Schizophrenia Research: Cognition 5 (2016) 35–40

Contents lists available at ScienceDirect

Schizophrenia Research: Cognition

journal homepage: http://www.schizrescognition.com/

# Positive schizotypy and negative schizotypy are associated with differential patterns of episodic memory impairment

Lili Sahakyan [a,*], Thomas R. Kwapil [a,b]

[a] University of Illinois
[b] University of North Carolina at Greensboro

ARTICLE INFO

*Article history:*
Received 5 January 2016
Received in revised form 25 June 2016
Accepted 1 July 2016
Available online 18 July 2016

*Keywords:*
Episodic memory
Cognition
Semantic network
Schizotypy
Schizophrenia

ABSTRACT

Cognitive impairment is a hallmark of schizophrenia; however, studies have not comprehensively examined such impairments in non-clinically ascertained schizotypic young adults. The present study employed a series of measures to assess episodic memory in high positive schizotypy, high negative schizotypy, and comparison groups (each group $n = 25$). Consistent with diminished cognitive functioning seen in negative symptom schizophrenia, the negative schizotypy group exhibited deficits on free recall, recognition, and source memory tasks. The positive schizotypy group did not demonstrate deficits on the above mentioned tasks. However, in contrast to the other groups, the positive schizotypy group showed an unexpected set-size effect on the cued-recall task. Set-size effect, which refers to the finding that words that have smaller networks of associates tend to have a memory advantage, is usually found in associative-cuing, but not cued-recall, tasks. The finding for the positive schizotypy group is consistent with heightened spreading activation and reduced executive control suggested to underlie psychotic symptoms. The findings support a multidimensional model of schizotypy and schizophrenia, and suggest that positive and negative schizotypy involve differential patterns of cognitive impairment.



## 1. Introduction

Cognitive impairment is a hallmark of schizophrenia. The vast literature on this topic indicates deficits in attention, memory, and executive functions (e.g., Aleman et al., 1999; Harvey, 2013; Heinrichs and Zakzanis, 1998; Reichenberg et al., 2008). However, challenges remain in distinguishing etiologically relevant cognitive impairment from sequelae of the disorder and determining whether individual areas of cognitive dysfunction simply represent generalized performance impairment. Episodic memory in schizophrenia appears to be impaired beyond deficits accounted for by generalized cognitive impairment (Dickinson et al., 2008; Mesholam-Gately et al., 2009). Episodic memory deficits in schizophrenia have been variously linked to deficits in encoding (i.e., organization of to be learned material), disruption of retrieval (i.e., conscious recollection), as well as deficits in working memory, inhibition, and context processing (e.g., Bonner-Jackson et al., 2005). Impaired memory in schizophrenia has significant real-world impact and is a strong predictor of poor functioning (Green, 1996; Green et al., 2000), even after accounting for generalized cognitive dysfunction (Laes and Sponheim, 2006). Memory deficits are found regardless of duration of illness prior to treatment and these deficits persist following treatment (Addington et al., 2005; Barnes et al., 2008; Goldberg et al., 2007). They also are independent of intelligence and executive functioning (Kopald et al., 2012).

The study of cognitive impairment in schizophrenia is complicated by the fact that it is difficult to disentangle whether the deficits are etiologically relevant, because the consequences of the disorder (e.g., medication, stress) may disguise influences that are specific to schizophrenia. Even when testing unmedicated, first-episode patients, acute symptoms may impair motivation and ability to perform cognitive tasks. Thus, schizotypy provides a promising vantage for studying these deficits relatively unaffected by the effects of schizophrenia. Schizotypy represents the expression of the underlying vulnerability for schizophrenia across a continuum of subclinical and clinical impairment (Kwapil and Barrantes-Vidal, 2015). Schizotypy, and by extension schizophrenia, is multidimensional with positive and negative dimensions the most commonly identified. Numerous studies have demonstrated that positive schizotypy and negative schizotypy are associated with differing patterns of impairment

* Corresponding author at: Department of Psychology, University of Illinois, 603 E. Daniel Street, Champaign, IL 61820.
*E-mail address:* lsahaky@illinois.edu (L. Sahakyan).

http://dx.doi.org/10.1016/j.scog.2016.07.001

(e.g. Barrantes-Vidal et al., 2013; Ettinger et al., 2015; Gooding and Pflum, 2011; Kwapil et al., 2013).

Multiple processes determine memory performance, and impairment may not necessarily impact all processes comparably. Understanding which cognitive processes are affected by schizotypy and schizophrenia requires the use of different memory paradigms that measure specific processes (vs. broad neurocognitive assessments that are more useful for diagnostic purposes rather than detailed assessment of memory processes). The present study assessed episodic memory in positive and negative schizotypy using a combination of paradigms, including free recall, recognition, source memory, cued recall, and associative cuing, which assesses the influence of set-size effects in semantic networks on episodic memory.

Set-size effects are based on the notion that encoding a familiar word implicitly activates its related concepts from past experiences (e.g., Anderson, 1983; Kintsch, 1988; Nelson et al., 1992). Although implicitly activated associates are not consciously experienced, they nevertheless affect episodic memory. For example, words that produce fewer associates in free association (i.e., have smaller network of associates) have a memory advantage compared to words that produce many associates — known as the *set-size effect* (Nelson and Friedrich, 1980; Nelson et al., 1992, 1998). The negative impact of set-size is contingent on the type of memory task. For example, in associative-cuing task, target words are studied in isolation (e.g., study DECORATION), and during the test, a meaningfully related word (e.g., CAKE) is presented as a cue to help retrieve the target. Associative-cuing tasks typically reveal the detrimental effect of set-size, with words having larger set size being poorly remembered. In contrast, set-size has no effect in a standard cued-recall test, when cues are studied simultaneously with the target (e.g., studying CAKE-DECORATION, and during the test receiving CAKE as a cue to retrieve DECORATION). The negative effect of set-size in associative cuing is attributed to interference from increasing number of competing associates that are activated in larger networks (DECORATION can have multiple meanings, and retrieving the appropriate meaning in response to CAKE becomes more challenging when there are multiple alternatives to select from given the large network size). In contrast, when cues are studied with targets, they *constrain* the meaning of the target, by down regulating or inhibiting the initial implicit activation of the target's competing associates. Thus, when CAKE is studied along with DECORATION, it prevents the alternative meanings of DECORATION from coming to mind. Therefore, set-size has a negative effect in associative cuing, but it does not affect cued recall.

The goals of the present study were to examine episodic memory deficits and set-size effect in positive and negative schizotypy. Previous studies have examined various forms of memory in schizotypy (see Ettinger et al., 2015, for a selective review); however, this is the first study to examine set-size effect. Gooding and Braun (2004) found reduced nonverbal memory performance in a negative schizotypy group relative to positive schizotypy and control groups. Stefaniak et al. (2015) reported that positive schizotypy was negatively related with controlled memory processes. LaPorte et al. (1994) failed to find associations between schizotypy and memory performance; however, their study was limited to a single logical memory task. Kaczorowski et al. (2009) reported that negative, but not positive, schizotypy was associated with memory recall deficits. However, the interpretation of other memory studies in schizotypy is often constrained by methodological limitations, including failure to examine schizotypy dimensions separately, use of problematic measures of schizotypy, failure to examine multiple memory processes, and the use of clinical screening measures of memory that are not sufficient for disentangling complex memory processes.

Given reports of cognitive impairment in negative symptom schizophrenia, it was expected that negative schizotypy would be associated with episodic memory impairment (Addington et al., 1991; Green and Walker, 1985), although the nature of the process that is disrupted in memory remains to be established. On the associative-cuing task, we expected all three groups to exhibit set-size effect, whereas obtaining larger set-size effect among schizotypy participants would suggest that they have larger and more expanded associative networks, indicating abnormalities with organization of their semantic system. Finally, consistent with previous memory research, we did not expect to obtain set-size effect in cued recall, whereas obtaining such an effect in the schizotypy groups would implicate disruption in processes that act on the semantic network (e.g., activation/inhibition).

## 2. Methods

### 2.1. Participants

Participants were 75 undergraduates from introductory psychology courses. They were invited to participate based on scores on the Wisconsin Schizotypy Scales—brief version (Winterstein et al., 2011) administered in mass-screening sessions. The positive and negative schizotypy groups included 25 participants each who scored at least 1.5 SD above the mean on the respective schizotypy dimension based on a sample of 6137 young adults (Gross et al., 2012). The comparison group contained 25 participants who scored within .5 SD of the mean on both the positive and negative schizotypy scores.

### 2.2. Materials and procedures

Participants completed brief versions of the Perceptual Aberration (Chapman et al., 1978), Magical Ideation (Eckblad and Chapman, 1983), Physical Anhedonia (Chapman et al., 1976), and Revised Social Anhedonia (Eckblad et al., 1982) Scales. Two factors, positive and negative schizotypy, underlie the original (Kwapil et al., 2008) and brief (Gross et al., 2015) versions of the scales. Positive and negative schizotypy factor scores were computed following formulae in Gross et al. (2015). Descriptive statistics for the schizotypy dimensions are in Table 1.

Participants completed a battery of verbal memory tests, and in between each test solved spatial tasks for 5 min. Memory was assessed with (A) a free recall test, (B) a recognition test along with source identification, (C) a cued-recall test, and (D) an associative-cuing test. To counterbalance the test order, forward (ABCD) and reverse (DCBA) order of administration was used. Stimuli for each test were unique and did not appear on the remaining tests.

*Free recall* test involved studying 12 unrelated nouns of medium frequency (based upon Kucera and Francis, 1967) presented at a rate of 5 s and completing math problems on the computer screen for 30 s, followed by a 60 s recall period, during which participants typed recalled words into the computer in any order. The procedure was repeated five times, with new words presented during each block.

**Table 1**
Mean standardized positive and negative schizotypy scores across the groups.

| | Positive schizotypy Z-scores | | Negative schizotypy Z-scores | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| Control group | −0.12 | 0.39 | −0.11 | 0.29 |
| Positive Schizotypy group | 2.65 | 0.67 | 0.07 | 0.48 |
| Negative Schizotypy group | −0.15 | 0.54 | 2.53 | 0.67 |

Positive and negative schizotypy factors scores are based upon formulae in Gross et al. (2015).