicit past experience and thus was not coded as containing a past reference.

Time/place measured whether the participant provided information about "when" (e.g., next week) and "where" (e.g., at my friend's house) the event took place. Memory and prospection narratives were coded for level of time/place on a 3-point scale (2 = inclusion of

²Prior to averaging the two positive narratives and two negative narratives into composite positive and negative scores for each condition, paired sample t-tests confirmed that individual positive and negative cues conformed to our *a priori* valence designation with respect to emotion words and reported emotion experience.

a time and place indicator, 1 = inclusion of either a time or place indicator, 0 = omission of a specific time and place indicator).

Sociality was rated on a 3-point scale (2 = active, 1 = passive, 0 = alone). A memory or prospection narrative was rated as “active” if it included an explicit and active social interaction. If the narrative included other people, but there was no active social engagement, the narrative was rated as “passive.”

Elaborative detail was rated on a 3-point scale (2 = elaborated, 1 = moderately elaborated, 0 = general) and measured the degree to which participants developed and expanded upon relevant information in order to create a comprehensive and detailed memory or prospection narrative. A rating of “elaborated” indicated that the narrative contained thorough and detailed descriptive information throughout the narrative; “moderately elaborated” indicated that the narrative included somewhat expanded and detailed descriptive information in some but not all of the narrative, and “general” indicated that the narrative was overly general and not very descriptive with respect to the essentials of the story.

Clarity was rated on a 3-point scale (2 = clear, 1 = moderately clear, 0 = unclear) and measured the participant’s ability to describe a memory or prospection narrative clearly and directly. A narrative was rated “clear” if it was organized and easy to understand, “moderately clear” if the narrative was relatively understandable, but at times the content was difficult to understand or follow, and “unclear” if the narrative was difficult to follow, disorganized, or unintelligible.

Clinical Ratings—For people with schizophrenia, we assessed general symptoms using the Brief Psychiatric Rating Scale (BPRS; Lukoff, Nuechterlein, & Ventura, 1986) and negative symptoms using the Clinical Assessment Interview for Negative Symptoms (CAINS; Kring, Gur, Blanchard, Horan, & Reise, 2013). The CAINS provides two negative symptom subscales, the Motivation and Pleasure (MAP) scale (range of scores: 0–36) and the Expression (EXP) scale (range of scores: 0–12), with higher scores indicating greater impairment. Means on the CAINS MAP and EXP scales (see Table 1) were comparable to those in the CAINS validation sample (Kring et al., 2013).

Data Analytic Plan

To test our hypotheses about memory and prospection, we used mixed effect ANOVAs with diagnostic group (Schizophrenia, Control) as a between subject factor and valence (positive, negative, neutral) and condition as within subjects factors. Depending upon the analysis, the condition factor had up to three levels: memory task; prospection task following the memory task; prospection task following the control task. Dependent variables included self-report (sensory experience, contextual experience, and current, predicted and recalled emotion experience) and coded (positive and negative emotion words, past reference, time/place, sociality, elaborative detail, clarity) variables. To test our hypotheses about current and predicted positive emotion experience and positive prospections, we used independent samples *t*-tests. In cases when sphericity was violated, we used the Huynh-Feldt correction for degrees of freedom when estimates of sphericity were greater than 0.75 and the Greenhouse-Geisser correction when estimates of sphericity were less than 0.75 (Girden,

1992). We examined planned comparisons of all pairwise valence combinations (positive vs. negative, negative vs. neutral, positive vs. neutral) using *Bonferroni* adjustment of significance level ($p = 0.017$) for multiple comparisons. Effect sizes are reported as partial eta squared (η^2).

Results

Demographic information and clinical ratings are reported in Table 1. Independent sample *t*-tests and chi-squared tests results revealed no differences between people with and without schizophrenia on any of the demographic variables.³

Preliminary Analyses

Rater agreement—Raters, blind to the diagnostic status of the participants, achieved high agreement for the narrative variables, with ICCs (Fleiss & Shrout, 1978; case 2 formula) ranging from 0.70 to 0.89. Given the good level of rater agreement, we collapsed scores across raters.

Emotion manipulation check—We evaluated whether our cues conformed to our *a priori* valence classification in two ways. First, we examined participants' reported *current* emotion experience following each narrative using a 2 (Group) X 3 (Condition) X 3 (Valence) mixed effect ANOVA. Only the valence main effect was significant ($F(1.71, 97.64) = 115.10, p < 0.01, \eta^2 = 0.67, 90\% \text{ CI } [0.57, 0.73]$). All follow-up pairwise comparisons were significant (p 's < 0.01); that is, for all participants, positive memories and prospectives were experienced more positively ($M = 2.34, SD = 0.99$) than negative and neutral; neutral memories and prospectives ($M = 2.91, SD = 0.98$) were experienced more positively than negative; and negative memories and prospectives ($M = 4.49, SD = 1.06$) were experienced more negatively than positive and neutral.

Second, we computed separate 2 (Group) X 3 (Condition) by 3 (Valence) mixed effect ANOVAs for the number of positive and negative emotion words in the narratives. For positive emotion words, the group main effect was significant ($F(1, 59) = 10.09, p < 0.01, \eta^2 = 0.15, 90\% \text{ CI } [0.04, 0.29]$) indicating that people with schizophrenia used fewer positive words across conditions and valence compared to controls. The valence main effect was also significant ($F(1.72, 101.40) = 81.02, p < 0.01, \eta^2 = 0.58, 90\% \text{ CI } [0.58, 0.74]$); all participants used more positive emotion words in positive narratives ($M = 4.20, SD = 1.32$) than in negative ($M = 2.42, SD = 0.80$) and neutral ($M = 2.50, SD = 0.96$) narratives (p 's < 0.01). For negative emotion words, only the valence main effect was significant ($F(1.45, 85.38) = 124.93, p < 0.01, \eta^2 = 0.68, 90\% \text{ CI } [0.58, 0.74]$) with all participants using more negative emotion words in negative narratives ($M = 1.89, SD = 0.80$) than in positive ($M = 0.53, SD = 0.31$) and neutral ($M = 0.59, SD = 0.43$) narratives (p 's < 0.01).

³We found two significant diagnostic group differences: people with schizoaffective disorder had more years of education ($t(30) = 2.83, p < 0.01$) and higher estimated IQ scores ($t(30) = 2.31, p < 0.03$) than people with schizophrenia. However, these two variables were not significantly correlated with any other study variables. We also found one significant sex difference: men with schizophrenia scored higher on the CAINS EXP scale than women with schizophrenia group ($t(30) = 3.43, p < 0.01$).

Word count—We examined whether people with and without schizophrenia differed in the number of words provided in narratives by conducting a 2 (Group) X 3 (Condition) X 3 (Valence) mixed effect ANOVA. Neither the group main effect nor any interaction with group was significant, consistent with other narrative studies (e.g., Gruber & Kring, 2008). Further, neither the valence main effect nor any interaction with valence was significant (positive: $M = 235.64$, $SD = 138.75$; negative: $M = 251.98$, $SD = 167.86$; neutral: $M = 258.75$, $SD = 162.72$). However, the condition main effect was significant ($F(1.73, 102.39) = 11.16$, $p < 0.01$, $\eta^2 = 0.16$, 90% CI [0.06, 0.26]), with follow-up analyses indicating that all participants' memory narratives ($M = 312.75$, $SD = 224.02$) contained more words than prospection narratives ($M = 216.82$, $SD = 130.39$), consistent with previous studies (e.g., Painter & Kring, 2015).

Control Task—To examine whether people with and without schizophrenia differed in describing routine task instructions, we examined the effect of group on the total number of steps included across the five control task activities. We found no difference between people with ($M = 19.66$, $SD = 4.37$) and without ($M = 21.31$, $SD = 3.78$) schizophrenia on the control task. Thus, people with and without schizophrenia were equally proficient at providing step-by-step instructions to help another person complete five routine tasks.

Past Reference in Prospections

To test our first hypothesis regarding memory—that people with schizophrenia would explicitly reference the past in their prospections less frequently than controls—we conducted a 2 (Group) X 2 (Condition: prospection following memory task; prospection following control task) X 3 (Valence) mixed effects ANOVA. Consistent with our hypothesis, we found a significant group main effect ($F(1, 57) = 4.26$, $p < 0.05$, $\eta^2 = 0.07$, 90% CI [0.00, 0.19]), indicating that people with schizophrenia explicitly referenced the past less frequently than controls in their prospections, whether preceded by the control task or the memory task. We also found a significant condition main effect ($F(1, 57) = 16.31$, $p < 0.01$, $\eta^2 = 0.22$, 90% CI [0.08, 0.36]), indicating that both groups explicitly referenced the past more frequently when their prospections followed the memory task. Thus, even though people with schizophrenia explicitly referenced the past in their prospections less frequently than controls overall, they nevertheless did so more frequently when they first recounted memories.

Content, Clarity, and Experience in Memories

We examined whether people with and without schizophrenia differed in the content, clarity, and experience of memories using separate 2 (Group) X 3 (Valence) mixed effect ANOVAs (see Table 2). Consistent with our second hypothesis about memory, these analyses revealed no interactions with group for coded content or reported experience. That is, people with schizophrenia generated memories with comparable content (time/place indicators, sociality, elaborative detail) and experience (reported sensory and contextual experience) as did people without schizophrenia when memories were prompted with specific cues. However, we found a significant group main effect for clarity ($F(1, 59) = 5.47$, $p < 0.02$, $\eta^2 = 0.09$, 90% CI [0.01, 0.21]). Despite providing specific cues, people with schizophrenia described their memories less clearly than controls.

With respect to our secondary exploratory aim to examine the role of emotion, we found significant valence main effects for sociality ($F(1.70, 100.05) = 4.12, p < 0.03, \eta^2 = 0.07$, 90% CI [0.01, 0.15]) and reported sensory experience ($F(2, 118) = 13.12, p < 0.01, \eta^2 = 0.18$, 90% CI [0.08, 0.27]). Pairwise comparisons indicated that all participants' negative memory narratives were coded as more social than either their positive or neutral memory narratives (p 's < 0.05). In addition, all participants reported experiencing fewer sensory details in their negative memories than their positive or neutral memories (p 's < 0.05). That we found no significant Group X Valence interactions suggests that the content, clarity, and experience of memories varied by emotion in similar ways for people with and without schizophrenia.

Content, Clarity, and Experience in Prospections

To test our hypotheses about prospections, we conducted separate 2 (Group) X 2 (Condition: prospection following memory task; prospection following control task) X 3 (Valence) ANOVAs for content, clarity, and experience variables (see Table 2).

Inconsistent with our first prospection hypothesis, we found no significant condition main effects or interactions with condition for content (time/place, sociality, elaborative detail) or reported experience (sensory, context) variables. Thus, generating and talking about memories prior to prospection was not associated with more detailed prospection content or experience for either group. However, we found a significant condition main effect for clarity, ($F(1, 57) = 3.87, p < 0.05, \eta^2 = 0.06$, 90% CI [0.04, 0.18]). Contrary to expectations, all participants generated prospections with *less* clarity after the memory task than after the control task.

Consistent with our second prospection hypothesis, we found two significant group main effects (see Figures 1 and 2). People with schizophrenia included fewer time and place indicators ($F(1, 57) = 4.09, p < 0.05, \eta^2 = 0.07$, 90% CI [0.01, 0.19]), and reported less sensory experience ($F(1, 59) = 8.60, p < 0.01, \eta^2 = 0.13$, 90% CI [0.02, 0.26]) compared to controls.

Relevant to our secondary exploratory aim regarding emotion, we found four significant valence main effects: time/place ($F(1.89, 107.49) = 26.43, p < 0.01, \eta^2 = 0.32$, 90% CI [0.19, 0.41]), elaborative detail ($F(1.85, 105.59) = 5.58, p < 0.01, \eta^2 = 0.09$, 90% CI [0.02, 0.17]), reported sensory experience ($F(2, 118) = 45.92, p < 0.01, \eta^2 = 0.44$, 90% CI [0.32, 0.52]), and reported context experience ($F(2, 118) = 9.88, p < 0.01, \eta^2 = 0.14$, 90% CI [0.05, 0.23]). Follow-up tests indicated that all participants' negative prospections included fewer time/place indicators, less elaborative detail, less sensory experience, and less context experience than their positive and neutral prospections (p 's < 0.01). Notably, these valence differences were observed for both groups and regardless of whether the prospections followed the control task or the memory task.

We also found a significant Group X Emotion interaction for clarity ($F(2, 114) = 3.54, p < 0.03, \eta^2 = 0.06$, 90% CI [0.01, 0.13]). People with schizophrenia recounted less clear prospections than controls, but this was true for negative prospections only ($t(59) = 2.72, p < 0.01, \eta^2 = 0.11$, 90% CI [0.02, 0.24]).

Emotion Experience and Positive Prospections

Consistent with our first hypothesis that people with schizophrenia would not exhibit deficits in experienced positive emotion following positive prospections that were preceded by the memory task, we found no group differences in current or predicted positive emotion experience. Stated differently, people with schizophrenia experienced comparable positive emotion following their positive prospections if they first recalled and described memories.

Consistent with our second hypothesis that the groups would differ in experienced positive emotion following positive prospections that were preceded by the control task, we found that people with schizophrenia reported less current positive emotion ($t(59) = 2.04$, $p < 0.05$, $\eta^2 = 0.07$, 90% CI [0.00, 0.18]) and predicted less positive emotion ($t(59) = 2.20$, $p < 0.03$, $\eta^2 = 0.08$, 90% CI [0.00, 0.20]). Although not central to our conceptualization of anticipatory pleasure, we also assessed whether people with and without schizophrenia differed in the use of positive emotion words in prospections that were preceded by the control task. Consistent with our findings for current and predicted emotion experience, people with schizophrenia included fewer positive emotion words ($t(59) = 2.80$, $p < 0.01$, $\eta^2 = 0.12$, 90% CI [0.02, 0.25]) than controls in positive prospections that were preceded by the control task.

Discussion

We sought to examine three interrelated processes that comprise anticipatory pleasure: memory, prospection, and emotion experience. We found that when prompted with specific cues, people with schizophrenia were able to recall and describe personal memories regardless of emotional valence, albeit less clearly. Nevertheless, people with schizophrenia were less likely than controls to explicitly refer to their memories when prospecting, and this may have contributed to our observation that people with schizophrenia generated prospections that were, in some ways, less detailed and richly experienced compared to controls. Interestingly, people with schizophrenia reported comparable current and predicted positive emotion in their positive prospections as did controls, but only when they first recalled and described positive memories. Taken together, these results suggest that even though people with schizophrenia were less likely to reference the past in their prospections, and their prospections were somewhat less detailed than controls, the “feeling” part of anticipatory pleasure was intact when they were first asked to generate memories. Thus, recalling and describing positive memories before prospection may help people with schizophrenia to *experience* greater anticipatory pleasure. We consider each of these findings in turn, with an eye toward integration with previous literature and discussion of future directions.

Memories

Based on research showing that people with schizophrenia have difficulty recalling and describing autobiographical memories, we hypothesized and found that people with schizophrenia referenced the past less frequently in their prospections compared to controls. However, we also found that both groups were more likely to explicitly reference the past in their prospections when they first recalled and described their memories. Together, these

findings suggest that there may be some benefit gained from talking about personal memories before prospection for people with schizophrenia insofar as it may prompt people to draw from their past while prospecting. Given that prior theory and research indicates that prospecting is created by flexibly recombining fragments of past experiences (Schacter et al., 2007), prompting people to first recall memories may in turn populate prospecting with such fragments from the past.

It is worth emphasizing that we only coded explicit references to the past. However, a participant may have nevertheless referenced the past in a more indirect, less explicit manner. For example, a person might state: "I'll go to Olive Garden for my next birthday." In this example, there is no explicit reference to visiting Olive Garden in the past and thus, it would not have been coded as such even if the person had indeed visited this restaurant. Our fairly conservative approach to measuring past references may have thus underestimated how often people draw from the past when prospecting. Future research could extend work in this area by more thoroughly assessing if and how past experiences are integrated into prospecting. For example, it might be fruitful to conduct follow-up interviews to ascertain whether participants previously experienced what they described in their prospecting.

Although people with schizophrenia explicitly referenced the past less frequently in their prospecting than controls, their memories contained similarly detailed content and comparable experience in response to specific, salient event cues. Further, memories varied by emotion in similar ways for people with and without schizophrenia. That is, both groups included greater social engagement, yet reported less sensory experience in their negative memories compared to positive memories. Consistent with previous autobiographical memory and narrative studies (Gruber & Kring, 2008; Raffard et al., 2010), however, the manner in which people with schizophrenia talked about personal memories was less clear. Taken together, these findings suggest that although people with schizophrenia are able to generate detailed and richly experienced memories no matter the valence, they are less likely to draw from these experiences during prospecting, which may contribute to anticipatory pleasure deficits.

At first glance, our results may seem inconsistent with other studies showing autobiographical memory deficits in schizophrenia (e.g., Danion et al., 2005; McLeod et al., 2006; Ranganath et al., 2008; Riutort et al., 2003). Methodological differences may help to explain these discrepant findings. First, we assessed different aspects of memories, including the content (i.e., time and place, sociality, elaborative detail), clarity, and experience (i.e., reported sensory and content experience). By contrast, other studies have assessed conscious recollection (i.e., "remember," "know," guess"; e.g., Danion et al., 2005) or specificity (e.g., Riutort et al., 2003). Second, we prompted participants with specific cues (e.g., an argument), instead of general cues with open-ended time frames (e.g., a time in childhood) or broad categories (e.g., family), which may have elicited responses more consistent with the domains we coded. These differences make direct comparisons of our results with studies using standardized autobiographical memory tasks or different coding schemes difficult. Nonetheless, our findings suggest that when provided with specific and salient cues, people with schizophrenia can recall and describe memories with comparable content and experience as controls.

Prospections

Given the relationship between memory and prospection in healthy people, we reasoned that participants might provide more detailed and richly experienced prospections following a memory task because they are explicitly cued to recall past experiences. Inconsistent with our hypothesis, we found no differences in the content or experience of prospections that followed a control task compared to those that followed a memory task for either group. In some ways, it is not surprising that the task completed before prospection didn't influence the content or experience of controls' prospections given that they were more likely to reference the past in both conditions than people with schizophrenia. In other words, controls likely did not need the memory task to "prime" them to draw from the past in their prospections. Nonetheless, these results suggest that explicitly prompting the generation of memories before prospection does not elicit more detailed or richly experienced prospections for people with schizophrenia.

Regardless of the task that preceded prospection, people with schizophrenia were less likely to include when and where future events would occur, and they experienced fewer sensory details when prospecting than controls. Importantly, the prospections of people with and without schizophrenia did not differ in word count so our observed differences in prospections can't be accounted for by less speech output. Furthermore, people with schizophrenia did not differ from controls in memory narratives, and thus it seems unlikely that group differences in prospection are better accounted for by language impairments. Instead, these findings suggest that the link between memory and prospection may not be as strong for people with schizophrenia, which may in turn impact anticipatory pleasure.

Interestingly, the prospections of people with schizophrenia did not differ from controls in sociality. Given that social functioning difficulties (e.g., Hooley, 2010) and diminished frequency and desire for close relationships (i.e., asociality; Kirkpatrick, Fenton, Carpenter, & Marder, 2006) are well documented in schizophrenia, it was surprising to find that people with schizophrenia were equally as likely to include others in their prospections as controls. Although we measured the degree of social interaction in narratives (active, passive, or none), assessing the quality of relationships that are included in prospections could further inform our understanding of asociality. That is, although people with schizophrenia were equally likely to mention other people in their prospections, they may prospect about less meaningful social relationships than controls. As a result, they may anticipate less pleasure because they don't feel close or connected with the people included in their prospections and, thus, may be less likely to desire, initiate, or engage in future social experiences.

Like our findings for memories, prospections varied by emotion in comparable ways for people with and without schizophrenia (with one exception). Specifically, we found that negative prospections differed from positive and neutral prospections for both groups. These findings are consistent with prior research with healthy people (D'Argembeau & Van der Linden, 2004; Painter & Kring, 2015) and may reflect a type of emotion regulation strategy (Rasmussen & Berntsen, 2013; Painter & Kring, 2015). That is, describing less detailed and richly experienced negative prospections may reflect a type of avoidance to keep distress associated with thinking about possible future negative events (e.g., worry, hopelessness) at bay.

Interestingly, we observed that people with schizophrenia generated less clear negative (but not positive and neutral) prospecting than did controls. This finding is consistent with studies reporting impairments in narrating about stressful or negative events (Docherty et al., 1998; Docherty & Hebert, 1997). Thus, our findings extend this literature, showing that people with schizophrenia exhibit less clarity in negative prospecting compared to people without schizophrenia. To the extent that describing less detailed and richly experienced negative prospecting reflects an emotion regulation strategy, people with schizophrenia may be less proficient in using this strategy as they described their negative prospecting less clearly.

Linkages to Current and Predicted Pleasure

We reasoned that participants may report greater current and predicted positive emotion if they are prompted to recall and describe positive memories prior to prospecting. Based on our time course model (Kring & Caponigro, 2010), we assessed both current positive emotion while anticipating future events and predicted positive emotion for the future events. Consistent with our hypothesis, we found that people with schizophrenia reported comparable current and predicted positive emotion as controls, but only when they first recalled and described positive memories. However, without the prior prompting of memories, people with schizophrenia reported less current and predicted positive emotion than controls (consistent with previous studies; see Kring & Caponigro, 2010; Kring & Elis, 2013 for reviews). It is also worth noting that people with schizophrenia included a similar number of positive emotion words as controls in positive prospecting preceded by the memory task, but fewer positive emotion words in prospecting preceded by the control task.

Together, these findings suggest that recalling and describing the past prior to prospecting may provide a boost to current and predicted pleasure. Further, even though the prospecting of people with schizophrenia were less detailed and richly experienced than controls', the emotion experience component of anticipatory pleasure was intact when memories were first recalled and described. Thus, an intervention that asks people to recall and describe memories before prospecting may help people with schizophrenia anticipate future pleasure. It remains to be tested, however, whether people with schizophrenia would experience current and predicted pleasure comparable to controls if their prospecting were more detailed (e.g., through training to prospect in greater detail), even without recalling and describing positive memories first.

Studies examining reward processing and motivated behavior in schizophrenia provide evidence for impairments in the neural correlates of anticipatory pleasure (e.g., ventral striatum; see Kring & Barch, 2014; Strauss, Waltz, & Gold, 2014 for reviews), even in people who are not taking antidopaminergic medications. To the extent that current and predicted emotion experience reflects reward value, our findings suggest that when prompted with specific and salient cues to recall personal memories, people with schizophrenia are able to generate value representations that are comparable to controls. Future studies will need to assess the neural correlates of anticipatory pleasure as well as the linkage between current and predicted pleasure and effort to engage in future pleasurable events. Of note, Gard et al (2007) found that the anticipatory pleasure deficit in daily life

(i.e., predicted pleasure for future events) was greater for goal directed activities. These findings along with our current results suggest, albeit speculatively, that aspects of the neural circuitry that support anticipatory pleasure are intact.

As with any study, there are important limitations to acknowledge. First, our sample sizes were relatively small. Second, we investigated only a subset of potential processes comprising anticipatory pleasure (i.e., memory, prospection, emotion experience). Other processes, such as defeatist beliefs (Grant & Beck, 2009) and difficulties with reward processing (Strauss et al., 2014) may well be related to anticipatory pleasure deficits (Kring & Barch, 2014). Third, several people with schizophrenia were receiving more than one medication, and overall, there was considerable variability in the combination of medications prescribed. Regardless of medication types, the possibility of medication effects cannot be ruled out. Finally, while we coded for several domains, we did not include others (e.g., personal importance, feelings of (p)re-experiencing, time since/until event).

To conclude, we investigated three processes that comprise anticipatory pleasure: memory, prospection, and emotion experience. While the ability to recall and describe memories in response to specific and salient cues was largely intact, our findings suggest two areas of difficulty in schizophrenia. First, people with schizophrenia were less likely to draw from the past when prospecting. Second, the prospecting of people with schizophrenia were, in some ways, less detailed and richly experienced than people without schizophrenia. Nonetheless, when people with schizophrenia recalled and described positive memories prior to prospection, they experienced and predicted comparable positive emotion.

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Figure 1.

Mean time/place scores as a function of prospection (collapsed across condition: past/future, control/future) and valence (positive, negative, neutral) for people with (SZ) and without (CT) schizophrenia. People with schizophrenia provided fewer time and place indicators in their prospectations than controls, overall ($p < 0.01$). However, both groups provided fewer time and place indicators in their negative prospectations than positive and neutral prospectations (p 's < 0.01).

Figure 2.

Mean reported sensory experience following prospection (collapsed across condition: past/future, control/future) and valence (positive, negative, neutral) for people with (SZ) and without (CT) schizophrenia. People with schizophrenia reported less sensory experience in their prospections than controls, overall ($p < 0.01$). However, both groups reported less sensory experience in their negative prospections than positive and neutral prospections (p 's < 0.01).

Table 1

Demographic And Clinical Variables

	Schizophrenia	Control	<i>p</i> -value
Sex (M/F)	17/15	16/13	0.87
Diagnosis (SZ/ SA)	20/12	--	
Age	48.56 (10.25)	47.59 (10.53)	0.72
Years of Education	15.19 (2.97)	15.88 (2.21)	0.31
WTAR	104.19 (12.95)	105.03 (9.81)	0.78
Ethnicity (n)			0.90
African American	6	8	
Asian American	5	4	
Caucasian	15	11	
Hispanic/Latino	3	4	
Other	2	2	
Number of hospitalizations	6.44 (4.87)	--	
BPRS total score	42.34 (11.06)	--	
CAINS MAP	14.94 (4.91)	--	
CAINS EXP	4.91 (3.19)	--	

Note. Tabled values are means with standard deviations in parentheses unless otherwise noted.

M=male; F=female; SZ=schizophrenia; SA=schizoaffective disorder; WTAR=Wechsler Test of Adult Reading, BPRS=Brief Psychotic Rating Scale; CAINS=Clinical Assessment Inventory for Negative Symptoms; MAP=Motivation and Pleasure; EXP=Expression.

Table 2
Descriptive Statistics for Coded And Self-Reported Memory And Prospection Variables

	Schizophrenia (SZ)				Control (CT)				Significant Comparison(s)
	Memory	Past/ Prospection	Control/ Prospection	Memory	Past/ Prospection	Control/ Prospection	Control/ Prospection	Control/ Prospection	
Time/Place									
Positive	1.16 (0.51)	1.12 (0.49)	1.27 (0.50)	1.48 (0.43)	1.38 (0.53)	1.47 (.048)		• Group: SZ < CT	
Negative	1.25 (0.81)	0.78 (0.39)	0.83 (0.62)	1.29 (0.59)	0.86 (0.53)	0.78 (0.43)		• Valence: negative < positive, neutral	
Neutral	1.25 (0.62)	1.23 (0.63)	1.13 (0.78)	1.48 (0.69)	1.52 (0.57)	1.28 (0.70)			
Sociality									
Positive	1.30 (0.68)	1.38 (0.57)	1.15 (0.68)	1.66 (0.40)	1.40 (0.62)	1.45 (0.60)		• Valence: negative > positive, neutral	
Negative	1.67 (0.59)	1.18 (0.70)	1.38 (0.45)	1.78 (0.37)	1.24 (0.58)	1.43 (0.56)			
Neutral	1.34 (1.29)	1.00 (0.91)	1.20 (0.89)	1.41 (0.82)	1.31 (0.93)	1.28 (0.96)			
Elaboration									
Positive	1.25 (0.68)	0.75 (0.54)	0.80 (0.67)	1.47 (0.52)	0.93 (0.62)	1.05 (0.71)		• Valence: negative < positive, neutral	
Negative	1.16 (0.76)	0.63 (0.63)	0.67 (0.58)	1.33 (0.64)	0.69 (0.57)	0.81 (0.71)			
Neutral	1.06 (0.91)	0.70 (0.70)	0.77 (0.77)	1.31 (0.66)	0.86 (0.64)	0.90 (0.77)			
Clarity									
Positive	1.91 (0.20)	1.85 (0.30)	1.93 (0.22)	1.97 (0.13)	1.93 (0.22)	1.98 (0.09)		• Group: SZ < CT	
Negative	1.84 (0.30)	1.78 (0.49)	1.87 (0.22)	2.00 (0.00)	1.97 (0.26)	1.98 (0.09)		• Prospection	
Neutral	1.84 (0.45)	1.93 (0.25)	1.93 (0.25)	2.00 (0.00)	1.93 (0.26)	1.97 (0.19)		• Condition: Control/Prospection > Past/Prospection	
								• Group X Valence: SZ < CT negative only	
Sensory									
Positive	4.24 (1.56)	4.37 (1.35)	3.89 (1.57)	4.78 (1.29)	4.75 (1.27)	5.17 (1.20)		• Valence: negative < positive, neutral	
Negative	3.61 (1.41)	3.30 (1.38)	3.17 (1.14)	3.91 (1.25)	3.83 (1.39)	3.93 (1.29)		• Prospection	
Neutral	4.16 (1.36)	4.10 (1.59)	4.02 (1.61)	4.83 (1.45)	4.74 (1.58)	5.15 (1.45)		• Group: SZ < CT	
								• Valence: negative < positive, neutral	
Context									
Positive	5.71 (1.03)	5.15 (1.64)	5.10 (1.51)	6.18 (.088)	5.24 (1.38)	5.83 (0.98)		• Valence: negative < positive, neutral	
Negative	5.55 (1.23)	4.48 (1.51)	4.89 (1.52)	5.80 (0.97)	4.81 (1.85)	4.78 (1.53)			
Neutral	5.77 (1.68)	5.29 (1.78)	5.26 (1.56)	6.10 (1.18)	5.49 (1.81)	5.45 (1.73)			

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Note. Tabled values are means with standard deviations in parentheses; Past/Prospection = prospections following the memory task; Control/Prospection = prospections following the control task.