



Attenuated positive psychotic symptoms and social anxiety: Along a psychotic continuum or different constructs?



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ABSTRACT

Social anxiety commonly occurs across the course of schizophrenia, including in the premorbid and prodromal phases of psychotic disorders. Some have posited that social anxiety may exist on a continuum with paranoia; however, empirical data are lacking. The study aim was to determine whether attenuated positive psychotic symptoms are related to social anxiety. Young adults ($N=1378$) were administered the Prodromal Questionnaire (PQ), which measures attenuated positive psychotic symptoms (APPS), and the Social Phobia Scale (SPS), which measures a subset of social anxiety symptoms. Confirmatory factor analyses were conducted to address the extent to which social anxiety and APPS tap distinct dimensions. Confirmatory factor analyses support the existence of a separate social anxiety factor scale and four separate, though interrelated, APPS factor domains (unusual thought content, paranoia/suspiciousness, disorganized thinking, and perceptual abnormalities). Additionally, social anxiety was significantly, but not differently related to each APPS domain, although the magnitude was reduced between social anxiety and distressing APPS. The current study suggests that social anxiety and attenuated positive psychotic symptoms are separable constructs, but are significantly associated with each other.

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1. Introduction

Social anxiety commonly occurs in the course of schizophrenia and other psychotic disorders (Lencz et al., 2004; Meyer et al., 2005; Rosen et al., 2006; Yung et al., 2003). Specifically, evidence supports a relationship between social anxiety disorder and schizophrenia (Braga et al., 2004; Pallanti et al., 2013), with rates of comorbidity ranging from 8–36% (Braga et al., 2004; Lysaker and Salyers, 2007). Further, signs of social anxiety, such as shyness and isolated play, have been noted in children who later go on to develop schizophrenia (i.e., during the premorbid period, before symptom emergence) (Evans et al., 2005). Similarly, social anxiety commonly occurs in those with attenuated psychotic symptoms (Jones et al., 1994), in those at clinical high-risk for psychosis (Corcoran et al., 2003; Rietdijk et al., 2013; Tan and Ang, 2001), and in those in the prodrome of the disorder, a period when psychotic symptoms start to emerge (Häfner et al., 1995; Meyer et al., 2005). Moreover, research on help-seeking individuals at

clinical high risk for psychotic disorders has indicated that those with social anxiety have decreased quality of life and lower self-esteem (Romm et al., 2012), a greater number of attenuated positive psychotic symptoms (APPS), such as perceptual abnormalities and unusual thought content (Jones et al., 1994; Lysaker and Salyers, 2007), and poorer prognoses for psychosis (Lysaker and Salyers, 2007; Wigman et al., 2012). Given these findings, it is imperative to understand how social anxiety relates to psychotic symptoms, especially in the earliest stages of psychosis.

Previous research has suggested that social anxiety may be on the same continuum as, but a less severe form of, paranoia (Freeman et al., 2005), whereas others have proposed that social anxiety is distinct from psychotic paranoia and precedes or co-occurs with psychotic symptoms (Wigman et al., 2012). Freeman et al. (2005) suggested a hierarchy of paranoia indicating that paranoia and symptoms of social anxiety are along a continuum. This hierarchy has a base of social suspiciousness and interpersonal worry, proceeding to progressively more problematic suspiciousness, finally transitioning into severe paranoia. The hierarchy they provided implies an additive structure, such that each worry or suspicion experienced can contribute toward the eventual development of severe paranoia at a delusional level and that severe paranoia cannot happen independently of the

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preceding stages (Freeman et al., 2005). Conversely, Wigman et al. (2012) suggested that social anxiety co-occurs with paranoia as a response to difficulties occurring in the course of a psychotic disorder. Psychotic symptoms have been associated with social stigmatization, which may lead to low morale and depression (Ritsher and Phelan, 2004). These factors may motivate an individual to avoid social situations due to increased symptoms and fear of appearing strange when around others (Link and Phelan, 2001). One recent study assessing the relationship between attenuated psychotic symptoms and anxiety found moderate correlations between an array of psychosis risk screeners and the Beck Anxiety Inventory (Kline et al., 2012). Nevertheless, studies have not investigated whether social anxiety represents a distinct construct from psychotic symptoms, which is a critical first step in understanding how social anxiety operates within psychotic disorders. Because previous research has suggested that treatment for social anxiety among schizophrenia populations can improve anxiety and psychosis-related symptoms (Halperin et al., 2000; Kingsep et al., 2003), determining how social anxiety is related to attenuated psychotic symptoms has potential applications for early prevention and treatment strategies; however, these clinical trials were conducted prior to characterizing social anxiety within psychotic disorders, which could further improve targeted interventions.

Studies have typically examined social anxiety among help-seeking individuals; it is therefore unclear whether social anxiety is related to the whole continuum of psychotic symptoms, including APPS. APPS, such as perceptual abnormalities or unusual thought content, are symptoms commonly endorsed in the general population that are not severe enough to meet criteria for diagnosis of a psychotic disorder (Hanssen et al., 2003; Kendler et al., 1996; Salokangas and McGlashan, 2008). APPS are typically examined through self-report measures (i.e., Prodromal Questionnaire (PQ); Loewy et al., 2007, 2005) and/or clinical interviews (i.e., Structured Interview for Psychosis Risk Syndromes (SIPS); Miller et al., 2003). In a portion of individuals, APPS can precede a psychotic disorder (Cannon et al., 2008); however, even in those who do not develop a psychotic disorder, findings suggest that APPS share many of the same risk factors as psychotic disorders, such as schizophrenia (Esterberg and Compton, 2009). Establishing whether social anxiety co-occurs with APPS in a non-help seeking population may help in identifying overlapping risk factors, as well as identify those who may benefit from proactive treatments for psychosis but do not meet criteria for a mental disorder.

The aims of the present study were to determine whether APPS are related to social anxiety. An additional aim of the present study was to determine if APPS endorsed as distressing (APPS-distressing) are also related to social anxiety, as distressing symptoms have been associated with a higher likelihood of seeking treatment and tend to have higher predictive power for conversion to psychotic disorders (Freeman and Garety, 1999; Garety et al., 2001). Factor analyses were conducted to address the extent to which social anxiety and particular positive psychotic symptom domains (paranoia/suspiciousness, perceptual abnormalities, disorganized thinking, unusual thought content) measure distinct dimensions. We hypothesized that (1) APPS/APPS-distressing will load on 4 distinct factors, similar to the positive categories within the SIPS (Miller et al., 2003): unusual thought content, paranoid/suspicious ideation, perceptual abnormalities, and disorganized thinking; (2) social anxiety will be positively correlated with all 4 APPS factors and all 4 APPS-distressing factors, but it will cross-load on the paranoid ideation factor, indicating that social anxiety may, in part, overlap with the construct of paranoia.

2. Method

2.1. Participants

The protocol was approved by the Institutional Review Board at Temple University. Written informed consent was obtained from all participants prior to enrollment. Participants ($N=1400$) were a diverse group of undergraduate students from a large university, who were recruited via an online participant recruitment website, were at least 17 years of age, and were representative of the university community. The online recruitment website, which was open to all undergraduate students at the university, listed the current study with all other available studies that one could choose to participate in; studies are listed in random order. To participate, an individual would select our study from the list of options, be provided information regarding what the study would entail and where it was located, and then choose a day and time that was conducive to their schedule from the options available. A general description of our study is provided to students, which states that the study focuses on psychological symptoms and life events. Our sample included only three 17-year-old participants due to mid-study IRB changes that now restrict participant recruitment to individuals who are age 18 and older. Following data screening (described below), our sample size for analyses was reduced to 1378 cases; see Table 1 for participant demographic characteristics as well as scores on the two primary study measures.

2.2. Procedures

Following informed consent, participants were directed to a laboratory computer terminal at which questionnaires were administered individually, electronically administered (Survey Monkey Inc., Palo Alto, CA). Demographic characteristics were first collected, followed by the administration of additional questionnaires, including the Prodromal Questionnaire (Loewy et al., 2007, 2005) and Social Phobia Scale (Mattick and Clarke, 1998).

2.3. Measures

2.3.1. The Prodromal Questionnaire (PQ) (Loewy et al., 2007, 2005)

The PQ, a 92-item self-report measure, has established validity in identifying individuals who are at risk for a psychotic disorder and measures attenuated psychotic symptoms in four domains: positive, negative, disorganized, and general. Participant responses were dichotomized to indicate whether or not they had experienced a given symptom ("Yes" or "No") in the past month. Additionally, for those items endorsed as having been experienced, the participant indicated ("Yes" or "No") whether or not each experienced symptom was distressing. The PQ, which has high levels of reported internal consistency ($\alpha=.96$, Loewy et al., 2005), has been tested against semi-structured interviews commonly used to identify individuals at risk for psychosis, such as the SIPS (Kline et al., 2012; Loewy et al., 2005; Miller et al., 1999) and has been found to be both reliable and valid in comparison, with 90% sensitivity and 49% specificity (Loewy et al., 2005; Miller et al., 1999). Endorsing 8 or more APPS items in the past month has been validated against the SIPS in clinical populations (Loewy et al., 2007). Similarly, 8 or more APPS-distressing identified 2% of an undergraduate sample (Loewy et al., 2012, 2007, 2005), which generally corresponds to expected lifetime prevalence rates of psychotic disorders in the general public (Kessler et al., 2005).

For the purpose of the current study, we were interested in investigating the attenuated positive symptom domain, as this domain has been associated with increased risk for psychotic disorders and has been primarily studied in investigations of

Table 1
Participant demographic characteristics and questionnaire scores.

	Overall Sample (N=1378)
Demographics	
Male, n (%)	390 (27.60)
Age (years), mean (SD) [range]	20.52 (2.40) [17–35]
Race, n (%)	
Non-Hispanic White	818 (59.40)
Asian/Pacific Islander	182 (13.20)
African-American	175 (12.70)
Hispanic/Latino	59 (4.30)
Biracial/Multiracial	62 (4.50)
Other	82 (4.90)
Social Phobia Scale, mean (SD) [range]	12.92 (11.94) [0–70]
Prodromal Questionnaire mean (SD) [range]	
Positive psychotic items	8.68 (7.10) [0–38]
Distressing positive psychotic items	3.13 (4.29) [0–33]

attenuated psychotic symptoms in the general population (Cannon et al., 2008; Loewy et al., 2007). In line with previous research, distressing items are an additional focus for the current study, as those who endorse APPS-distressing items are at a higher likelihood of developing a psychotic disorder (Hanssen et al., 2003; Loewy et al., 2007). PQ positive items were examined using binary variables: (1) the presence or absence of the symptom (APPS), and (2) whether or not an endorsed symptom was experienced as distressing (APPS-distressing). Further, subscales of the APPS/APPS-distressing items were examined to determine whether social anxiety was related to and/or overlapped with specific APPS/APPS-distressing domains. Specifically, APPS/APPS-distressing items were categorized into suspiciousness/paranoia, unusual thinking, perceptual abnormalities, and disorganized thinking, based on categories from the SIPS (Miller et al., 2003) (see Table 2–4).

2.3.2. Social Phobia Scale (SPS) (Mattick and Clarke, 1998)

The SPS assesses social anxiety related to performing various tasks (e.g., writing, drinking, eating) while being observed by others. The SPS has been shown to have high internal consistency in undergraduate ($\alpha=0.90$), community ($\alpha=0.90$), and clinically socially anxious ($\alpha=0.89$) samples (Mattick and Clarke, 1998), as well as test-retest reliability and convergent relationships with other measures of social anxiety (Brown et al., 1997; Heimberg et al., 1992; Mattick and Clarke, 1998). The SPS consists of 20 items rated on a 5-point Likert scale that ranged from 0 (*not at all characteristic or true of me*) to 4 (*extremely characteristic or true of me*).

The SPS is often administered with the Social Interaction Anxiety Scale (SIAS), and previous factor analyses typically included both questionnaires (Heimberg et al., 1992; Mattick and Clarke, 1998). In the original development of the SPS (Mattick and Clarke, 1998), three factors were obtained: being observed or attracting attention, specific fears, and fears of being viewed as sick or odd. In an exploratory factor analysis investigating the joint factor structure of the SPS and SIAS, three factors were found: interaction anxiety, anxiety about being observed, and fear that anxiety symptoms would be noticed by others (Safren et al., 1998). However, this study also showed that a hierarchical factor analysis yielded a single factor of social anxiety. To our knowledge, however, there has been no additional work investigating the factor analytic structure focusing solely on the items of the SPS.

2.4. Data screening

Participants who did not report their age ($n=6$) were removed to ensure that participants from the sample were within the

Table 2
Prodromal Questionnaire (PQ) positive items grouped by subscale.

	Unusual thought
2	The passage of time has felt unnaturally faster or slower than usual
7	Previously familiar surroundings have seemed strange, confusing, threatening or unreal
8	I seemed to live through events exactly as they happened before (<i>déjà vu</i>)
24	I have had experiences with telepathy, psychic forces, or fortune-telling
27	I have felt that I was not in control of my own ideas or thoughts
30	I have thought that I am very important or have abilities that are out of the ordinary
32	My thoughts have seemed to be broadcast out loud so that other people knew what I was thinking
36	I have heard my own thoughts as if they were outside of my head
46	I have thought that things I saw on the TV or read in the newspaper had a special meaning for me
55	I have been worried that something may be wrong with my mind
56	I have felt that I did not exist, the world did not exist, or that I was dead
57	I have been confused whether something I experienced was real or imaginary
61	I have thought about beliefs that other people would find unusual or bizarre
65	My thoughts have been so strong that I could almost hear them
67	I have seen special meanings in advertisements, shop windows, or in the way things were arranged around me
74	I have felt that some person or force interfered with my thinking or put thoughts into my head
75	I have had experiences with the supernatural, astrology, seeing the future or UFOs
	Paranoia/suspiciousness
12	I have thought that other people could read my mind
25	I have thought that other people had it in for me
35	I have had superstitious thoughts
38	I have felt that other people were watching me or talking about me
52	I have had the sense that some person or force was around me, even though I could not see anyone
68	I have picked up hidden threats or put-downs from what people said or did
76	People have dropped hints about me or said things with a double meaning
77	I have been concerned that my closest friends and co-workers were not really loyal or trustworthy
	Perceptual abnormalities
4	When I looked at a person, or at myself in a mirror, I have seen the face change right before my eye
5	I have noticed strange feelings on or just beneath my skin, like bugs crawling
9	I have smelled or tasted things that other people did not notice
13	I have heard things other people could not hear like voices of people whispering or talking
18	I have heard unusual sounds like banging, clicking, hissing, clapping or ringing in my ears
19	I have mistaken shadows for people or noises for voices
20	Things have appeared different from the way they usually do (larger or smaller, or changed in some other way)
26	My sense of smell has seemed unusually strong
34	I have felt unusually sensitive to noise
50	I have felt suddenly distracted by distant sounds that I am not normally aware of
60	I have experienced unusual bodily sensations such as tingling, pulling, pressure, aches, burning, cold, numbness, shooting pains, vibrations or electricity
64	I have felt that parts of my body had changed in some way, or that parts of my body were working differently than before
79	I have seen unusual things like flashes, flames, blinding light, or geometric figures
84	I have seen things that other people apparently could not see
	Disorganized thinking
3	I have had difficulty organizing my thoughts or finding the right words
23	I have wandered off the topic or rambled on too much when I

Table 2 (continued)

Unusual thought	
	was speaking
37	I have had trouble focusing on one thought at a time
49	My thinking has felt confused, muddled, or disturbed in some way
69	I have used words in unusual ways
90	People have found it hard to understand what I say

typical age range (17–35 years old) of individuals developing schizophrenia (American Psychiatric Association, 2013). Those who reported being over 35 years of age ($n=15$) were also removed as they were > 3 SDs above the mean age. One additional case was removed for omitting responses to the SPS. Data analyses used the total resultant sample of 1378 participants.

2.5. Data analysis plan

Mean and variance adjusted weighted least-squares confirmatory factor analyses (CFA) were conducted using M-Plus, Version 7 (Muthen and Muthen, 1998) to assess the factor structure of the SPS, as well as the joint factor structure of the SPS and PQ subscales (unusual thought content, perceptual abnormalities, paranoia/suspiciousness, disorganized thinking) for (1) positive items and, (2) positive items endorsed as distressing. CFAs were conducted to investigate whether SPS items would cross-load with the PQ paranoia/suspiciousness subscale when all items were restricted to load on four total factors (i.e., SPS and 1. paranoia/suspiciousness, 2. unusual thought content, 3. perceptual abnormalities, and 4. disorganized thinking) or whether a 5 factor solution better fit these data (i.e., SPS plus the 4 PQ subscales). Models were conducted separately for APPS and APPS-distressing.

Fit indices were considered acceptable if indices were near 0.95 (Hu and Bentler, 1999), which is consistent with previous work suggesting that index cutoffs can be misleading and strict cut-offs should be avoided (Hayduk et al., 2007). Specifically, acceptable fit was reached when the comparative fit index (CFI) was > 0.90 , Tucker-Lewis index (TLI) was > 0.90 , root mean square error of approximation (RMSEA) was < 0.06 (Hu and Bentler, 1999), and factor loadings of 0.30 or greater were considered acceptable. Factor loadings lower than 0.30 and eigenvalues below 1 were suppressed. Internal consistency was calculated using Cronbach's alpha (Cronbach, 1951) for the SPS, and Kuder-Richardson Formula 20 (KR20) for the PQ; scores for both Cronbach's α and KR20 range from 0.0–1.0, with scores > 0.7 being acceptable and scores > 0.9 being excellent (Cronbach, 1951; Kuder and Richardson, 1937). Finally, Pearson's correlations were calculated to determine the magnitude of the associations between factors.

3. Results

As Table 1 indicates, the sample was diverse with regard to race/ethnicity. There were, however, significantly fewer males than females [$\chi^2(1, N=1378)=277.16, p < .001$]. All analyses were conducted stratified by gender, but because results did not differ, combined statistics are presented for the sake of brevity (data available upon request). The overall age ($M=20.52, SD=3.56$) of the sample was consistent with that of an undergraduate sample and falls within the typical age range for onset of a psychotic disorder (ages 17–35; APA, 2013). The sample endorsed a similar number of APPS ($M=8.68, SD=7.10, \text{range}=0\text{--}38$) as reported in previous studies (Loewy et al., 2007). SPS scores in our sample were comparable to those reported for other undergraduate

samples (Heimberg et al., 1992).

3.1. Factor analyses and correlations

CFAs were conducted to determine if SPS items loaded preferentially onto the paranoia/suspiciousness positive symptom subscale or if another model was more appropriate. CFAs were conducted forcing SPS items to load specifically onto the paranoia/suspiciousness, with a 4-factor solution (i.e., SPS and 1. paranoia/suspiciousness, 2.unusual thought content, 3. perceptual abnormalities, and 4. disorganized thinking). The 4-factor model fit was poor (CFI / TLI < 0.90 ; RMSEA=.06), suggesting that the model was not acceptable. Conversely, the model better fits the data when there are 5 separate and distinct factors (SPS and the 4 PQ subscales).CFA fit indices show superior fit, as indicated by being near or over 0.95, for CFAs including the PQ factors plus SPS scores as 5 separate factors (CFI=0.943, TLI=0.941, RMSEA=0.024 [90% CI 0.022, 0.025]), as well as the PQ distressing factors plus SPS scores as 5 separate factors (CFI=0.966, TLI=0.965, RMSEA=0.014 [90% CI 0.013, 0.016]). Additionally, the SPS was significantly correlated with each subscale of the PQ and the magnitude of these associations was approximately equal for each subscale (see Table 5). While significant correlations occurred for all factors in both APPS and APPS-distressing, it is of note that correlations between SPS and APPS-distressing subscales were substantially lower than correlations between SPS and APPS subscales.

3.2. Internal consistency

Internal consistency was calculated using Cronbach's alpha (Cronbach, 1951) for the SPS, and was found to be excellent ($\alpha=0.94$), and consistent with previous undergraduate samples (Mattick and Clarke, 1998). Internal consistencies for the PQ were computed using Kuder-Richardson Formula 20 (KR20). Alpha levels for PQ subscales were as follows: unusual thought content KR20=0.79, perceptual abnormalities KR20=0.74, paranoia/suspiciousness KR20=0.73, disorganized thinking KR20=0.70. All PQ subscales demonstrated acceptable internal consistency.

4. Discussion

This study suggests that social anxiety and APPS/APPS-distressing appear to be non-overlapping, but associated constructs. Specifically, results from the present study indicated that items from the SPS do not load on the paranoia/suspiciousness factor of the PQ, providing some initial evidence that social anxiety may represent a distinct construct from paranoia/suspiciousness. Nevertheless, the SPS factor was similarly correlated with each APPS/APPS-distressing domain, suggesting that social anxiety is associated with a range of attenuated positive psychotic symptoms. The SPS factor, however, was more strongly related to APPS than it was to APPS-distressing, potentially indicating that as APPS symptoms become more clinically meaningful they become less related to social anxiety. Support for this possibility comes from unreported findings that those individuals with potentially more clinically relevant attenuated psychotic symptoms (D-APPS; defined by those experiencing 8 or more distressing attenuated positive psychotic symptoms on the PQ) compared with those at lower risk (low-APPS; defined by those experiencing 3 or fewer symptoms on the PQ) exhibited significantly higher social anxiety scores (close to 20 points higher on the SPS scale, $\eta^2=0.28$), suggesting that social anxiety still occurs frequently in those with distressing APPS ($M=45.45, SD=14.72$) relative to those with few APPS ($M=28.77, SD=14.72$), which is consistent with our previous findings, as well (Reeves et al., 2014).

Table 3
Factor loadings of a confirmatory factor analysis of the Social Phobia Scale (SPS) and Prodromal Questionnaire (PQ) APPS items.

Factors and items	1 Social Anxiety Factor	2 APPS: Unusual Thought	3 APPS: Paranoia/Suspiciousness	4 APPS: Perceptual Abnormalities	5 APPS: Disorganized Thinking
Social anxiety					
SPS20	0.735	–	–	–	–
SPS15	0.726	–	–	–	–
SPS4	0.708	–	–	–	–
SPS16	0.704	–	–	–	–
SPS6	0.698	–	–	–	–
SPS12	0.697	–	–	–	–
SPS17	0.692	–	–	–	–
SPS13	0.691	–	–	–	–
SPS8	0.669	–	–	–	–
SPS7	0.661	–	–	–	–
SPS14	0.627	–	–	–	–
SPS11	0.600	–	–	–	–
SPS10	0.557	–	–	–	–
SPS5	0.553	–	–	–	–
SPS3	0.545	–	–	–	–
SPS18	0.545	–	–	–	–
SPS19	0.538	–	–	–	–
SPS9	0.524	–	–	–	–
SPS1	0.480	–	–	–	–
SPS2	0.468	–	–	–	–
APPS: Unusual thought					
PQ55	–	0.761	–	–	–
PQ36	–	0.754	–	–	–
PQ61	–	0.752	–	–	–
PQ27	–	0.743	–	–	–
PQ65	–	0.736	–	–	–
PQ57	–	0.697	–	–	–
PQ32	–	0.671	–	–	–
PQ67	–	0.664	–	–	–
PQ74	–	0.656	–	–	–
PQ7	–	0.644	–	–	–
PQ46	–	0.632	–	–	–
PQ56	–	0.574	–	–	–
PQ75	–	0.569	–	–	–
PQ24	–	0.564	–	–	–
PQ30	–	0.553	–	–	–
PQ2	–	0.506	–	–	–
PQ8	–	0.426	–	–	–
APPS: Paranoia/suspiciousness					
PQ76	–	–	0.762	–	–
PQ38	–	–	0.740	–	–
PQ68	–	–	0.716	–	–
PQ52	–	–	0.715	–	–
PQ25	–	–	0.683	–	–
PQ77	–	–	0.652	–	–
PQ12	–	–	0.613	–	–
PQ35	–	–	0.589	–	–
APPS: Perceptual abnormalities					
PQ84	–	–	–	0.778	–
PQ50	–	–	–	0.751	–
PQ20	–	–	–	0.732	–
PQ60	–	–	–	0.653	–
PQ13	–	–	–	0.651	–
PQ64	–	–	–	0.651	–
PQ79	–	–	–	0.649	–
PQ19	–	–	–	0.633	–
PQ34	–	–	–	0.625	–
PQ4	–	–	–	0.589	–
PQ5	–	–	–	0.587	–
PQ18	–	–	–	0.569	–
PQ9	–	–	–	0.537	–
PQ26	–	–	–	0.491	–
APPS: Disorganized thinking					
PQ49	–	–	–	–	0.851
PQ90	–	–	–	–	0.707
PQ69	–	–	–	–	0.684
PQ37	–	–	–	–	0.676
PQ23	–	–	–	–	0.633
PQ3	–	–	–	–	0.613

Table 4
Factor loadings of a confirmatory factor analysis of the Social Phobia Scale (SPS) and Prodromal Questionnaire (PQ) APPS-distressing items.

Factors and items	1 Social Anxiety Factor	2 APPS: Distressing Unusual Thought	3 APPS: Distressing Paranoia/Suspiciousness	4 APPS: Distressing Perceptual Abnormalities	5 APPS: Distressing Disorganized Thinking
Social anxiety					
SPS20	0.751	–	–	–	–
SPS15	0.734	–	–	–	–
SPS6	0.722	–	–	–	–
SPS4	0.719	–	–	–	–
SP16	0.714	–	–	–	–
SPS12	0.691	–	–	–	–
SPS13	0.689	–	–	–	–
SPS17	0.677	–	–	–	–
SPS8	0.675	–	–	–	–
SPS7	0.664	–	–	–	–
SPS14	0.619	–	–	–	–
SPS11	0.610	–	–	–	–
SPS18	0.565	–	–	–	–
SPS5	0.549	–	–	–	–
SPS10	0.547	–	–	–	–
SPS9	0.531	–	–	–	–
SPS19	0.527	–	–	–	–
SPS3	0.511	–	–	–	–
SPS1	0.474	–	–	–	–
SPS2	0.465	–	–	–	–
APPS: Distressing unusual thought					
PQ67	–	0.926	–	–	–
PQ30	–	0.829	–	–	–
PQ65	–	0.797	–	–	–
PQ55	–	0.795	–	–	–
PQ32	–	0.793	–	–	–
PQ36	–	0.793	–	–	–
PQ27	–	0.782	–	–	–
PQ61	–	0.753	–	–	–
PQ46	–	0.728	–	–	–
PQ24	–	0.718	–	–	–
PQ57	–	0.699	–	–	–
PQ75	–	0.673	–	–	–
PQ74	–	0.672	–	–	–
PQ7	–	0.667	–	–	–
PQ56	–	0.554	–	–	–
PQ8	–	0.540	–	–	–
PQ2	–	0.516	–	–	–
APPS: Distressing paranoia/suspiciousness					
PQ76	–	–	0.797	–	–
PQ38	–	–	0.755	–	–
PQ68	–	–	0.750	–	–
PQ25	–	–	0.744	–	–
PQ52	–	–	0.730	–	–
PQ77	–	–	0.716	–	–
PQ35	–	–	0.694	–	–
PQ12	–	–	0.657	–	–
APPS: Distressing perceptual abnormalities					
PQ84	–	–	–	0.801	–
PQ50	–	–	–	0.756	–
PQ20	–	–	–	0.711	–
PQ60	–	–	–	0.685	–
PQ18	–	–	–	0.658	–
PQ13	–	–	–	0.655	–
PQ19	–	–	–	0.643	–
PQ64	–	–	–	0.640	–
PQ4	–	–	–	0.636	–
PQ79	–	–	–	0.629	–
PQ5	–	–	–	0.607	–
PQ34	–	–	–	0.595	–
PQ9	–	–	–	0.548	–
PQ26	–	–	–	0.445	–
APPS: Distressing disorganized thinking					
PQ49	–	–	–	–	0.860
PQ37	–	–	–	–	0.750
PQ69	–	–	–	–	0.720
PQ23	–	–	–	–	0.700
PQ90	–	–	–	–	0.700
PQ3	–	–	–	–	0.595

Table 5
Correlations for 5-Factor Confirmatory Model of APPS/SPS items and APPS-distressing/SPS items.

Item	SPS	Disorganized Thinking	Paranoia / Suspiciousness	Perceptual Abnormalities	Unusual Thought
APPS items					
Disorganized Thinking	0.460	–			
Paranoia/Suspiciousness	0.486	0.813	–		
Perceptual Abnormalities	0.440	0.781	0.830	–	
Unusual Thought	0.457	0.887	0.921	0.878	–
APPS-distressing					
Disorganized Thinking	0.129	–			
Paranoia/Suspiciousness	0.173	0.359	–		
Perceptual Abnormalities	0.144	0.313	0.376	–	
Unusual Thought	0.112	0.285	0.338	0.281	–

Note: All correlations are significant, $p < 0.001$. APPS=attenuated positive psychotic symptoms. SPS=Social Phobia Scale.

Results from the present study fail to support the hypothesis that social anxiety and paranoia are different manifestations of the same underlying construct (Freeman et al., 2005). Rather, current results provide preliminary support for the hypothesis that social anxiety may occur either in response to or in conjunction with various aspects of attenuated positive psychotic symptoms (Wigman et al., 2012) and are consistent with studies that suggest that social anxiety occurs in response to prodromal and full psychotic symptoms (Yung and McGorry, 1996).

Results from the current study are consistent with findings from prodromal, first episode, and chronic psychosis research. Specifically, in prodromal and first-episode populations, increases in psychotic symptoms, social stigmatization, low morale, depression, and shame have all been associated with avoidance of social situations (Birchwood et al., 2007; Ritscher and Phelan, 2004). These results have been interpreted as patients having fear of experiencing increased symptoms in social situations and an increased fear of being perceived as strange or odd (Birchwood et al., 2007). Similarly, stigma related to psychosis and experiences of discrimination based on a diagnosis of a psychotic disorder have been related to increased social anxiety in individuals with schizophrenia (Lysaker et al., 2010). Our findings support the possibility that social anxiety emerges as a consequence of or co-occurs with attenuated positive psychotic symptoms; yet it remains plausible that social anxiety items loaded onto a separate factor than the APPS/APPS-distressing items in the current study due to differences in severity of symptoms that may still exist on the same dimension. To address this concern, future studies should follow socially anxious populations longitudinally to determine if social anxiety changes over time into attenuated positive psychotic symptoms, such as suspiciousness/paranoia, in a subset of these individuals.

Although previous research has studied social anxiety in schizophrenia (Braga et al., 2004; Pallanti et al., 2013), in the prodromal stage of the disorder (Häfner et al., 1995; Meyer et al., 2005), and in those at high risk for developing a psychotic disorder (Corcoran et al., 2003; Rietdijk et al., 2013; Tan and Ang, 2001), this study examines social anxiety as it relates to attenuated positive psychotic symptoms in non-help-seeking individuals. Based on these studies, assessing social anxiety in non-help-seeking individuals who have begun to experience attenuated positive psychotic symptoms may reduce a number of clinical confounds, including problems associated with prolonged use of antipsychotic medications and stigma associated with a diagnosis of a psychotic disorder (Dinos et al., 2004). Understanding the relationship between social anxiety and attenuated positive psychotic symptoms in non-help-seeking individuals may help provide a foundation to assess the trajectory of these symptoms as psychosis emerges.

Furthermore, a better understanding of the relationship between social anxiety and the trajectory of psychosis has the

potential to improve existing treatments in populations across the psychosis spectrum. Research conducted using cognitive-behavioral treatment for social anxiety in individuals with chronic schizophrenia has shown improvement in social anxiety symptoms, psychosis-related symptoms, and overall quality of life (Halperin et al., 2000; Kingsep et al., 2003). Although there have not yet been randomized controlled trials of social anxiety treatment in those at clinical high risk for developing psychotic disorders, preliminary evidence suggests that cognitive-behavioral treatment for social anxiety may have utility in those at clinical high risk by reducing transition to psychosis in at least one small sample of individuals at ultra-high risk for psychosis (Morrison et al., 2004). Further, a case study presented by (Haglund et al., 2014) of a young person who initially met criteria for being at high risk of developing psychosis underwent cognitive-behavioral therapy for social anxiety. Psychotherapy began as manualized treatment, but adaptation was required due to paranoia/suspiciousness and cognitive functioning. Following nine months of psychotherapy, the young person was deemed not to be at risk for developing a psychotic disorder. These results suggest that social anxiety treatment may be effective earlier in the developmental trajectory of psychotic disorders, including in those experiencing attenuated positive psychotic symptoms; therefore the current study findings could inform the development of future treatment strategies.

Strengths of this study include a large, non-help-seeking, diverse population of individuals at an age when psychosis tends to emerge. The university from which participants were drawn is large (38,000 students) and diverse from a socioeconomic and ethnic/racial perspective (e.g., the university is one of the least expensive in the country, 35% of students are considered low income, acceptance rates are very high, and close to 50% of our sample reported being employed at the time of the study), which increases the generalizability of our findings to same-aged individuals relative to studies that are limited to clinical populations, in which approximately 41% of individuals are of college age (Fusar-Poli et al., 2010; Snyder and Dillow, 2012). Further, the current study further supports dimensional approaches to understanding the phenomenology of mental disorders (Helzer et al., 2006). Emerging evidence supports the concept of an extended psychosis phenotype in which individuals who experience attenuated positive psychotic symptoms and those with clinical psychosis share similar risk factors (van Os and Linscott, 2012; van Os et al., 2009). Evidence has also supported viewing social anxiety in a dimensional manner, showing that a dimensional approach better predicted a range of clinically important outcomes than did the categorical approach of the DSM-IV (Ruscio, 2010; Weeks et al., 2010).

The present study is not without limitations. Our analyses relied on a single self-report measure each for social anxiety and

attenuated positive psychotic symptoms and employed a cross-sectional design, limiting the ability to make causal inferences. An additional limitation that should be noted is that the PQ and SPS measure symptoms using slightly different methodologies. Whereas the SPS uses a Likert-type scale, the PQ responses were dichotomized into “Yes” or “No” responses and then summed, which may have influenced the variability in responding for the two measures. Additionally, the relevant timeframe differs between questionnaires: the PQ assesses symptoms in the last month, whereas the SPS measures symptoms without specific reference to timeframe. Taken together, it is possible that these factors have contributed to the distinct factors found in the current study. It should be noted that, due to the online nature of recruitment, there was self-selection involved in participation in the study. However, because our sample is comparable to the overall demographic of the university, we believe that enrollment in the study is reflective of the larger university community. Relatedly, attending a university generally requires average levels of cognitive functioning, which may be a protective factor against developing a psychotic disorder, which may limit the generalizability of our findings to the general population. This said, the current sample likely has more variability in cognitive functioning than many college samples, given that the sample is quite diverse and acceptance rates are very high (64% for freshmen applicants and 81% for transfer students). Lastly, further research is necessary to determine the exact nature of the relationship between social anxiety and attenuated positive psychotic symptoms over the developmental course of psychotic disorders, which would be critical to determine whether social anxiety shifts into paranoia in a subset of individuals. This study represents an important first step, which may contribute to more accurate diagnosis and treatment of individuals at risk for psychotic disorders.

The present study indicated that social anxiety and APPS are distinct symptom clusters that are significantly associated with each other but that likely do not occur on the same dimension. These findings, from a sample of non-help-seeking individuals, may contribute to future efforts to develop treatment strategies for individuals experiencing social anxiety at the earliest stages of psychosis (Halperin et al., 2000; Kingsep et al., 2003). Further, the present study could contribute to future efforts to identify new clinical markers in those who may be at risk for psychotic disorders.

Conflicts of interest

None.

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