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The Building Blocks Of Anticipatory Pleasure: Prospection, Memory & Imagery

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Abstract

The Building Blocks Of Anticipatory Pleasure: Prospection, Memory & Imagery

by

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Anticipatory pleasure deficits have been recently documented in people with schizophrenia (Kring & Caponigro, 2010). However, less is known about the extent to which particular processes that support anticipatory pleasure, including memory, prospection, and imagery, are disrupted in schizophrenia. We asked 32 people with schizophrenia or schizoaffective disorder and 29 people without schizophrenia to provide prospection narratives in response to positive, negative, and neutral event cues. Prior to prospection, participants provided personal memory narratives or completed a control task. When prompted with salient event cues, the content and experience of personal memories rendered by people with schizophrenia did not differ from those of controls. Further, people with and without schizophrenia reported similar vividness of mental imagery and their prospectations varied by valence in similar ways. However, we found interesting group differences in the context and experience of prospectations. Specifically, the prospectations of people with schizophrenia included fewer time and place indicators, less sensory experience, and were less likely to reference the past than controls. Contrary to expectations, talking about personal memories before prospection didn't influence the content or manner of rendering prospectations with one exception: People with schizophrenia reported experiencing less positive emotion when prospecting and less predicted positive emotion than controls if they completed the control task before prospection, but did not differ from controls in current or predicted positive emotion if they completed the personal memory task before prospection. Taken together, these findings suggest that whereas the ability to generate memories and rich vivid imagery appear intact in schizophrenia, difficulties in anticipatory pleasure may be related, in part, to difficulties in prospectations, including drawing from the past.

The Building Blocks Of Anticipatory Pleasure: Prospection, Memory & Imagery

Much of the pleasure we experience in life occurs in anticipation of good things that have yet to come (e.g., feeling excited about an upcoming vacation). Anticipating future pleasure involves many interrelated processes, including pre-experiencing the future, also referred to as prospection (Gilbert & Wilson, 2007), memory (Schacter & Addis, 2007), and mental imagery (Buckner & Carroll, 2007). Thus, in order to anticipate that a slice of your favorite pie will be pleasurable, you will likely recall the last time you had that pie, mentally create an image of the pie, and envision yourself eating it in the future, all of which will help you to predict a certain level of pleasure from the experience. Unfortunately, people with schizophrenia appear to anticipate less pleasure than people without schizophrenia (Kring & Caponigro, 2010). It may be the case that people with schizophrenia anticipate less pleasure because they are less able to draw from their past experiences, create vivid or rich prospectations, or generate vivid mental images. In the present study, we sought to extend our understanding of anticipatory pleasure deficits in schizophrenia by investigating memory, prospection, and imagery.

Although there is convincing evidence that people with schizophrenia do not have trouble experiencing emotion in the presence of evocative materials (Cohen & Minor, 2010; Kring & Moran, 2008), other research suggests difficulties in anticipatory pleasure (Kring & Caponigro, 2010; Kring & Elis, 2013; Kring & Moran, 2008). Models of anticipatory pleasure consider two different emotional experiences (Kring & Caponigro, 2010): (1) the current experience of pleasure while anticipating a future event; and (2) the predicted pleasure that will be experienced at the time the future event actually occurs. Gard and colleagues (2007) found that while people with schizophrenia reported similar levels of *in-the-moment* pleasure, both in their daily lives and on trait measures of consummatory pleasure, they predicted less pleasure from future daily life events and reported generally experiencing less current pleasure while anticipating future events than people without schizophrenia. Heerey et al. (2007) found that people with schizophrenia select more immediate rewards over long-term rewards, suggesting that they discount the positive value of distant rewards and thus, may be less likely to engage in behaviors to obtain these rewards. Further, fMRI studies have found that people with schizophrenia exhibit less activation than people without schizophrenia in the ventral striatum, an area of the brain related to the anticipation of reward (Esslinger et al., 2012; Juckel et al., 2006; Nielsen et al., 2012; Schlagenhauf et al., 2009). Taken together, these findings suggest that anticipatory pleasure is impaired in schizophrenia and this deficit may adversely influence planning and initiating goal directed or motivated behaviors (Kring & Barch, 2014; Kring & Caponigro, 2010). However, less is known about the extent to which processes that support anticipatory pleasure, including memory, prospection, and imagery are disrupted in schizophrenia.

Prospection and Memory

Prospection is a frequent part of everyday life, with some estimates suggesting that we do so every 16 minutes (D'Argembeau, Renaud, & Van der Linden, 2011). A growing line of research indicates that people's prospectations draw from their personal memories (see Buckner & Carroll, 2007; Schacter, Addis, & Buckner, 2007; Szpunar, 2010, for reviews). First, memory and prospection tend to emerge at similar times in development (Busby & Suddendorf, 2005). Second, some types of memory impairments (i.e., autobiographical memory) are often accompanied by impairments in prospection (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. For example, the extent to which people recount memories occurring at a specific time and place and that last no longer than a single day—this is called specificity in this literature—is related to the extent to which people recount the same type of specificity in their prospectations (e.g., Williams et al., 1996). Fourth, a common set of brain regions, including areas in the prefrontal and medial temporal regions, are similarly activated during both memory and prospectation (Addis, Wong, & Schacter, 2007; Botzung, Denkova, & Manning, 2008; Okuda et al., 2003), though this common activation appears to be observed only during the recounting of personal experiences (Szpunar, Watson, & McDermott, 2007).

Schacter and Addis (2007) have argued that prospectation requires a system that can “flexibly extract, recombine, and reassemble” details from past experiences (i.e., constructive episodic simulation hypothesis; also see Schacter et al., 2007). Thus, prospectations should draw from and even explicitly reference personal past experiences. In an fMRI study designed to test this hypothesis, participants were given fragments of their previously reported memories and were instructed to use only these fragments to either remember the past as it happened or imagine a future event containing those fragments (Addis, Pan, Vu, Laiser, & Schacter, 2009). Participants showed similar brain activation in the hippocampal-cortical network during recall and prospectation, suggesting similarities at the level of the brain when remembering the personal past and generating prospectations from recombined memory fragments. To our knowledge, only one study has measured the explicit reference of memories in freely generated prospectations, finding that about half of the content in people’s prospectations referenced the same content as their memories (Caponigro & Kring, 2014).

The Role of Emotion in Memory and Prospectation

Insights from affective science suggest that emotion may play an influential role in memory. Emotional information is processed more quickly than non-emotional information, and emotional information is more easily encoded, which facilitates the process of integrating this information into memory, facilitating later retrieval (e.g., Levine & Edelman; Holland & Kensinger, 2010; 2009; Phelps, 2004). Thus, emotional events are more likely to be recalled than events that lack emotional significance. Indeed, many laboratory studies with healthy people have confirmed this “emotional memory enhancement effect,” whereby people exhibit greater recall and recognition of emotional stimuli than of neutral stimuli (e.g., pictures, words, and sentences; see Buchanan & Adolphs, 2002; Hamann, 2001, for reviews). Further, there is evidence to suggest that autobiographical memories vary by emotion. For example, D’Argembeau and colleagues (2003) found that positive memories contained more sensory and contextual details than negative and neutral memories.

Other studies suggest that prospectations also vary depending on the valence of the event. For example, Caponigro & Kring (2014) found that negative prospectations less frequently referenced the past, contained fewer time and place indicators, and were less social and more distant in time than positive and neutral prospectations. Findings from the few studies that have assessed both memory and prospectation across different emotional valences suggest that memories and prospectations vary in similar ways according to the emotional valence of the event. For example, Williams et al. (1996) found that neutral memories and prospectations were rated as more specific than either positive or negative memories and prospectations. D’Argembeau and Van der Linden (2004) found differences in sensory experiences such that participants rated their

negative memories and prospectons as less vivid, clearer in time, and containing a greater sense of re-experiencing (or pre-experiencing) than their positive memories and prospectons.

In sum, research with healthy people suggests that prospecton draws explicitly from personal memories and that memories and prospectons vary depending upon emotional valence. However, the extent to which these observations also pertain to people with schizophrenia is not known. In the present study, we sought to ascertain whether people with schizophrenia explicitly refer to their memories in their prospectons. Because prospectons are a key part of anticipatory pleasure, an area of difficulty in schizophrenia, we reasoned that people with schizophrenia might have difficulties with prospecton, in part, because they are less likely than people without schizophrenia to refer to the past in their prospectons. We also sought to investigate how emotion might influence the content and manner of rendering memories and prospectons in schizophrenia.

Memory, Emotion, and Schizophrenia

For people with schizophrenia, there is evidence to suggest significant and stable deficits in some but not all types of memory (Heinrichs & Zakzaniz, 1998). For example, a meta-analysis by Aleman and colleagues (1999) reported moderate to large effect sizes for short-term and long-term memory impairments, including the retrieval and free recall of declarative information from memory. Although impaired relative to healthy controls, people with schizophrenia seem to perform better on recognition and cued recall tasks compared to free recall tasks (Aleman et al., 1999). There are, however, some areas of memory that are intact in schizophrenia, including implicit memory (Bazin & Perruchet, 1996; Clare, McKenna, Mortimer, & Baddeley, 1993), procedural learning (Strauss, Waltz, & Gold, 2014), declarative memory for verbal information (Kern, Hartzell, Izaguirre, & Hamilton, 2010), and intentional control of working memory encoding (Gold, Hahn, Strauss, & Waltz, 2009). Findings from this literature suggest that despite clear deficits, people with schizophrenia are able to use routine information and salient cues to encode, access, and recount relevant information.

Nevertheless, another area of apparent deficit is in recalling autobiographical memories (D'Argembeau, Raffard, & Van der Linden, 2008; Danion et al., 2005; McLeod, Wood, & Brewin, 2006; Ranganath, Minzenberg, & Ragland, 2008; Riutort, Cuervo, Danion, Peretti, & Pierre, 2003). For example, Danion and colleagues (2005) asked participants to recall personal memories in response to a particular time period cue and a general cue word (e.g., Time Frame: childhood to 9 years, Cue: Family; "Describe in detail a specific event taken from your family life") and then describe their subjective state of conscious recollection. They found that people with schizophrenia reported fewer "Remember" (i.e., the ability to mentally relive aspects of the past experience) and "Know" (i.e., a feeling of familiarity, but no conscious recollection) responses, and more "Guess" (i.e., a recollection without any certainty of the details) responses than people without schizophrenia, suggesting reduced autobiographical memory of their personal past experiences. Riutort and colleagues (2003) cued participants with open-ended time periods (e.g., "Can you remember anything that happened to you in school") and found that the autobiographical memories of people with schizophrenia were rated by coders as less specific (i.e., an event at a specified time and place, lasting one day or less) than those of controls. Taken together, these studies suggest that people with schizophrenia perform more poorly than controls on autobiographical memory tasks that prompt for the recall of memories using general and open-ended cues.

The findings on emotion and memory in schizophrenia are mixed, with some studies showing that people with schizophrenia perform similarly as controls on emotional memory tasks (i.e., they exhibit the emotion enhancement effect) and others showing deficits in remembering emotionally evocative laboratory stimuli, with no clear pattern emerging for a deficit in positive versus negative memory (see Herbener, 2008 for a review). Although fewer studies have examined emotion in autobiographical memories in schizophrenia, one study (Neumann, Blairy, Lecompte, & Philippot, 2007) found that people with schizophrenia recalled more positive than negative memories when they were cued with an emotionally evocative picture and asked to recall a specific personal memory evoked by the picture. People without schizophrenia showed the opposite pattern: they recalled more negative than positive personal memories in response to the picture cues.

Other studies suggest that people with schizophrenia do not have difficulties generating emotional autobiographical memories per se, but rather have trouble describing these memories clearly. For example, in response to emotion cue words, people with schizophrenia generated positive and negative memories that were rated as less appropriate, linear, clearly presented, and relevant to the prompted cue than were the memories recounted by people without schizophrenia (Gruber & Kring, 2008). Similarly, Raffard and colleagues (2010) found that although people with schizophrenia did not differ from controls in the number of specific memories generated or in the proportion of positive, negative, and neutral memories, their narrative responses were coded as less coherent. These findings are consistent with studies indicating that people with schizophrenia exhibit more referential language disturbance (particularly vague and confused references) when recounting stressful or negative (i.e., “bad memories” or “stressful times”) compared to non-stressful or positive topics (i.e., “good memories” or “pleasant, nonstressful times”) (e.g., Docherty, Hall, & Gordinier, 1998; Docherty & Hebert, 1997).

Two small autobiographical memory intervention studies in schizophrenia suggest that autobiographical memories are sensitive to change. In the first, 12 people with schizophrenia completed a 10-week group designed to enhance the specificity of their autobiographical memories by repeated practice and the use of salient, personally relevant cues. Upon completion, people with schizophrenia were able to generate more specific memories *and* prospections compared to the pre-intervention interview and compared to nine people assigned to a psychoeducation/conversation control group (Blairy et al., 2008). Second, a ten-week group intervention focused on increasing the specificity of autobiographical memories through journaling showed that 26 people with schizophrenia generated more specific memories, compared to 24 people who completed a ten-week social skills and occupational therapy control group (Ricarte, Hernandez-Viadel, Latorre, & Ros, 2012). Though speculative, the repeated practice of autobiographical memory generation along with the generation of personally relevant cues and goals may have bolstered participants’ post-intervention success by capitalizing on intact areas, including intentional control of working memory encoding and the use of salient cues to encode, access, and recount relevant information.

In sum, people with schizophrenia have memory deficits, including autobiographical memory, but some evidence suggests that providing support for memory recall, whether through practice or presentation of salient cues, may diminish these deficits. We thus reasoned that we might be able to bolster memories and thus prospections by asking people to generate personal memories with the aid of personally relevant and salient cues before prospection. It remains less clear whether people with schizophrenia will have problems recalling emotional compared to non-emotional memories, but it is likely that people with schizophrenia will have difficulties in

the way in which they talk about their emotional memories, as exemplified by less clarity, more vagueness, and less coherence.

Prospection and Schizophrenia

To date, only two studies have examined prospection in schizophrenia. Raffard and colleagues (2013) asked people with and without schizophrenia to generate prospections in response to three positive and three negative pictures. That is, participants were asked to imagine and then describe a new (i.e., had not happened before) future event happening at a specific time and place that involved the scene depicted in the picture in as much vivid detail as possible. Raters coded prospections as either specific (i.e., an event that occurs at a particular place and time and lasts for one day or less), categoric (i.e., events that occur repeatedly over a period of time), or extended (i.e., a series of events that last for longer than a day). People with schizophrenia reported less sensory, self-referential, and other-referential experience from their prospections compared to people without schizophrenia, and this was true for both positive and negative prospections. Further, the prospections of people with schizophrenia were rated as less specific (i.e., were more likely to be categoric or extended) than controls.

D'Argembeau, Raffard, and Van der Linden (2008) asked people with and without schizophrenia to generate memories and prospections in response to cues depicting general feelings or situations (e.g., “a situation in which you feel guilty about something,” “a situation in which someone smiled at you”), though these cues were not tied to particular emotional valences. Using the same three coding categories as Raffard et al. (2013), both memories and prospections of people with schizophrenia were rated as less specific than controls.

The Role of Imagery in Prospection

A final process related to prospection involves the projection of the self into potential future scenarios (Buckner & Carroll, 2007). In other words, prospection likely requires a complex system that allows us to pre-experience an event by calling to mind a novel or related experience from the past and to generate an image of that event in some level of detail. Research in healthy people suggests that the vividness of visual imagery about the future predicts the amount of reported sensory details of both memories and prospections (D'Argembeau & Van der Linden, 2006). To date, only two studies have compared mental imagery ability in schizophrenia and a healthy control group (Oertel et al., 2009; Sack, van de Ven, Etschenberg, Schatz, & Linden, 2005). Both studies found that people with schizophrenia reported greater vividness of imagery, as measured by the Questionnaire Upon Mental Imagery, than people without schizophrenia. Thus, to the extent that people with schizophrenia are able to generate vivid mental images, they may not be as impaired in prospection.

Present Study

In the present study, we sought to examine whether people with schizophrenia have deficits in processes that support anticipatory pleasure, including memory, prospection, and imagery and to examine if these processes vary depending upon emotional valence. Taken together, previous research indicates that people with schizophrenia have deficits in memory, including autobiographical memory, suggesting that they may be less likely to draw from their personal past when prospecting. On the other hand, additional evidence indicates that some areas of memory in schizophrenia are relatively intact (e.g., use of routine information and salient cues to encode, access, and recount relevant information), perhaps including emotional memories.

Thus, if autobiographical memories are asked about in a way that maximizes the likelihood of success (i.e. using salient cues, explicit events, and common experiences) people with schizophrenia may generate more detailed memories, which may also help to facilitate more detailed prospectons. Furthermore, to the extent that people with schizophrenia are able to generate vivid images, they may also be able to generate detailed prospectons. Even if people with schizophrenia generate more detailed prospectons and memories, however, the manner in which they describe their memories and prospectons is likely to differ from people without schizophrenia. What remains less clear is whether the content and experience of memories and prospectons of people with schizophrenia will vary by emotional valence. Finally, the literature indicating that people with schizophrenia have deficits in two aspects of anticipatory pleasure: current pleasure while anticipating and predicted pleasure for future events, suggests that people with schizophrenia may experience less positive emotion while prospecting about positive events and predict that future events will be less pleasurable compared to people without schizophrenia.

We addressed the following questions. First, can we enhance the content and experience of personal memories in schizophrenia by providing more salient cues? Second, do people with schizophrenia explicitly draw from the past (i.e., talk about past experiences) when prospecting about the future? Third, can we manipulate the richness of prospectons by first asking participants to talk about personal (autobiographical) memories? Fourth, do memories and prospectons vary by emotional valence among people with schizophrenia? Fifth, are the current and predicted positive emotions evoked by positive prospectons related to anticipatory pleasure deficits in schizophrenia?

We used a narrative task to examine these questions and test the following hypotheses. We tested two competing hypotheses about personal memories in schizophrenia:

Hypothesis 1a: To the extent that people with schizophrenia might benefit from salient cues to encode, access, and recount relevant information, memory content and experience will not differ between people with and without schizophrenia when prompted with explicit, salient event cues of common life experiences.

Hypothesis 1b: Based on treatment studies indicating that autobiographical memories are sensitive to change after repeated practice and exposure to salient cues, one memory session may not be sufficient to enhance autobiographical memories in people with schizophrenia. Thus, people with schizophrenia will generate less detailed memories compared to people without schizophrenia.

Hypothesis 2. Based on prior studies of autobiographical memory, narrative, and speech discourse (Danion et al., 2005; Docherty et al., 1998; Docherty & Hebert, 1997; Gruber & Kring, 2008), people with schizophrenia will talk about their personal memories less clearly than people without schizophrenia.

Hypothesis 3: Given that people with schizophrenia have difficulty accessing their personal (autobiographical) memories, people with schizophrenia will be less likely to reference the past in their prospectons compared to people without schizophrenia.

Hypothesis 4: To the extent that prospectons draw from the past, providing people an opportunity to talk about the past ought to enhance prospectons. Thus, people with and without schizophrenia who talk about personal memories before generating prospectons will generate more detailed content and greater clarity in their prospectons compared to when they generate prospectons following a task that does not involve personal memory.

We tested two hypotheses about prospectons:

Hypothesis 5a: Based on the two prior studies that assessed prospecting in schizophrenia (D'Argembeau et al., 2008; Raffard et al., 2013), we hypothesized that the prospecting of people with schizophrenia will contain fewer time and place indicators and be experienced as less sensory and contextual compared to people without schizophrenia.

Hypothesis 5b: Consistent with the literature suggesting valence differences during prospection (Caponigro & Kring, 2014; D'Argembeau & Van der Linden, 2004), we hypothesized that people with and without schizophrenia will provide less detailed content and report less sensory and context experience in their negative prospecting compared to positive prospecting.

We tested two hypotheses about current and predicted anticipatory pleasure:

Hypothesis 6a: People with schizophrenia will experience less current positive emotion during prospection and will predict less positive emotion for future positive events compared to people without schizophrenia.

Hypothesis 6b: Current and predicted positive emotion for positive prospecting will be related to clinical ratings of motivation and pleasure in schizophrenia.

Method

Participants

Thirty-two people with either schizophrenia (n=20) or schizoaffective disorder (n=12) and 29 people without schizophrenia between the ages of 18 and 65 years participated. People with schizophrenia were recruited from community advertisement and referrals. Diagnoses were confirmed using the Structured Clinical Interview for DSM-IV (SCID-I/P; First, Spitzer, Gibbon, & Williams, 2002b). People without personal history of schizophrenia or bipolar disorder, confirmed using the SCID non-patient version (SCID-I/NP; First, Spitzer, Gibbon, & Williams, 2002a), were recruited through community advertisement and enrolled into the control group. Controls with family history of schizophrenia or bipolar disorder and more than two depressive episodes were excluded from the study. Exclusion criterion for both groups included: 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) substance abuse within the last month or dependence within the last six months. People who met any of the exclusion criteria were not invited to participate.

Procedure

Participants completed two interview sessions scheduled one week apart. During each session, participants provided five prospection narratives. To examine whether providing memories in response to detailed contextual cues will influence the level of details of memories and prospecting, participants were randomly assigned to complete one of two tasks before prospection: (1) narrate about five personal past events (personal memory task) or (2) complete a control task where they were asked to provide instructions to help another person complete five everyday tasks. Thus, one set of prospection narratives followed a set of narratives about personal memories and the other set of prospection narratives followed a set of instructions about non-personal everyday tasks. Participants were randomly assigned to one of two orders that differed by whether the personal memory or control task occurred during the first interview session. Thus, half of the participants completed the control task before the prospection task during session one and half completed the personal memory task before the prospection task

during session one.¹ Participants also completed clinical rating interviews and self-report questionnaires during the first session.

Control task. Participants provided step-by-step instructions to help another person complete five commonly experienced tasks (e.g., “Tell me each of the steps that Sally would need to take in order to get food from a vending machine”). These tasks were modeled and extended from the Wechsler Individual Achievement Test (Wechsler, 2009) and are presented in Appendix 1. This task was comparable to the personal memory task in its level of complexity and required imaginative ability, but differed in that it did not require participants to access explicit personal memories or to create a narrative. Each of the five control tasks were scored based on the inclusion (or omission) of the five steps necessary to complete each task. Each step was worth one point, resulting in a score ranging from 0 – 5 per task. Performance on the five tasks were summed, providing a composite control task score ranging from 0 – 25.

Personal memory and prospection tasks. The personal memory and prospection tasks followed a standardized interview protocol. Participants provided personal memory or prospection narratives in response to common life experiences (e.g., a birthday, an argument; see Appendix 1 for all cues). Event cues were divided into three matched lists of five event cues each (2 positive, 2 negative, 1 neutral) and were counterbalanced across the two prospection tasks and personal memory task, so that each participant received each of the event cues lists only once throughout the study.

Personal memory task. Participants provided five memory narratives in response to cues that prompted the personal past (2 positive, 2 negative, 1 neutral). 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. For each event cue, participants were prompted to “Remember a specific time in the past you [event cue]. Tell me about it in as much detail as possible, as if you were telling me a story.” They were then given a practice trial whereby they were asked to provide a specific narrative about “a 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. After each narrative, participants were given the opportunity to provide additional details.

Prospection tasks. During each interview session, participants provided five prospection narratives in response to cues that prompted future events (2 positive, 2 negative, 1 neutral), one prospection task followed a control task and one prospection task followed the personal memory task. 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. For each event cue, participants were prompted to “Picture a specific time in the future you will [event cue]. Tell me about it in as much detail as possible, as if you were telling me a story.” They were then given a practice trial whereby they were asked to provide a specific narrative about “a time in the future you will listen to music or the radio.” Researchers provided feedback (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 *future* you will experience the following events”) and then began the prospection task. After each narrative, participants were given the opportunity to provide additional details. If participants did not provide a prospection narrative in response to the cue, they were asked to provide the narrative again. If, after the second attempt, the participant was unable to provide a prospection narrative, the task continued onto the next event cue and the prospection was considered missing. In addition, 6 prospectations were missing due to inability to think of ($n = 4$)

or declination to provide (n=2) an answer. In sum, 14 out of 320 prospection narratives were missing for the schizophrenia group and 1 out of 290 was missing for the control group.

Narrative experience questionnaire. Once participants completed a memory or prospection narrative, they rated their experience of the narrated event using a 1 (none) to 7 (a lot) Likert scale. Participants were asked to report on their (1) sensory experience, which included visual, sound, and smell/taste of the event; (2) context experience, which included clarity of location, spatial arrangement of objects, and spatial arrangement of people; (3) current emotional experience (1 = negative, 7 = positive), and (4) anticipated or recalled emotional experience (1 = negative, 7 = positive). Consistent with previous studies (D'Argembeau & Van der Linden, 2004, 2006), composite sensory experience (visual, sounds, smell/taste) and context experience (location, spatial arrangement of objects, arrangement of people) indices were created.

Narrative coding. Personal memory and prospection narratives were audio recorded, transcribed, and coded by trained research assistants. To assess whether the personal memory and prospection narratives conformed to our *a priori* valence designations of the cues, 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).

The following coding system was applied to the personal memory and two prospection narratives. The control task was not coded using this system because participants did not provide personal narratives but rather described a set of instructions necessary for another person to complete a task. Five variables were coded and covered both the content and manner in which the content was rendered.

Past reference was rated dichotomously (present/absent) and measured whether a prospection narrative included an explicit reference to a personal past experience. The past reference could be something that was previously experienced on a frequent or recurring basis (e.g., every year my family and I go on vacation and I always end up arguing with my sister, so I'm sure that next year we'll get into an argument about something silly), or one-time previous experience (e.g., I really liked the movie "21 Jump Street," so I'm going to see "22 Jump Street" next week in the theaters). 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. Personal memory and prospection narratives were coded for level of time/place on a 3-point scale (0 = omission of a specific time and place indicator, 1 = inclusion of either a time or place indicator, 2 = inclusion of a time and place indicator).

Sociality was rated on a 3-point scale (2 = active, 1 = passive, 0 = alone). A narrative was rated as "active" if it included an explicit and active social interaction. If the narrative involved other people, but there was no active social engagement (e.g., other people are present but there is no interaction), the narrative was rated as "passive."

Elaboration 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 unambiguous narrative. A rating of “elaborated” indicated that the narrative contained thorough descriptive information throughout the narrative with rich description; “moderately elaborated” indicated that the narrative included somewhat expanded and descriptive information on some but not all aspects of the story, 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 express a 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 rating scales. People with schizophrenia participated in a semistructured interview to measure current symptoms, using the Brief Psychiatric Rating Scale (BPRS; Overall & Gorham, 1962) and Clinical Assessment Interview for Negative Symptoms (CAINS; Kring, Gur, Blanchard, Horan, & Reise, 2013). The CAINS provides two negative symptom subscales. The nine-item Motivation and Pleasure (MAP) scale rates the level of engagement in motivated behavior as well as pleasure derived from social, vocation, and recreational activities over the past week using a 0 – 4 scale, with higher scores indicating greater impairment. The four-item Expression (EXP) scale rates changes in expressivity using a 0 – 4 scale, with higher scores indicating greater impairment.

Imagery abilities. The Questionnaire Upon Mental Imagery – Short (QMI-S; Sheehan, 1967) is a 35-item self-report questionnaire that measures the vividness of a person’s mental imagery abilities across seven different sensory modalities using a 7-point scale (1 = very vivid, 7 = I have no image before me). A total score was computed for all items, and lower scores indicated *greater* vividness of mental imagery. Example items include, “How clearly and vividly can you imagine the sound when you think of the horn of a car,” “How clearly and vividly can you imagine the touch of fur,” and “How clearly and vividly can you imagine the taste of apple juice?” Internal consistency was good ($\alpha = 0.95$).

Data Analytic Plan

To test our hypotheses involving narrative data, we used mixed effect ANOVAs with a between subject factor for diagnostic group (Schizophrenia, Control) and within subjects factors for condition and valence. The condition factor had three levels: narratives from the personal memory task; narratives from the prospection task that followed the personal memory task; and narratives from the prospection task that followed the control task. The valence factor covered positive, negative, and neutral cues. Thus, we used a 2 (Group: Schizophrenia, Control) X 3 (Condition: Personal memory task; Prospection following personal memory task; Prospection following control task) X 3 (Valence: Positive, Negative, Neutral) mixed effect ANOVA design. For hypotheses specific to the personal memory condition only, we used a 2 (Group: Schizophrenia, Control) X 3 (Valence: Positive, Negative, Neutral) mixed effect ANOVA design. For hypotheses specific to the prospection conditions only, we used a 2 (Group: Schizophrenia, Control) X 2 (Condition: Prospection following personal memory task; Prospection following control task) X 3 (Valence: Positive, Negative, Neutral) mixed effect ANOVA design. 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 using *Bonferroni* adjustment of significance level for multiple comparisons.

Results

Mean ratings and group comparisons for demographic variables, clinical ratings, and self-report measures are reported in Table 1. Independent sample *t*-tests results revealed no group differences on any of the demographic variables.

Rater agreement. Raters, blind to the diagnostic status of the participants, achieved high agreement for the narrative codes, 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. Variables from the two positive narratives and two negative narratives were averaged into a positive and negative composite score, respectively.² Separate, parallel analyses of event cue valence classification was confirmed by examining emotion experience ratings and the number of valenced words. 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 ($F(1.71, 97.64) = 115.10, p < 0.01, \eta^2 = .67$). All follow-up pairwise comparisons were significant; that is, positive memories and prospections (collapsed across the personal memory or the control task), were experienced more positively ($M = 2.34, SD = 0.99$) than negative and neutral; neutral memories and prospections ($M = 2.91, SD = 0.98$) were experienced more positively than negative, and negative memories and prospections ($M = 4.49, SD = 1.06$) 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. For positive emotion words, the group ($F(1, 59) = 10.09, p < 0.00, \eta^2 = .15$) and valence ($F(1.72, 101.40) = 81.02, p < 0.01, \eta^2 = .58$) main effects were significant. People with schizophrenia used fewer positive emotion words than those without schizophrenia across all three narrative tasks, and 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. For negative emotion words, only the valence main effect was significant ($F(1.45, 85.38) = 124.93, p < 0.01, \eta^2 = .68$) 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 ($M = .59, SD = 0.43$) narratives.

Taken together, these findings confirmed that our emotion manipulation was effective. Furthermore, that the groups did not differ in their current emotion experience after rendering their memories and prospections is consistent with and extends the large body of evidence showing that people with schizophrenia do not differ from people without schizophrenia in their current or "in-the-moment" emotion experience (Kring & Moran, 2008). However, people with schizophrenia used fewer positive emotion words than people without schizophrenia whether talking about personal memories or prospections.

Word count. We examined whether people with and without schizophrenia differed in the number of words in the 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 ($F(1.73, 102.39) = 11.16$, $p < .00$, $\eta^2 = .16$), with follow-up analyses indicating 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., Caponigro & Kring, 2014).

Control Task. To confirm that groups did not differ on the control task, we examined the effect of group on the total number of steps included across the five control conditions. As shown in Table 1, we found no difference between groups on the control task, $t(59) = 1.57$, $p = .31$. Thus, people with and without schizophrenia were equally proficient at providing step-by-step instructions to help another person complete five everyday tasks.

Content and Clarity of Memory

For the personal memory task, we examined whether people with and without schizophrenia differed in the content and experience of memories using six separate 2 (Group) X 3 (Valence) mixed effect ANOVAs for time/place, sociality, elaboration, clarity, reported sensory experience, and reported context experience. These analyses revealed no interactions with group and only one significant group main effect for clarity ($F(1, 59) = 5.47$, $p < .02$, $\eta^2 = .09$). Thus, consistent with hypothesis 2, people with schizophrenia generated less clear personal memory narratives regardless of valence than people without schizophrenia. Consistent with our competing hypothesis 1a, we did not find group differences in the other variables. That is, we found that by providing detailed and salient cues prompting for the recall of specific life events, people with schizophrenia generated personal memories containing comparable time/place indicators, sociality, elaboration, and reported sensory and contextual experience as did people without schizophrenia.

We also found significant emotion main effects for sociality ($F(1.70, 100.05) = 4.12$, $p < .03$, $\eta^2 = .07$) and sensory experience ($F(2, 118) = 13.12$, $p < .00$, $\eta^2 = .18$). Pairwise *Bonferroni* corrected comparisons indicated that all participants' negative personal memory narratives were coded as more social than either positive and neutral personal memory narratives (p 's $< .05$). In other words, people were more likely to provide a memory involving other people if the event was negative. In addition, all participants experienced fewer sensory details from their negative personal memory narratives than their positive and neutral personal memory narratives.

Explicit Reference to Memories in Prospections

To examine whether people with schizophrenia were less likely than controls to explicitly reference the past in their prospections, we conducted a 2 (Group) X 2 (Condition: Prospection following personal memory task; Prospection following control task) X 3 (Valence) mixed effect ANOVA. We found significant condition ($F(1, 57) = 16.31$, $p < .00$, $\eta^2 = .22$) and group ($F(1, 57) = 4.26$, $p < .05$, $\eta^2 = .07$) main effects, indicating that people with and without schizophrenia referenced the past more when their prospections were preceded by the personal memory task. However, consistent with hypothesis 3, people with schizophrenia referenced the past less, in both conditions, than did controls.

Content and Clarity of Prospections

To examine if talking about memories before prospection enhanced the content and clarity of prospections and to explore the role of emotion in prospection, we conducted six

separate 2 (Group) X 2 (Condition: Prospection following memory task; Prospection following control task) X 3 (Valence) ANOVAs for time/place, sociality, elaboration, clarity, reported sensory experience, and reported context experience (see Table 2 for means and standard deviations).

These analyses revealed one significant condition main effect. People with and without schizophrenia generated more clear prospectations after the control task than they did after the memory task ($F(1, 57) = 3.87, p < .05, \eta^2 = .06$). Thus, contrary to hypothesis 4, generating and talking about memories before prospection did not enhance the content and clarity of prospectations.

We found two significant group main effects, partially supporting hypothesis 5a. As shown in Figures 1 and 2, people with schizophrenia provided fewer time and place indicators ($F(1, 57) = 4.09, p < .05, \eta^2 = .07$) and reported less sensory experience ($F(1, 59) = 8.60, p < .00, \eta^2 = .13$) than controls. None of the other group main effects were significant.

We found one significant Group X Emotion Interaction for clarity ($F(2, 114) = 3.54, p < .03, \eta^2 = .06$). People with schizophrenia provided less clear negative prospectations than people without schizophrenia ($t(59) = 2.72, p < .00$), but there was no group difference in the clarity of positive and neutral prospectations.

With regard to emotion, we found support for hypothesis 5b in that negative prospectations were less rich in content and experience than positive prospectations. Specifically, we found four emotion main effects for time/place ($F(1.89, 107.49) = 26.43, p < .01, \eta^2 = .32$), elaboration ($F(1.85, 105.59) = 5.58, p < .01, \eta^2 = .09$), sensory experience ($F(2, 118) = 45.92, p < .01, \eta^2 = .44$), and context experience ($F(2, 118) = 9.88, p < .01, \eta^2 = .14$). Follow-up tests indicated that negative prospectations included fewer time/place indicators, less sensory experience, and less context experience than positive and neutral prospectations, and that negative narratives were less elaborated than positive narratives (p 's $< .01$).

In sum, our prediction that remembering the personal past before prospecting would enhance the content and clarity of prospectations was not supported. In other words, talking about memories before prospection did not enhance the content or manner of rendering prospectations, and this was true for people with and without schizophrenia. Consistent with predictions, however, people with schizophrenia generated prospectations with fewer time/place indicators and less sensory experience compared to people without schizophrenia regardless of the task completed before prospection. Consistent with our findings for memory, people with schizophrenia provided less clear prospectations than people without schizophrenia, though this was only true for negative prospectations. In addition, the negative prospectations of people with and without schizophrenia contained fewer time and place indicators, less elaboration, less sensory experience, and less context experience than positive (and in most cases neutral) prospectations.

Current and Predicted Emotions for Positive Prospectations

To assess anticipatory pleasure during the prospection tasks, we examined positive emotion in two ways: (1) current experience of positive emotion while prospecting about a future positive event; and (2) predicted positive emotion for the future positive event.

We used independent sample t -tests to examine current experience of positive emotion while prospecting and predicted positive emotion separately for the two positive prospection conditions (i.e., prospection following the memory task and prospection following the control task). Consistent with hypothesis 6a, we found significant group differences in current positive emotion while prospecting and predicted positive emotion. However, the group difference was

only significant for prospecting that followed the control task condition. That is, people with schizophrenia reported less current positive emotion while prospecting about positive events than controls ($t(59) = 2.04, p < .05$) when they did so after the control task but not after the personal memory task. Similarly, people with schizophrenia predicted less positive emotion for future positive events ($t(59) = 2.20, p < .03$) than controls but only for prospecting that followed the control task. There were no group differences in either current or predicted positive emotion for prospecting that followed the personal memory task. Thus, when people with schizophrenia talked about their personal memories before prospecting about positive events, they experienced and predicted comparable amounts of positive emotion as people without schizophrenia.

Next, we examined the relationship of a clinical rating of motivation and pleasure (CAINS MAP) with current positive emotion while prospecting and with predicted positive emotion. In partial support of hypothesis 6b, CAINS MAP scores were negatively correlated with current positive emotion while prospecting, but only for prospecting that were preceded by the control task (see Table 3). There were no significant correlations of CAINS MAP scores with predicted positive emotion for positive prospecting in either prospecting condition. That is, the amount of positive emotion people with schizophrenia experienced while prospecting about positive events following the control task was related to clinical ratings of motivation and pleasure deficits. However, the amount of current positive emotion while prospecting about positive events after the personal memory task was not related to a clinical rating of motivation and pleasure nor was the amount of predicted positive emotion following either prospecting condition.

In sum, when asked to talk about personal memories before prospecting, people with schizophrenia experienced comparable amounts of current positive emotion while prospecting and predicted positive emotion about future positive events as controls. However, people with schizophrenia experienced less current positive emotion than controls when prospecting about positive events if they were prompted to provide simple instructions helping another person complete everyday tasks. Finally, current positive emotion while prospecting was associated with clinical ratings of motivation and pleasure deficits, but predicted positive emotion was not.

Imagery Abilities

An independent sample *t*-test revealed no group difference in mental imagery as assessed by the QMI, $t(53) = 1.29, p = .20$, suggesting that people with and without schizophrenia generally call to mind similarly clear and vivid mental images. Given that mental imagery abilities appear largely intact, it is likely that other processes account for anticipatory pleasure deficits in schizophrenia. Indeed, the QMI was not significantly related to the CAINS MAP score.

Discussion

In this study, we sought to examine processes that might contribute to anticipatory pleasure deficits in people with schizophrenia. We tested several hypotheses about memory, prospecting, and imagery using a narrative task, and extended the literature with several key findings. First, people with schizophrenia generated rich memories when provided with salient cues, even though their memories are rendered less clearly. However, people with schizophrenia did not explicitly draw from the past as often as controls in their prospecting, suggesting that while people with schizophrenia can generate detailed memories, they may not pull from these

past experiences when prospecting. Second, we found differences in the content and experience of prospectations, suggesting that prospectations may be an area of difficulty for people with schizophrenia. Third, the type of task completed before prospectation did not influence the content or manner of rendering prospectations but it did influence the experience of emotion. Specifically, people with schizophrenia experienced less current positive emotion while prospecting and less predicted positive emotion than controls but only when their prospectations were preceded by a non-personal control task. Third, people with and without schizophrenia did not differ in reported vividness of mental imagery, suggesting that deficits in anticipatory pleasure are not likely due to deficits in creating vivid images.

We first examined the content of personal (autobiographical) memories by exploring two competing hypotheses. To the extent that people with schizophrenia would benefit from being prompted with salient event cues of common life experiences, we expected that people with and without schizophrenia would not differ in the richness of their narrated memories. However, if one memory session wasn't sufficient enough to enhance autobiographical memories in people with schizophrenia, we expected that they would generate less detailed memories compared to people without schizophrenia. We found very few group differences between people with and without schizophrenia on the personal memory task, providing support for the first competing hypothesis. That is, people with schizophrenia provided similar content (e.g., time and place indicators, sociality) and reported comparable sensory and context experience from their narrated memories as controls. However, the manner of which they talked about their personal memories was less clear, consistent with our second hypothesis and previous studies (Gruber & Kring, 2008; Raffard et al., 2010).

Our results are seemingly inconsistent with some studies reporting autobiographical memory deficits in schizophrenia (D'Argembeau, Raffard, & Van der Linden, 2008; 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. In our study, we cued participants with specific and salient event cues (e.g., an argument), instead of vague cues with open-ended time frames (e.g., a time in childhood) or broad categories (e.g., family). Our method may have thus capitalized on areas of preserved memory abilities, including using routine information and salient cues to encode, access, and recount relevant information, and helped people with schizophrenia to recall personal memories with richness and detail. We also assessed several aspects of memories, including the content of memories (i.e., time and place, sociality), the way in which the memories were recounted (i.e., clarity, elaboration), and the experience of the memories (i.e., reported emotion, sensory experience, content experience). By contrast, other studies have assessed different domains, including conscious recollection (i.e., "remember," "know," "guess"; e.g., Danion et al., 2005) or specificity (e.g., Riutort et al., 2003). Indeed, these measurement differences make direct comparisons of our results with those from studies using standardized autobiographical memory tasks or different coding schemes difficult. Nonetheless, our findings suggest that when provided with salient cues prompting for the recall of specific life events, people with schizophrenia can provide equally as rich memory content and experience as controls even if they do so less clearly. These findings also provide evidence that the ability to recount personal memories in response to salient cues remains largely intact in schizophrenia, and suggest that difficulties with remembering the past may not account for anticipatory pleasure deficits.

A growing line of research suggests that prospectation draws from past experiences (i.e., constructive episodic simulation hypothesis; Schacter et al., 2007). To our knowledge, only one

study has measured explicit reference to past experiences during unconstrained prospecting (Caponigro & Kring, 2014), providing initial evidence for the inclusion of past content in the prospecting of healthy people. In the present study, we found that all people, regardless of diagnostic group, were more likely to explicitly reference the past during prospecting if they first completed a personal memory task. At first glance, this finding suggests that there may be some benefit from generating and talking about personal memories before prospecting for people with schizophrenia. However, consistent with our third hypothesis, we also found that people with schizophrenia were nonetheless less likely to refer to the past in their prospecting compared to controls. That is, although people with schizophrenia are able to generate personal memories (e.g., remember a past birthday in detail), they are less likely to explicitly refer to past experiences in their prospecting (e.g., including details about a past birthday when prospecting next year's birthday). Thus, difficulties with anticipatory pleasure may be related, in part, to impairments in drawing from the past.

Although our findings suggest that those with schizophrenia may be drawing less from their personal life histories to prospect, it is important to acknowledge a limitation in our ability to make this claim. Within the current study, a prospecting was coded as referencing the past only if the participant explicitly mentioned a personal past experience. For example, a participant could prospect a future birthday in different ways: "I'll go to my favorite restaurant, Olive Garden, and order spaghetti and meatballs"; or "I'll go to Olive Garden and order spaghetti and meatballs." In the first example, it is clear that the person previously visited Olive Garden, thus it would receive a code for past reference. In the second statement, there is no indication that the person had previously been to Olive Garden and thus, it would not receive a past reference code even if the person had indeed visited Olive Garden in the past. Because our approach to assessing the past in prospecting was conservative, we may have underestimated how often people draw from the past when prospecting. Indeed, theory and research in cognitive science indicates that prospecting are created by flexibly recombining fragments of past experiences (Schacter et al., 2007). Participants may well have included such fragments in their prospecting without an explicit reference to the past.

Future research should continue to examine if and how past experiences are integrated into prospecting. That is, do people include non-explicit references to past experiences in their prospecting, and if so, how much content is drawn from the past? Future studies could collect data on whether participants have previously experienced components of their prospecting (e.g., where they were, who they were with, what they did) by including a post-prospecting follow-up questionnaire. For example, if a participant stated, "I'll go to Olive Garden and order spaghetti and meatballs," follow-up questions might include, "Have you ever visited an Olive Garden?" and "Have you ever eaten spaghetti and meatballs." Answering 'yes' to these follow-up questions could provide support for greater inclusion of past experiences in prospecting. Based on our finding that people with schizophrenia explicitly referenced the past less than controls, we would nonetheless expect that they would also include fewer non-explicit references to past experiences in their prospecting than people without schizophrenia.

To the extent that prospecting draw from the past, we reasoned that asking people to first remember and talk about personal memories might influence the richness of their prospecting. We reasoned that people with schizophrenia might benefit from the "boost" provided by the personal memory task. However, our findings did not support this hypothesis. That is, asking people with (or without) schizophrenia to first remember and talk about their personal memories before prospecting did not enhance the richness of their prospecting, at least relative to

prospections that followed the control task.

In some ways, it is not surprising that the controls' prosppections following the personal memory task did not differ in content or clarity from their prosppections following the control task given that they were more likely to explicitly reference the past in their prosppections than people with schizophrenia. In other words, they were referring to the past in both conditions and thus may not have needed the aid of first talking about personal memories to enhance their prosppections. However, given that people with schizophrenia were less likely to explicitly reference the past than controls, one memory session may not be sufficient enough to influence the content of prosppections for people with schizophrenia. Taken together, these findings suggest that although people with schizophrenia can generate equally rich memories as controls, recalling personal memories before prosppection did not influence the content or manner of rendering prosppections, perhaps because they are less likely to explicitly refer to the past when they are generating prosppections.

We also found interesting group differences in the content and experience of prosppections. First, people with schizophrenia were less likely to include when and where future events would occur, and second, they experienced fewer sensory details when prosppecting than controls. These findings are consistent with the work of Raffard and colleagues (2013) who found that people with schizophrenia provided less specific prosppections with fewer experienced sensory details compared to controls. Importantly, the prosppections of people with and without schizophrenia did not differ in word length, so these differences in prosppections can't be accounted for by less speech output.

Interestingly, the prosppections of people with schizophrenia did not differ in sociality, elaboration, or context experience. Given that social functioning difficulties in schizophrenia are well documented (Hooley, 2010), it was surprising to find that people with schizophrenia were equally as likely to include others in their prosppections as controls. Further, one of the negative symptom of schizophrenia, asociality, refers to diminished frequency of social interactions as well as diminished closeness or desire for closeness in social relationships (Kirkpatrick, Fenton, Carpenter, & Marder, 2006). When developing our event cue list, we intentionally sought to include events that almost by definition included other people (e.g., an argument, spending time with friends, asking for directions). Yet, other event cues could also have included other people even though it was not part of the cue stem (e.g., watching your favorite movie). Thus, regardless of whether the cue was explicitly or implicitly social, people with and without schizophrenia were equally as likely to include others in their memory and prosppection narratives. In our study, we measured the degree of social interaction in narratives (active, passive, or none), but did not assess the quality or closeness of the relationship between a participant and the people mentioned in the narratives. Given that impairments in social closeness are components of asociality, future studies might assess whether the quality or closeness of social involvement in prosppections is similar between people with and without schizophrenia. Results from this type of assessment could further inform our understanding of motivation and pleasure for social interactions. That is, people with schizophrenia may anticipate less social pleasure because they don't prosppect about meaningful interactions with people with whom they feel close and connected.

Our finding that people with and without schizophrenia did not differ in level of elaboration is consistent with previous studies (e.g., Gruber & Kring, 2008) and our finding that narrative length did not differ between the groups. Thus, people with schizophrenia are able to generate and create prosppections that are similar in length and elaboration to those of controls. People with schizophrenia also reported equally as rich context experience as controls. That is,

when generating a future prospection, people with schizophrenia reported experiencing similarly vivid experience of the surrounding context (location, objects, people) as people without schizophrenia. Overall, our findings from the prospection tasks suggest that the prospectations of people with schizophrenia are, in some ways, less detailed (i.e., contain fewer time and place indicators and less sensory experience) than people without schizophrenia, and in other ways comparable to people without schizophrenia (i.e., equally social, elaborated, and contextually experienced). Thus, deficits in anticipatory pleasure may be related, in part, to difficulties in just some aspects of generating prospectations.

As expected, the valence of an event influenced prospection in similar ways for people with and without schizophrenia. More specifically, negative prospectations significantly differed from positive and neutral prospectations in content and the manner in which they were rendered. Consistent with previous work, negative prospectations contained fewer time and place indicators than positive and neutral prospectations (Caponigro & Kring, 2014). Further, negative prospectations of people with and without schizophrenia were experienced as less sensory and contextual compared to positive and neutral prospectations, and were less elaborated than positive prospectations. These results are consistent with a study by D'Argembeau and Van der Linden (2004), who found that participants subjectively rated their negative prospectations as less vivid, clearer in time, and containing a greater sense pre-experiencing than positive prospectations. Together, results from the memory and prospection tasks suggest that people with schizophrenia generate appropriate memories and prospectations that match the emotional valence of a cued event, albeit the overall clarity of these memories and prospectations are sometimes less coherent than controls. We also provide the first evidence that people with schizophrenia provide less rich negative prospectations, suggesting that emotion influences prospection in similar ways for people with and without schizophrenia.

We found partial support for our hypothesis that the manner in which people with schizophrenia rendered prospectations would be less clear for emotional events than people without schizophrenia. That is, the negative prospectations of people with schizophrenia were rated as less clear than the negative prospectations provided by controls. However, we found no clarity differences in positive and neutral prospectations. On the one hand, this finding is somewhat surprising given that we did not see a similar valence distinction in the clarity of narrated memories in the schizophrenia group. On the other hand, it is consistent with studies reporting impairments in narrating about stressful or negative events (Docherty et al., 1998; Docherty & Hebert, 1997).

Following from the Kring and Caponigro (2010) time course of emotion model, we examined the experience of current positive emotion while prospecting and predicted positive emotion. While the task preceding prospection (i.e., personal memory or control task) did not influence the content or manner of rendering prospectations, it appeared to influence current and predicted positive emotion. More specifically, people with schizophrenia experienced less current positive emotion when prospecting and predicted less positive emotion for positive prospectations than controls, but only for prospectations that were preceded by the non-personal control task. Moreover, clinical ratings of motivation and pleasure deficits were associated with current positive emotion while prospecting, but again, only for prospectations following the control task. When prospectations were preceded by the personal memory task, however, both current and predicted positive emotion for positive events were similar for people with and without schizophrenia. That is, when people with schizophrenia recalled positive past experiences before prospection they experienced current and predict positive emotion

comparable to controls. However, without the prompting to remember their personal past before prospection, they experienced less current and predicted positive emotion than controls. Thus, remembering the positive past before prospecting the positive future may help people with schizophrenia experience positive emotion at a level comparable to people without schizophrenia.

Interestingly, people with schizophrenia included fewer positive emotion words in their memories and prospectations than people without schizophrenia. That is, whether people with schizophrenia talked about their personal past or prospected future events, they included less positive emotion words in their narratives than controls. This finding was somewhat unexpected given that previous studies of conversational speech (St-Hilaire, Cohen, & Docherty, 2008) and narratives of emotional life events (Gruber & Kring, 2008) reported no differences in the use of positive emotion words between people with and without schizophrenia. However, differences in narrative cues or the measurement of emotion words may help to explain these inconsistent findings. For example, Gruber & Kring (2008) cued participants with broad emotion terms and used a different method for counting emotion words, a dictionary comprised of approximately 300 root words, which may have underestimated the number of emotion words included in a narrative. Conversely, St-Hilaire and colleagues (2008) used the same method for counting emotion words as our study (LIWC), but instructed participants to simply talk about themselves in order to examine natural speech patterns, and thus the topics chosen may not have been particularly emotional. Our study, however, used salient life-event cues varying in valence to prompt narratives. Further, we are the first to extend the measurement of emotion word usage to the domain of prospection. An interesting question for future research is whether a decrease in the verbal expression of positive emotion words is related to other emotion expression deficits in schizophrenia (e.g., facial expression, affective prosody).

Taken together, our findings shed light on whether processes that support anticipatory pleasure are disrupted in schizophrenia, and this in turn points to potential avenues for intervention. That is, deficits in anticipatory pleasure may be related to difficulties in explicitly referring to and drawing from past experiences when developing a prospection. In our study, people with schizophrenia experienced current and predicted positive emotion comparable to controls if they were prompted to remember the positive past before prospection. Although speculative, it may be the case that when people with schizophrenia are thinking about the future in everyday life they do not generate memories that help them to experience current and predicted positive emotion when prospecting. For example, when thinking about what to have for dinner, they may not call to mind previously enjoyed meals, which may result in less current and predicted experiences of positive emotion.

Experience sampling studies could help shed light on whether this same mechanism can be applied to understanding prospection in everyday life. For example, a future study could ask people with schizophrenia to prospect upcoming events throughout their day. After each prospection, they could complete a brief survey indicating the information they used when developing their prospectations (e.g., I thought about... past experiences, what I think the experience will be like, what other people told me experience will be like, etc.). It may be the case that people with schizophrenia are less likely than people without schizophrenia to pull from past experiences when developing a prospection. If our speculation is correct, an intervention designed to help people with schizophrenia call to mind and draw from past experiences during prospection in their everyday lives may help to improve anticipatory pleasure.

Our findings also point to new directions in studying the relationship between anticipatory pleasure deficits and motivated behavior in schizophrenia. A recent study in healthy people found that participants were more likely to choose delayed but larger rewards than immediate but smaller rewards following a positive prospection task compared to a no prospection condition (Liu, Feng, Chen, & Li, 2013). In other words, when prospecting about a positive event, participants were more likely to forego smaller immediate rewards for greater future rewards. It is possible that this tendency to prefer immediate, smaller rewards could be related to diminished positive emotion while prospecting or predicting as much positive emotion in the future. Our findings would suggest, however, that recalling the positive past before prospection might help people with schizophrenia to experience current and predicted positive emotion similar to people without schizophrenia, which may in turn help them to place higher value on more distant rewards. It would be interesting to test this idea in a future study by conjointly assessing prospection for future events and reward discounting.

As with any study, there are important limitations to acknowledge. First, our sample sizes were relatively small. Although we found group differences on some of our measures, the inability to find group differences on other measures may reflect the fact that we were underpowered to do so or that our measures were not sensitive enough to detect subtle group differences. Second, our group of people with schizophrenia had higher estimated IQ scores and years of education than is reported in some studies, suggesting that our sample may not be as representative of people with schizophrenia. However, it is important to note that the schizophrenia sample experienced moderate symptoms (as measured by the BPRS and CAINS) and reported a chronic illness history. Thus, from a clinical perspective, our sample closely resembled other samples with schizophrenia. Third, we investigated only a subset of potential processes related to anticipatory pleasure (i.e., memory, prospection, and imagery). Indeed, other processes are related to anticipatory pleasure deficits (Kring & Barch, 2014), such as defeatist beliefs (Grant & Beck, 2009) and difficulties with reward processing (Strauss et al., 2014).

To conclude, this study was the first to investigate three building blocks of anticipatory pleasure (i.e., memory, prospection, and imagery) in one study, providing insights about processes that may and may not be disrupted in schizophrenia. While the abilities to generate memories and vivid imagery appear to remain intact, our findings suggest that further exploring prospection abilities may help to provide greater understanding of anticipatory pleasure deficits in schizophrenia. Specifically, future studies should continue to investigate similarities and differences in how people with and without schizophrenia generate and draw from past experiences when creating prospectations.

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Appendix 1

Event Cue List

Narrative Cue: *“With as much detail as possible, as if you were telling me a story, tell me about a specific time in the (past/future) you (will) [insert event cue here].”*

List A	List B	List C
Birthday	Argue or disagree	Financial problems or stress
Sick or injured	Favorite movie or TV show	Meal for yourself
Ask for directions	Morning routine	Time with friends
Receive bad or stressful news	Accomplishment big or small	Lose something important
Favorite food or meal	Broke or needs repair	Favorite “free time” activity

Control Memory Cue List

Control Cue: *Tell me each of the steps that Sally would need to take in order to [insert control cue here]. Tell me enough detail so that she can do each step.*

Getting food from the vending machine
Making a PB&J Sandwich
Purchasing socks from the store
Scheduling a doctor’s appointment
Getting a book from the library

Footnotes

¹ Preliminary analyses revealed no order effects, one significant sex difference: men with schizophrenia scored higher on the CAINS EXP scale than women with schizophrenia group ($t(30) = 3.43, p < 0.00$), and two significant diagnosis differences: people with a schizoaffective disorder diagnosis had more years of education ($t(30) = 2.83, p < 0.01$) and had higher IQ scores ($t(30) = 2.31, p < 0.03$) than people with a schizophrenia diagnosis.

² Individual positive and negative cues produced the same results and also confirmed to our *a priori* valence designation.

Table 1**Demographic and clinical variables**

	Schizophrenia Mean (S.D.)	Control Mean (S.D.)	<i>p</i> -value
Sex (M/F)	17/15	16/13	.87
Diagnosis (SZ/ SA)	20/12	--	
Age	48.56 (10.25)	47.59 (10.53)	.72
Years of Education	15.19 (2.97)	15.88 (2.21)	.31
WTAR FSIQ	104.19 (12.95)	105.03 (9.81)	.78
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)	--	
QMI	78.66 (28.71)	68.96 (26.78)	.20
Control Task	19.66 (4.37)	21.31 (3.78)	.11

Note. 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; QMI = Questionnaire upon Mental Imagery; * $p < .05$.

Table 2
Mean ratings of coded and self-rated variables for memories and prospections

	Schizophrenia			Control		
	Memory	Past/Future	Control/Future	Memory	Past/Future	Control/Future
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
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)
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)
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)
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)
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)
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)
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)
Sensory Experience						
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)
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)
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)
Context Experience						
Positive	5.71 (1.03)	5.15 (1.64)	5.10 (1.51)	6.18 (.088)	5.24 (1.38)	5.83 (0.98)
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)

Note. Past/Future = prospections following the personal memory task; Control/ Future = prospections following the control task.

Table 3

Correlations of CAINS MAP scores with current or predicted positive emotion

	Prospections after the Personal Memory task		Prospections after the Control task	
<u>Positive Emotion</u>	<u>Current</u>	<u>Predicted</u>	<u>Current</u>	<u>Predicted</u>
CAINS MAP	-.36*	-.16	.10	.20

Note: CAINS MAP = Clinical Assessment Inventory for Negative Symptoms Motivation and Pleasure Scale; * $p < .05$.

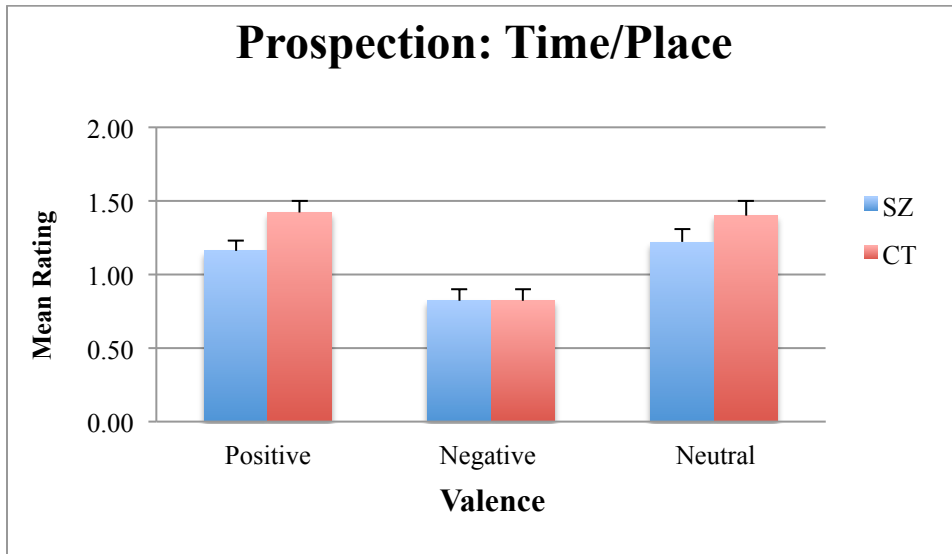


Figure 1. Mean time/place scores as a function of prospection (collapsed across condition: past/future, control/future) and valence (positive, negative, neutral) for people with (SZ) and without (CT) schizophrenia. Scores range from 0 (no time or place indicators) to 2 (both time and place indicators). Analyses revealed significant group ($p < .05$) and valence ($p < .00$) main effects, with people with schizophrenia providing fewer time/place indicators than controls, and negative prospectations containing fewer time/place indicators than positive and neutral prospectations.

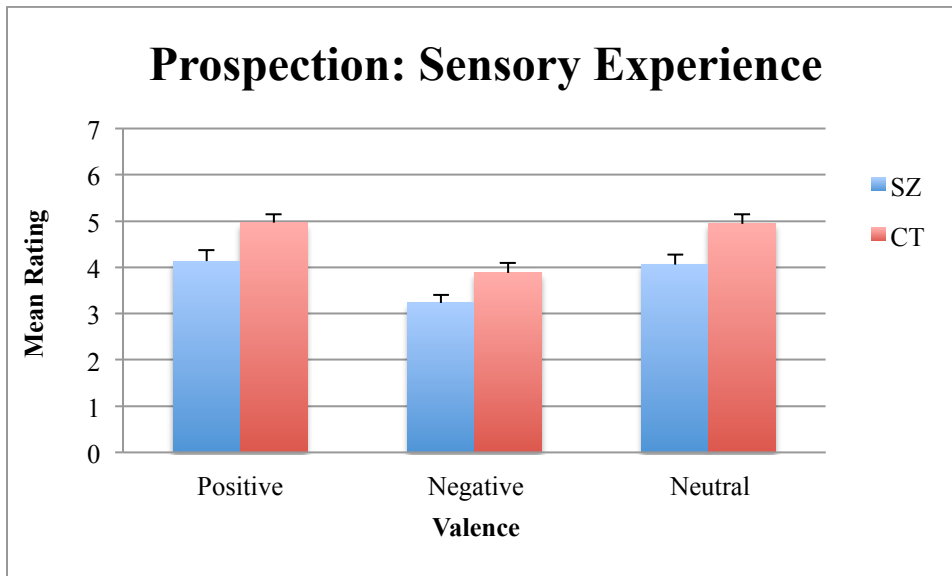


Figure 2. Mean sensory experience scores as a function of prospection (collapsed across condition) and valence (positive, negative, neutral) for people with (SZ) and without (CT) schizophrenia. Scores range from 0 (none) to 7 (a lot). Analyses revealed significant group ($p < .00$) and valence ($p < .00$) main effects, with people with schizophrenia reporting less sensory experience than controls, and negative prospectings containing less sensory experience than positive and neutral prospectings.