Published in final edited form as:

Am J Psychiatr Rehabil. 2014 ; 17(3): 272–305. doi:10.1080/15487768.2014.935681.

Enhancing and Promoting Recovery In Attentionally Impaired People Diagnosed With Schizophrenia: Results From A Randomized Controlled Trial Of Attention Shaping In A Partial Hospital Program

Steven M. Silverstein,

University Behavioral Health Care, Rutgers University; Rutgers, The State University of New Jersey

Matthew W. Roché,

University Behavioral Health Care, Rutgers University; Rutgers, The State University of New Jersey

Zaynab Khan,

University Behavioral Health Care, Rutgers University; Rutgers, The State University of New Jersey

Sarah J. Carson,

University Behavioral Health Care, Rutgers University; Rutgers, The State University of New Jersey

Igor Malinovsky,

University Behavioral Health Care, Rutgers University; Rutgers, The State University of New Jersey

William A. Newbill,

University Behavioral Health Care, Rutgers University, now at Oregon State Hospital; Rutgers, The State University of New Jersey

Anthony A. Menditto, and

Fulton State Hospital, Fulton, MO

Sandra M. Wilkniss

Thresholds, Inc., now at the National Governor's Association

Abstract

The attentional impairments associated with schizophrenia are well-documented and profound. Psychopharmacological and most psychosocial interventions have been shown to have limited effect in improving attentional capacity. That said, one form of psychosocial treatment, attention shaping procedures (ASP), has been repeatedly demonstrated to produce significant and meaningful change in various aspects of participant attentiveness behaviors. To date, studies of

ASP have been limited in that they have been conducted primarily with inpatients, have not assessed the generalizability of ASP's effects, and have not explored whether reinforcement is required to be contingent on performance of attentive behaviors. To address these limitations we conducted the first randomized clinical trial of ASP with people diagnosed with schizophrenia who are being treated in a partial hospital program. Our results indicate that ASP is effective in improving attention in people with schizophrenia in these types of programs, the effects of ASP generalize outside of the immediate treatment context to both other treatment groups and real world functioning, and contingent reinforcement is a critical ingredient of ASP. This project provides further evidence for the benefits of use of ASP in the recovery-oriented treatment of people diagnosed with schizophrenia who have significant attentional impairments.

Keywords

Schizophrenia; attention; cognitive remediation; behavior therapy; serious mental illness; recovery-oriented care

The attentional impairments associated with schizophrenia are well-documented and profound (Hahn et al., 2012; Millan et al., 2012; Nuechterlein, 1977). These deficits antedate the onset of schizophrenia (Fusar-Poli et al., 2012), become more pronounced once the full syndrome is present, and, for most people, do not fully remit after psychotic symptoms have resolved (Medalia & Choi, 2009). While these deficits are present in most people diagnosed with schizophrenia, there is marked heterogeneity in the degree to which they impact different people. Importantly, various researchers have demonstrated that the degree of attentional difficulties a person with schizophrenia has is inversely related to their social and vocational functioning, and quality of life (Addington & Addington, 2000; Evans et al., 2004; Green, Kern, & Heaton, 2004; Oie, Sundet, & Ueland, 2011; Ritsner, 2007). Furthermore, given that attentional capacity is a pre-requisite for higher-order cognitive skills (e.g. working memory) and learning, people with schizophrenia who have more severe attentional impairments tend to have significant impairments in multiple cognitive domains and gain the least from evidenced-based psychosocial treatments (Green, 1996; Green, Kern, Braff, & Mintz, 2000; Silverstein et al., 1998). Therefore, the treatment of these impairments represents an important avenue for improving both objective and subjective outcomes for people diagnosed with schizophrenia.

Psychopharmacological and psychosocial treatments have met with limited success in improving attention in people with schizophrenia (Barch, 2010). Psychopharmacological intervention with first- and second-generation antipsychotic medications, although a pillar of treatment of acute psychosis, has not consistently demonstrated positive effects on attention in people with clinically stable schizophrenia (Barch, 2010; Buchanan, Freedman, Javitt, Abi-Dargham, & Lieberman, 2007; Goldberg et al., 2007; Keefe et al., 2007). Various psychosocial interventions, largely subsumed under the label of cognitive remediation, although associated with large improvements in some cognitive domains (e.g. verbal learning and memory), also have a limited impact on attention (McGurk, Twamley, Sitzer, McHugo, & Mueser, 2007; Silverstein & Wilkniss, 2004; Wykes, Steel, Everitt, & Tarrier, 2008). Moreover, these programs are not designed for, and are rarely used with, people with

the most severe attentional impairments. In contrast, a type of cognitive remediation called attention shaping procedures (ASP) has been consistently demonstrated to improve attentional capacity and treatment engagement even in people diagnosed with schizophrenia who are the most chronically ill and have attentional impairments (Menditto, Baldwin, & O'Neal, 1991; Silverstein et al., 2005; Silverstein et al., 1998; Silverstein et al., 2009; Silverstein et al., 1999; Spaulding, Storms, Goodrich, & Sullivan, 1986).

ASP is a behavioral intervention based on operant conditioning that aims to gradually increase a person's attentional capacity, or, more concretely, the amount of time spent performing behaviors reflecting attention to a target stimulus. In essence, it capitalizes on the well-known (e.g., Kraepelin, 1919/1971) and repeatedly demonstrated link between motivation and attention (reviewed in Silverstein, 2010). In ASP, successive approximations towards person-specific attentional goals are rewarded within the context of ongoing psychosocial treatment interventions. For example, for a person with a baseline attention span of 2 minutes and an ultimate attention goal of 10-minutes, progress towards this goal would be fostered by gradually changing the criterion for reward, over time and with repeated success, in one-minute increments (subgoals). Participant progress is reinforced through verbal praise and tangible reinforcers. A large body of research (e.g., Menditto, Baldwin, & O'Neal, 1991; Silverstein et al., 2005; Silverstein et al., 1998; Silverstein et al., 2009; Silverstein et al., 1999; Spaulding, Storms, Goodrich, & Sullivan, 1986) has demonstrated that ASP improves attention, task performance, and skill acquisition from psychosocial groups, regardless of individual differences in symptom type or severity, and intelligence.

While the effectiveness of ASP for improving attention, task performance, and learning enjoys robust support, prior studies have been limited in at least five ways. First, they have not explored whether ASP-related gains generalize outside of the immediate treatment context. That is, while attention within, and learning related to, groups that include ASP have been demonstrated to improve, it is unknown whether these gains extend to other treatment groups or to social and vocational functioning outside the clinical research context. Second, it is unclear whether ASP-related gains result from intrinsic or extrinsic motivation. Clearly, as a reinforcement-based intervention, ASP draws heavily on extrinsic motivation. That said, as Silverstein (2010) outlined, there is reason to believe that as a person's attention improves and he/she is able to learn skills that benefit them in and outside of the group (e.g. that lead to gratifying social interactions), intrinsic motivation increases and may eventually drive new behaviors more than extrinsic motivation. Third, in all past studies of ASP, participants who received ASP were given tangible (usually monetary) rewards, whereas participants in the control condition were not. Therefore, it cannot be determined from those studies whether pairing reinforcement with target behaviors is a critical ingredient in ASP, or whether receiving a reward in general (i.e., reward that is noncontingent upon behavior) could account for all or part of past treatment effects. Fourth, whether there are certain subgroups of people diagnosed with schizophrenia that particularly benefit from ASP and if so, what distinguishes these people from people who derive less benefit from the intervention, has yet to be explored. Finally, evidence for the effectiveness of ASP in non-inpatient settings is sparse (limited to a relatively small portion of the overall sample in Silverstein et al., 2009) and so evidence is needed on its effects outside of a state

hospital setting. This point is of particular importance, because partial hospital programs are a primary treatment setting for many people with schizophrenia and positive findings in this group would support the widespread use of ASP.

In light of these limitations, the current project was undertaken. Herein we describe the impact of ASP on a sample of people diagnosed with schizophrenia who were identified by partial hospital staff as having attentional issues that significantly interfered with their ability to benefit from psychosocial interventions. To test the generalizability of ASP's effects, participant attention was rated in non-study groups that did not use ASP, and a battery of role-play, performance-based, and self- and informant-report measures assessing learning and social and functional skills were completed. To determine whether there were changes in intrinsic motivation and related psychological factors, participants completed a brief battery of self-report measures assessing constructs such as perceived mastery in social situations and self-efficacy. Finally, to identify and characterize a subgroup of people with schizophrenia who respond particularly well to ASP, we compared people who showed a particularly robust response to ASP to those who showed a less robust response, on a range of study variables. We hypothesized that: 1) ASP would have a significant, positive impact on partial hospital participants' attentional abilities and amount of skill acquisition in a social skills training group; 2) the effects of ASP on attention would generalize outside of the study group to attentiveness in other (non-study related) therapy groups; 3) the effects of ASP would generalize outside of the study group and positively impact real world functioning; 4) rewards contingent upon demonstrating attentive behaviors at criterion levels, but not non-contingent reward, would produce changes in attentiveness; 5) people receiving ASP would demonstrate significant increases on psychological variables such as sense of mastery and self-efficacy; and 6) the participants with the strongest responses to ASP would demonstrate the largest gains on all study variables.

As we describe this latest study of ASP, we wish to acknowledge our debt to Robert Liberman, a pioneer and giant in the field of psychiatric rehabilitation. Dr. Liberman made extensive use of shaping procedures in the treatment of schizophrenia, over many years, at the UCLA Clinical Research Center for Schizophrenia and Psychiatric Rehabilitation. Indeed, the first author's (SMS) initial exposure to shaping of appropriate within-group behaviors occurred during a multi-day training with Dr. Liberman at Camarillo State Hospital in 1993. There, he observed for the first time the powerful and positive effects that use of shaping procedures could have on increasing attentiveness and engagement, and on the enjoyment and personal satisfaction of group members. Since that time, Dr. Liberman has been a valuable mentor and advisor to our research group, including serving as co-author on a 2009 research report on ASP. While, among his many contributions, Dr. Liberman may be best known for his work on the development of skills training interventions, and on the concept and promotion of recovery, we wish here to recognize his seminal contribution to behavioral interventions for people with schizophrenia, including the use of shaping procedures to promote positive treatment outcomes.

Methods

Study Design

Participants were assigned to one of two therapeutic conditions: the UCLA Basic Conversations Skills Module (BCSM; Liberman & Wallace, 1990) with ASP, or the BCSM without attention shaping (control). Both groups met twice weekly for 22 weeks for a total of 45 treatment sessions. Each treatment session took 1 hour. The average number of sessions actually attended by participants in the ASP and control groups were 35 and 30, respectively. All participants were assessed at pretreatment and at the conclusion of treatment using selected measures of cognition, subjective experience, social and vocational functioning, and symptoms (see below for description of measures). Additionally, during each group session, participant attentiveness was rated using the interval sampling coding method described below.

Participants

127 people who met DSM-IV criteria for schizophrenia or schizoaffective disorder on the Structured Clinical Interview for DSM-IV diagnosis (First et al., 1995) and were being treated in a partial hospital program expressed interest in study participation. All participants were between 18-55 years of age and were identified by hospital staff as having significant attentional impairments that markedly impacted their ability to profit from psychosocial interventions. Participants were excluded from participation if they had a history of head trauma with loss of consciousness exceeding 10 minutes, neurological illness, or active substance abuse within six months of study enrollment. Detailed information about participant flow and attrition is available in Figure 1. Reasons for study discontinuation included partial hospital discharge, psychotic relapse, transfer to a state hospital, or subject relocation. No participant withdrew from the study for treatment-specific reasons. The groups were predominantly male (70% ASP, 79% Control) and Caucasian (63% ASP, 63% Control).

Using pre-treatment data, every effort was made to match study groups on baseline attentional functioning and Basic Conversation Skills Module comprehensive test (BCSM-T) scores (see below). Matching was successful for baseline BCSM-T scores (indicating equivalence between groups in pre-treatment social skills), but not for total minutes of attention during the first two group sessions (described below). Participants were recruited from, and groups were run at two university-affiliated partial hospital programs. Staff therapists from these sites ran the BCSM groups, while research study staff administered participant assessments, rated participant attention in sessions, and provided the within-group reinforcement.

Owing to participant availability and staffing resources across the two sites only two groups could be run concurrently. As such, initially, one site ran an ASP group while the other ran a non-ASP group. The site that initially used ASP and the nature of each subsequent group at each site was determined, after each new cohort completed pre-treatment assessments, using a computerized random number generator. In this way, participants were randomly assigned

to treatment condition. On average, 6 participants were enrolled in each group in each treatment condition during each round of groups.

Interventions

Basic Conversational Skills Module (BCSM)—The BCSM (Lieberman & Wallace, 1990) is a manualized, structured, skills training program from the UCLA Social and Independent Living Skills series. The BCSM focuses on five skill areas: recognizing verbal and nonverbal cues, starting a friendly conversation, keeping a conversation going, ending a conversation appropriately, and putting all these skills together. Each skill area is taught using seven standard learning activities (i.e., introduction to the skill area, videotape presentation with question and answer session, role-plays, resource management, outcome problems, in-vivo exercises, and homework assignments) that are based on behavioral principles and include abundant repetition of critical content and use of verbal praise. The first-author trained all study staff and therapists to deliver the BCSM, and he and an outside observer (SMW) monitored therapist fidelity throughout the study with the UCLA Therapist Fidelity Assessment for Modules (Wallace, Lieberman, Mackain, Blackwell, & Eckman, 1992).

Shaping—Shaping is the application of reward-based learning techniques to bring about new, or modify existing behavior. The primary technique involved is differential reinforcement of successive approximations toward a target behavior. That is, rather than waiting for the desired behavior (e.g. 20 minutes of continuous) to occur before introducing a reward, reinforcement is provided for successive approximations toward the desired behavior, beginning with reinforcement of a variant of the behavior that is at the upper end of what the person can already achieve. When the initial step towards the desired behavior has been reinforced and occurs regularly (e.g. 2 minutes of continuous attention), the criterion for reinforcement is advanced to the next step in a pre-specified hierarchy (e.g. 3 minutes of continuous attention). This sequence of reinforcing, changing the criterion for reinforcement, fading reinforcers for previous goals, and limiting reinforcement to only behavior meeting the new criterion is repeated until the desired behavior is achieved. Thus, a strength of shaping is that it can be used to develop or strengthen behavior that does not normally occur or else occurs infrequently (e.g. attentiveness).

Attention Shaping—Beginning in the third group session, initial, individualized attentiveness goals were established for each ASP group participant. These were based on the median length of observed attentiveness episodes, recorded during the first two sessions by the non-interactive attention rater. Thereafter, at the outset of each group, each individual's goal, and the general criteria for attentiveness and inattentiveness were reviewed. Participant goals had two parts: duration of attentiveness (i.e. subtarget) and how many times the subtarget was met during the group session (i.e. class target). Each time a participant met a subtarget, he/she received two forms of reinforcement: verbal praise (including specification of the attentive behaviors engaged in) and a shaping ticket. When, in the course of the group, a participant met their class target, the group was briefly stopped while the change agent (see below) verbally reinforced the successful participant, regarding specific attentive behaviors he/she engaged in, in front of the rest of the group and gave

him/her \$2 monetary reinforcement. This was then followed by congratulatory applause, and then the group session continued. Additionally, at the end of each group each participant received feedback about their performance relative to their class target in front of the group. Participants who did not meet their class target were informed what specific attentive behaviors they would have to show improvement on in order to be more successful in the next session (and then reminded again of this at the beginning of the next session). If a participant met their class target for two consecutive groups, their class target was increased following a pre-specified hierarchy; if a participant failed to meet their class target for two consecutive sessions, their class target was reduced to the next lowest goal in the hierarchy.

Group sessions for both treatment conditions had two trainers: Control groups had a leader and cotherapist and ASP groups had a leader and change agent. Change agents observed group participants and provided them with specific feedback about their inattentive and attentive behaviors, and when a subtarget was met, a shaping ticket. Change agents also used positive verbal reinforcement to encourage participants who were part-way through their subtarget goal. For example, if the participant's target was 10 minutes, the change agent might provide positive verbal reinforcement after 5 minutes of continuous attention and note that 5 more minutes of continuous attention would lead to earning a shaping ticket. Instances of inattentive behavior were addressed using a specific negative-positive prompt sequence that was designed to encourage extinction of inattentive behavior, and to ensure that attentive behaviors were reinforced more (by staff attention) than inattentive behaviors. The negative aspect of the prompt sequence included specification of the inattentive behavior that had occurred and a statement that this was an example of not paying attention that would interfere with the person's ability to earn their next shaping ticket. The positive aspect of the prompt sequence reminded the person that engaging in specific personally-relevant attentive behaviors would help them earn their next shaping ticket. If the participant resumed attentive behavior, this would be immediately reinforced with specific verbal praise, commenting on the attentive behavior. Continued inattention was not responded to in order to hasten extinction.

Control Group—In an effort to equate the groups on the total amount of tangible, external reinforcement, following each treatment session some people in the control group were selected to receive \$2 rewards. The number of control group participants who received a reward for any group was based on the percentage of people in the most recent ASP group (typically the day before) who earned rewards. Therefore, the ASP and control groups were matched on total monetary reinforcement throughout the study, with the main difference being that for the ASP group reinforcement was contingent on frequency and quality of attentive behaviors, while for the control group reinforcement was non-contingent. Importantly, whereas participants in the ASP condition were informed that their reinforcement was for demonstrating specific levels of attentive behaviors, control group participants were told that as part of this research project, \$2 rewards would be given out randomly to some people at the end of each group session. The orders of the names of the participants who would be rewarded in any given control group session were determined at pre-treatment, by generating 50 randomly-ordered lists of group participants' names, with each random order corresponding to one group session (e.g., the 3rd order was used for the

3rd session, the 8th order was used for the 8th session, etc.). At the end of each control group session, rewards were given out starting with the name at the top of the list, and then moving down the list until the number of participants to be rewarded (based on the prior ASP session) was reached.

Measures

The measures in the below battery were selected to assess participant characteristics that could be viewed as confounding factors (e.g., intelligence) and to assess change in the constructs we hypothesized would be influenced by ASP.

Intelligence

Shipley Institute of Living Scale, Vocabulary Subscale (SILS): The SILS (Zachary, 1991) is a brief assessment of verbal and nonverbal (abstract) intelligence. The SILS has excellent test-retest reliability and scores on the SILS correlate highly with IQ estimates from the Wechsler Adult Intelligence Scale (Zachary, Crumpton, & Spiegel, 1985; Zachary, Paulson, & Gorsuch, 1985). Because the vocabulary portion is relatively resistant to mental state changes whereas the abstraction score is not, we used the vocabulary score to estimate the abstraction score, and then the sum or both scores was used to estimate premorbid IQ scores using age and education-level normed tables in the test manual. IQ data were collected because we wanted to ensure groups did not significantly differ in premorbid intelligence and to determine if this variable had any impact on the amount participants gained from ASP.

Attention

Attention Ratings: Non-interactive raters used operationalized, behavioral criteria (available in Silverstein et al., 2009) to rate participants' attentiveness in both conditions. Raters attended every group and observed participants for 10 seconds every minute. Participants were observed for the same 10-second interval each minute and during these intervals were rated as either attentive or inattentive. If any inattentive behavior was observed during a ten second interval, the participant was coded as being inattentive.

Reliability of Attention Ratings: All raters underwent the same training and annual reliability checks described by Silverstein and colleagues (2009). Briefly, at the outset of the study, raters reviewed a detailed attention rating manual and participated in a video-based training. The training videos included 466 ten-second clips of attentive and inattentive behavior that raters scored. At the conclusion of the training, scores from each rater were compared with the manual's gold standard ratings to determine kappa coefficients. Additionally, a videotaped session of each change agent was created, annually, and sent to an outside rater (AAM) with thousands of hours of experience in shaping, to determine level of agreement between this rater and the on-site rater. Further, the outside rater also visited Rutgers once per year to rate groups in-vivo and to compare these ratings with those generated by the attention rater. Any instances of rater-drift were addressed in extra supervision with the first author and, when necessary, re-rating of the training videotapes until kappa coefficient levels of $>.8$ were obtained. As a result, in this study, across all raters and time points, the average kappa coefficient exceeded .80, indicating adequate inter-rater

reliability. Beyond their use to ensure high levels of reliability, these procedures were employed to minimize rater bias, since raters could not be blinded to which treatment condition participants were in.

Symptoms

Positive and Negative Syndrome Scale (PANSS): The PANSS (Kay, Fiszbein, & Opler, 1987) is a widely used interview-based assessment of symptoms associated with schizophrenia. The PANSS assesses 30 symptoms, which we reduced to 5 factors (positive, negative, cognitive, excitability, and depression; as per Lindenmayer, Bernstein-Hyman, & Grochowski, 1994). The PANSS has excellent internal and inter-rater reliability (Müller & Wetzell, 1998). To ensure symptom ratings were accurate and reliable, all raters underwent PANSS training and reliability checks prior to the initiation of data collection and then 2 more times during the course of the study. To pass these checks, a rater had to achieve an intraclass correlation (ICC) of at least .8 with the gold standard ratings, and the group as a whole had to achieve an ICC > .80 for its own ratings. Across the entire study, no rater failed to achieve this level.

Cognition and Learning

MATRICES Consensus Cognitive Battery (MCCB): The MCCB (Kern et al., 2008; Nuechterlein et al., 2008) is a neuropsychological test battery that includes assessments of working memory, attention/vigilance, verbal learning and memory, visual learning and memory, speed of processing, reasoning and problem solving, and social cognition. To summarize a person's overall cognitive ability, the MCCB produces an age- and gender-corrected global cognition T-score. The assessments making up the battery have excellent psychometric properties, small practice effects, no ceiling effects, and strong relationships with social functioning.

The Schizophrenia Cognition Rating Scale (SCoRS): The SCoRS (Keefe, Poe, Walker, Kang, & Harvey, 2006) is an 18-item interview-based assessment of cognitive functioning for people diagnosed with schizophrenia. Global scores were calculated based upon participant answers given to interview questions about functioning across several cognitive domains. The SCoRS has excellent inter-rater reliability and internal consistency, and interviewer ratings correlate significantly with performance on cognitive tests and measures of real-world functioning.

Micro-Module Learning Test (MMLT): The MMLT (Silverstein, Wallace, & Schenkel, 2005) is an analogue assessment of a person's ability to benefit from the primary components of skills training interventions. A person's responsiveness to, and ability to learn from, verbal and videotaped instruction, as well as ability to demonstrate skills through role-play, is assessed in a dynamic, interactive fashion that includes assessment of the ability to learn from repeated administration of material upon commission of errors. The MMLT outputs percentage correct scores for each subtest (i.e. verbal instruction, learning from modeling, and role-play), and also gives a total score. Domain and global percentage scores are calculated by dividing the total number of points earned by the participant by the total number of points possible and then multiplying by 100. Here we were only concerned with

changes in the overall percentage correct scores. The MMLT has seven psychometrically equivalent alternate forms, and excellent inter-rater and test-retest reliability. MMLT scores have been found to predict full-length skills training group performance (Silverstein et al., 2005).

Attention Process Training Test II (APT-II): The APT-II (Sholberg et al, 2001) is a 12-item informant report of a person's attention problems (e.g., “The client can only concentrate for very short periods of time”; “The client misses details or makes mistakes because their level of concentration decreased”). The APT-II assesses multiple forms of attention including sustained, selective, divided, and alternating attention. APT-II measures were completed by clinic staff based on their observation of study participants in regular clinic groups.

Social and Functioning Skills

UCLA Comprehensive Module Test for the Basic Conversational Skills Module (BCSM-T): The BCSM-T (Wallace, Liberman, MacKain, Blackwell, & Eckman, 1992) assesses the amount of information a person has learned in each of the four skill areas taught in the BCSM groups (described above). Participants' skill learning is assessed through self-report, demonstration of skills, and role-plays. BCSM-T total scores are calculated by summing the total number of points the participant earned across all skill areas and dividing by the total number of points possible, and then multiplying by 100.

Assessment of Interpersonal Problem Solving Skills (AIPSS): The AIPSS (Donahoe, Carer, Bloem, Hirsch, Laasi, & Wallace, 1990) is an assessment of a person's ability to recognize and describe, and then develop and enact a plan to overcome, social problems. Participants are asked to watch 13 videotaped social problem vignettes, identify the interpersonal issue therein, and then role-play their solution to that problem in a simulation test. Examinee's responses are then rated following specific criteria and a total score is determined. The AIPSS has good test-retest and inter-rater reliability, and correlates significantly with self-reported quality of life and real world functioning.

Independent Living Skills Inventory (ILSI): The ILSI (Wallace, Liberman, Tauber, & Wallace, 2000) is an 89-item informant report that measures the extent to which individuals are able to competently perform a broad range of skills important for successful community living. It contains 11 subscales including interpersonal skills, home maintenance, cooking, and medication management. For the purposes of this study, only the 9-question interpersonal skills subscale was used. The ILSI's internal consistency, test-retest reliability, and inter-rater reliability are all excellent.

Self Report Measures

Self-Efficacy – Social Situations Subscale (SESS): The SES (McDermott, 1995) is a 57-item self-report measure developed to assess feelings of competence in the management of positive and negative symptoms, as well as perceived social efficacy, in people with schizophrenia spectrum conditions. In this study, only data on self-efficacy in interpersonal situations was collected. The SESS has high internal consistency and test-retest reliability,

and correlates significantly with measures of psychosocial functioning (Pratt, Mueser, Smith, & Lu, 2005).

Interpersonal Competence Questionnaire (ICQ): The ICQ (Buhrmester, Furman, Wittenberg, & Reis, 1988) is a 40-item structured interview that assesses subjective feelings of competence in interpersonal situations that has been modified for use with people diagnosed with schizophrenia (Semple, et al., 1999). Respondents rate their perceived competence in a range of hypothetical interpersonal situations on a Likert-type scale with four answer choices that range from “I am poor at this” to “I am extremely good at this”. The content of the ICQ's five subscales closely parallel skills taught in the UCLA BCSM: 1) initiation of interactions; 2) negative assertion; 3) self-disclosure; 4) provision of support to others; and 5) conflict management. This modified version of the ICQ has demonstrated excellent internal consistency for each subscale and total scores, and good discrimination of people with schizophrenia from non-psychiatric controls (Semple et al., 1999).

Mastery Scale (MS): The MS (Pearlin & Schooler, 1978) is a 7-item self-report scale that assesses perceived ability to change. Questions are answered on a 5-point Likert-type scale ranging from “Strongly Disagree” to “Strongly Agree”. The scale outputs an overall score with higher scores representing greater perceived ability to change. Adequate psychometric properties have been demonstrated with this scale in psychiatric populations (Rosenfield, 1997).

Analytic Plan

As in previous ASP studies (e.g., Silverstein et al., 2009) change in attentiveness was quantified in two ways. First, the average total minutes of attentiveness per group during the first two groups each participant attended was compared with this average for their final two sessions. This was done for study groups, and for one non-study group (to assess generalizability outside of study groups) for each participant. Second, each participant's time series of attentiveness scores during their study group (across all study sessions attended) was characterized by three parameters: a mean, linear slope with the 1st order autoregressive component removed, and root mean square error which reflects day-to-day variability around a person's overall linear trend. These parameters are considered ideal for the characterization of dynamic systems over time (Thiel, 1966) and have been gainfully used to analyze symptom course and treatment response in samples of people diagnosed with schizophrenia (Kupper & Hoffmann, 2000), including in past studies of attention shaping (e.g., Silverstein et al., 2009).

Groups were compared on background variables and dependent variables at each time point using independent samples *t*-tests and chi-square tests of independence. To study change over time, groups were compared on all dependent variables using 2 (group) X 2 (time) repeated measures ANOVAs. Finally, to split the ASP group into those participants who showed an enhanced response to the intervention and those who did not, we calculated the mean and standard deviation of the slope of the mean duration of attentiveness episodes for the control group (*mean* = -.003, *SD* = .025) and designated those participants in the ASP group scoring two standard deviations above the mean of the control group (.048) as “Super

Responders". All other ASP participants were considered "Responders" (note, however, that while ASP Responders demonstrated the least degree of change among ASP participants, they nevertheless still demonstrated significantly greater improvement than control subjects). These two groups were compared on all study variables using the same analytic techniques described immediately above.

Results

The means, standard deviations, and the results of all between-group comparisons for the study's dependent variables are presented in Tables 2 and 3.

Pre-Post treatment Comparisons between ASP and Control Conditions

Participant Characteristics—At baseline, there were no significant differences between the ASP and control conditions in age ($t(76) = 1.17, p = .247$), education level ($t(76) = -.525, p = .601$), estimated IQ ($t(76) = -1.43, p = .157$), or number of groups attended ($t(76) = 1.53, p = .129$). There were also no significant differences between the groups in terms of race ($\chi^2(2) = .394, p = .821$) or sex ($\chi^2(1) = .438, p = .508$). Descriptive statistics for the study groups are available in Table 1.

Effects of Shaping on Attentiveness

In study groups: The two groups significantly differed at baseline on total minutes of attention and mean duration of attentiveness per episode. Specifically, on average, at baseline, subjects in the ASP condition paid attention 5.13 minutes less and had a mean duration of attention that was 0.58 minutes less than participants in the control condition. For both of these variables, there was a significant main effect of time, as well as a group $\times$ time interaction. By the final two sessions, the ASP group improved their total attentiveness by 10.42 minutes and their mean duration of attentiveness episodes by 3.58 minutes. In contrast, the control group evidenced 4.87 and .018 minute *reductions* in total attentiveness and mean duration of attentiveness, respectively. On both variables, the post group differences were statistically significant and characterized by large effect sizes ($d = 1.61$ and .79, respectively). Taken together, these results indicate that ASP leads to marked improvement in the number of total minutes participants pay attention in a group, and to longer periods of attentiveness.

For slope of total minutes of attentiveness and mean duration of attentiveness, the ASP group demonstrated significantly steeper slopes of improvement over the course of treatment. Additionally, RMSE differed significantly between groups for mean duration of attentiveness, but not for total minutes of attentiveness. These results converge with the above to suggest that regardless of the operationalization of attentiveness, ASP leads to significantly overall improved attention.

In non-study groups: At baseline, there was no difference between groups in total minutes of attentiveness, but there was a difference in mean duration of attentiveness. More specifically, on average, the duration of attentiveness for ASP participants was .87 minutes less than for participants in the control group. There were not significant main effects of

time for either variable, but for both duration of attentiveness and total minutes of attentiveness there were significant group x interactions. The ASP group increased their total attentiveness by 10.45 minutes and their mean duration of attentiveness by 1.97 minutes, while total attentiveness and mean duration of attentiveness *decreased* by 1.5 minutes and .29 minutes, respectively, in the control group. These results suggest, for the first time, that the effects of ASP generalize very well outside of groups in which it is used.

Effects of Shaping on Symptoms—At pre-treatment, there were no significant differences between groups on any PANSS symptom or factor. There were no main effects for time, but the group x time interaction was significant for the Cognitive and Depression factors with the ASP group improving significantly more than the control group. The only significant post-treatment difference between groups was on the Depression factor.

Effects of Shaping on Cognition and Learning—There was a significant baseline difference between the conditions on the MCCB and the MMLT with the ASP group demonstrating poorer cognitive and learning abilities than the control group. From pre- to post-treatment, there were significant main effects of time and significant group x time interactions for the MCCB and MMLT. On the MCCB, the ASP group composite T score improved by 5.36 at post-treatment while the control condition's average T score remained approximately the same ($\eta_p^2 = .18$, medium-to-large effect). On the MMLT, the ASP group's score increased by 15% while the control group's score increased by 4%. The between group differences on the MCCB and MMLT were no longer statistically significant at post-treatment. There were no pre or post treatment differences, main effects of time, or group x time interactions for the SCoRS or APT-II. Taken together, these results suggest that ASP markedly improves peoples' cognitive skills and ability to learn, though it does not impact their subjective experience of cognitive issues. Practically, this means ASP should increase a person's ability to profit from various treatment and real world learning experiences (e.g., psychotherapy; informational television shows or lectures).

Social and Functional Skills—At pre-treatment, the groups were rated similarly on each measure except that participants in the ASP condition were rated as having significantly poorer interpersonal skills on the ILSI than participants in the control condition. There were main effects of time for the BCSM-T, AIPSS, and ILSI, but the group x time interactions were not significant for any of these measures and there were no statistically significant post-treatment differences between groups. The magnitude of the gains on the BCSM-T and AIPSS were quite large, with both groups gaining 25 percentage points on the BCSM-T and 6 percentage points on the AIPSS. Thus, while our results do not suggest differential improvement in social or functional skills as a result of ASP in a partial hospital sample, which is in contrast to prior research with long-stay state hospital inpatients (Silverstein et al., 2006; 2009), they do support the efficacy and effectiveness of the BCSM for use with even people diagnosed with schizophrenia who have the most severe attentional impairments being treated in partial hospital programs.

Self-Report Measures—There were no statistically significant pre-treatment or post-treatment differences, main effects, or interaction effects for any self-report measure.

Pre-Post Comparison of ASP Super Responders and Responders, defined by the Slope of the Mean Duration of Attentiveness Episodes

Participant Characteristics—At baseline, there were no significant differences between Super Responders and Responders in terms of age ($t(38) = .952, p = .347$), education level ($t(38) = -.339, p = .737$), or estimated IQ ($t(38) = .669, p = .669$), but on average, the ASP Super Responder group attended more ASP sessions than did the Responder group ($t(38) = -2.095, p = .043$). There were also no significant differences between the groups in terms of race ($\chi^2(2) = 4.43, p = .109$) or sex ($\chi^2(1) = .001, p = .974$). Descriptive statistics for the study groups are available in Table 1.

Effects of Shaping on Attentiveness—At baseline, there were no differences between Super Responders and Responders in terms of total minutes of attentiveness or mean duration of attentiveness, but there were significant main effects of time and significant group x time interaction effects for both variables. By the final two groups, Super Responders increased their total minutes of attentiveness by approximately 16 minutes and mean duration of attentiveness by approximately 7 minutes, while Responders evidenced only 7 and 2-minute improvements. Both of these post-treatment differences were statistically significant. Additionally, the groups significantly differed on the slope of total minutes of attentiveness, mean duration of attentiveness, and RMSE for mean duration of attentiveness. Thus, it appears the method used to divide the groups resulted in a meaningful separation of subjects in terms of their response to treatment.

Effects of Shaping on Symptoms—At pre-treatment, there were no significant differences in symptoms between groups. From pre- to post-treatment, there was a significant main effect of time for ratings of the severity of positive and negative symptoms, and a group x time interaction for negative symptoms (with the Super Responder group demonstrating a greater reduction). The groups did not significantly differ at post-treatment on either variable. That said, the post-treatment between-group difference for negative symptoms was characterized by a medium effect size ($d = .53$) thereby suggesting a between-group difference did exist, but we did not have enough power to detect it. There were no significant main effects, interaction effects, or post-treatment differences between groups on any other PANSS factors. The finding regarding negative symptoms is notable as it provides additional evidence of the generalization of skills taught in the ASP group. More specifically, it seems reasonable to assume that the attentive behaviors encouraged in the ASP group served to counter many of the behavioral criteria for negative symptoms (e.g., avoidance of eye contact, poverty of speech, and other signs of withdrawal) and thus, resulted in lower ratings for negative symptoms.

Effects of Shaping on Cognition and Learning—There were no baseline differences between Super Responders and Responders on any measure of cognition or learning. From pre- to post-treatment, there were significant main effects of time for the MCCB and SCoRS, and a significant group x time interaction for the SCoRS. There were no other main effects for time or group x time interactions. At post-treatment, the groups significantly differed on the SCoRS ($d = 1.54$) and APT-II ($d = 1.02$) with ASP Super Responders reporting fewer cognitive issues and being rated as more attentive. Taken together, these

results suggest that participants who respond particularly well to ASP experience differential reductions in the experience of cognitive impairment associated with schizophrenia and, outside of the immediate treatment context, appear to be more engaged and attentive.

Social and Functional Skills—At pre-treatment, the groups did not differ on any measure of social or functional skills. There were significant main effects of time for the BCSM-T, AIPSS, and ILSI indicating both groups increased their social knowledge and skill level, social problem solving abilities, and independent living skills over the course of the study. The group x time interaction was significant for the BCSM-T and AIPSS, but not the ILSI. At post treatment, Super Responders improved by 42% on the BCSM and 12% on the AIPSS, while Responders gained 16% on the BCSM-T and evidenced no gain on the AIPSS. In contrast, on the ILSI, Super Responders showed no improvement, while Responders demonstrated improvement in independent living skills. These results demonstrate that ASP-related attentional improvement positively impacts the amount participants gain from the BCSM and the degree to which they can generalize information gained in-group to novel social situations.

Self-Report Measures—There were no significant pre-treatment between-group differences, or main effects or group x time interactions for any self-report measure. There was a significant post-treatment difference on the ICQ whereby Super Responders reported feeling more competent in social interactions than did Responders.

Discussion

The purpose of our study was to determine: 1) the effectiveness of ASP in a partial hospital environment; 2) the generalizability of ASP's effects to non-study groups; 3) the effects of ASP on real-world social functioning; 4) the relative effects of contingent vs. non-contingent reinforcement; 5) the effects of ASP on aspects of subjective experience such as intrinsic motivation and perceived level of mastery in social situations; and 6) characteristics of those participants for whom the treatment is most effective. Our results indicate that ASP significantly improves attention in people diagnosed with schizophrenia who are being treated in partial hospital programs, and that the effects of ASP generalize outside of the immediate treatment context, but that it does not lead to differential changes in constructs related to subjective experience of self-efficacy or mastery in social situations. Importantly, contingent reinforcement of attentive behaviors appears to be a critical ingredient of ASP. Finally, analyses comparing participants who responded particularly well to ASP with participants who did not revealed that those who responded most strongly to ASP showed larger gains on a variety of study measures (e.g., symptom reduction, social engagement), including learning of new skills in the treatment group, thereby demonstrating ASP's effects are at once non-uniform and far reaching.

Of our results, we believe the following warrant special attention. First, across all observational attentiveness metrics, participants in the ASP group significantly improved their ability to pay attention in *both* study and non-study groups and this was not true for participants in the control condition. In fact, ASP participants increased their attention span by over *10 minutes* for both types of groups, while control participants evidenced *decreases*

in attention (presumably due to boredom, as per anecdotal reports). This gain in within-group attention mirrors the effect Silverstein and colleagues (2009) found for inpatients with schizophrenia and suggests partial hospital patients can benefit from ASP as much as individuals who are more acutely ill. That the gain in attention was equivalent for ASP participants for study and non-study groups highlights the remarkable power of attention shaping to change behavior across contexts and, for the first time, the generalizability of ASP's effects.

That participants in the control condition evidenced reductions in their ability to pay attention over the course of the study, if considered more than just an artifact of the limitations in the precision of observer ratings, is disconcerting: treatment as usual, which is designed to have a positive impact, is not even maintaining baseline functioning. This concern is only heightened when the significant differences between groups in change between time points and post treatment scores on various measures of cognition and learning are considered. Ultimately, our results suggest that a relatively simple modification to group treatment in partial hospitals can, at a minimum, forestall progressive disengagement and in many cases, lead to meaningful improvements in attentional and cognitive functioning for many people.

Second, we were able to divide ASP participants into two groups based on their response to the treatment: those who responded particularly well and those who showed a less robust response. Although these participants did not significantly differ on *any* study variable at baseline, highly responsive participants evidenced differential change on a number of study variables including reductions in negative symptoms and improvements in social and functional skills. The implication of these findings is twofold. First, in practice, people should not be excluded from ASP groups based on any clinical or demographic variables. Instead, any person diagnosed with schizophrenia with a significant attentional impairment should be enrolled in and expected to benefit from the treatment. Second, given that some people with schizophrenia do respond particularly well to ASP, future research should be aimed at identifying those factors that distinguish highly responsive participants from those who are less responsive, and variations of ASP should be developed to enhance the intervention's effects for people who respond sub-optimally to standard procedures. To this end, we are currently investigating the predictive ability of laboratory measures of reinforcement learning to predict ASP response.

Third, participants in the ASP group showed a statistically significant increase in composite MCCB scores while the control group evidenced no change. The magnitude of the difference between pre and post treatment scores for the ASP group was approximately half of a standard deviation ($d = .59$). This change is noteworthy given the nature of our sample (i.e. highly impaired) and that cognition focused interventions, such as computerized cognitive remediation and procognitive medication have rarely resulted in gains this large, and, when similar gains have occurred, they have sometimes been on a modified MCCB composite score that excluded the social cognition factor (e.g., Lane et al., 2009).

Fourth, as has been demonstrated previously (e.g., Silverstein et al., 2009), changes in attention occurred independently of changes in psychotic symptoms, although they were

associated with reductions in cognitive symptoms and depression. Moreover, when only ASP participants were considered, those participants who were highly responsive to ASP evidenced a differential reduction in negative symptoms. This latter finding is novel and suggests treatment providers can use ASP as a tool for people with schizophrenia evidencing pronounced negative symptoms. Although the mechanism by which this change occurs is unknown, it seems reasonable to hypothesize that ASP leads to reductions in negative symptoms by reducing behaviors (e.g., poverty of speech) typically interpreted as evidence of negative symptoms and thereby leads to lower observer ratings on these symptoms.

Fifth, we did not find that self-report measures of various psychological constructs related to mastery of social situations, self-efficacy, or perceived interpersonal competence differentially improved as a result of ASP. Even participants who were highly responsive to ASP did not report changes over time on these variables. These findings are contrary to our hypotheses and somewhat perplexing given participants in the ASP and control groups demonstrated increased understanding of and ability to use social skills, and this was particularly the case for participants who responded most strongly to ASP.

Several study limitations are of note. First, although our participant groups were generally well matched, there were some significant baseline differences between groups. Most prominently, baseline total minutes of attention was significantly lower in our ASP group. While this may have allowed for greater gains in attention for the ASP group, supplemental analyses comparing ASP Responders (i.e., not Super Responders) to control subjects revealed that despite having similar baseline scores, these ASP participants still evidenced greater gains in attention over time than control participants. This suggests that the effects we observed result from treatment and are not an artifact resulting from baseline group differences. Second, it is unknown whether participants in the ASP group reached the attentiveness levels of people not selected to participate in the study. Future studies should collect attentiveness ratings on people with schizophrenia not included in ASP to determine whether ASP participants are approximating attentiveness levels in people not identified as being attentionally impaired. Having such data will provide another means of assessing the impact of ASP. Third, there was a lack of blindness to several aspects of the study. For example, while research assistants were blind to eventual group assignment during pre-treatment assessments, this was not the case during post-treatment assessments, as there were not sufficient staffing resources to support staff for testing who were not also needed for the in-group co-therapist, change agent and/or attention rater roles. In addition, attention raters could of course not be blind to which group they were observing, and participants were aware of whether they were involved in ASP. To reduce potential bias, as noted in Methods, we had outside raters (i.e., not involved in any other aspect of the study, and not part of Rutgers) with extensive experience in attention shaping provide annual ratings of fidelity to intervention delivery (for both ASP and BCSM), and ratings of attentiveness to assess inter-rater reliability. This was done annually using both videotapes and in-vivo ratings. That high levels of reliability were observed throughout the study between on-site and outside raters suggests that fidelity and accuracy of ratings were not unduly affected by bias. However, the strongest test of this would be if all assessors at pre- and post-treatment assessment points were blind to subject condition. Finally, whether the positive effects of

ASP are maintained after the conclusion of treatment is unknown, although this is currently being explored.

In sum, our findings add to the growing body of literature (Menditto, Baldwin, & O'Neal, 1991; Silverstein et al., 2005; Silverstein et al., 1998; Silverstein et al., 2009; Silverstein et al., 1999; Spaulding, Storms, Goodrich, & Sullivan, 1986) demonstrating that ASP profoundly improves attention in people diagnosed with schizophrenia who have marked impairments. Further, across multiple metrics of various constructs related to attention, cognition, social and functional skills, and learning, we found that ASP leads to meaningful improvements. Moreover, for the first time, ASP was shown to be an effective intervention in a partial hospital setting and the effects of ASP were shown to extend beyond the immediate treatment context to other groups and to influence, among other things, neuropsychological test performance and participants' ability to learn. Given the consistency and magnitude of its effects for people with schizophrenia regardless of their background characteristics and symptom profiles, we believe all people with schizophrenia who have attentional impairments should be offered ASP whether to augment psychosocial groups (Menditto, Baldwin, & O'Neal, 1991; Silverstein et al., 2005; Silverstein et al., 1998; Silverstein et al., 2009; Silverstein et al., 1999; Spaulding, Storms, Goodrich, & Sullivan, 1986) or computer-based remediation efforts (Combs et al., 2008). To be sure, at present, ASP is underutilized: few treatment programs, whether inpatient or partial hospitals, use ASP, despite the large number of people with schizophrenia who continue to demonstrate limited response to treatment.

Acknowledgments

We thank Debby Hartley, Kara Biondo, Payal Pandya, Danielle Seraile, Travis Bess, and Jay Jeschke for their assistance with data collection and clinical service provision for this project. We also thank administration and clinical staff at Rutgers University Behavioral Health Care for their dedication to, and support of, this project.

This research was supported by grant R01MH074650 from the National Institutes of Mental Health to Steven M. Silverstein.

References

- Addington J, Addington D. Neurocognitive and social functioning in schizophrenia: A 2.5 year follow-up study. *Schizophrenia Research*. 2000; 44(1):47–56. [PubMed: 10867311]
- Barch DM. Pharmacological strategies for enhancing cognition in schizophrenia. *Current Topics in Behavioral Neurosciences*. 2010; 4:43–96. [PubMed: 21312397]
- Buchanan RW, Freedman R, Javitt DC, Abi-Dargham A, Lieberman JA. Recent advances in the development of novel pharmacological agents for the treatment of cognitive impairments in schizophrenia. *Schizophrenia Bulletin*. 2007; 33(5):1120–30.10.1093/schbul/sbm083 [PubMed: 17641146]
- Buhrmester D, Furman W, Wittenberg MT, Reis HT. Five domains of interpersonal competence in peer relationships. *Journal of Personality and Social Psychology*. 1988; 55(6):991–1008. [PubMed: 3216292]
- Combs DR, Tosheva A, Penn DL, Basso MR, Wanner JL, Laib K. Attentional-shaping as a means to improve emotion perception deficits in schizophrenia. *Schizophrenia Research*. 2008; 105(1-3):68–77.10.1016/j.schres.2008.05.018. [PubMed: 18585899]
- Donahoe CP, Carter MJ, Bloem WD, Hirsch GL, Laasi N, Wallace CJ. Assessment of interpersonal problem-solving skills. *Psychiatry: Interpersonal and Biological Processes*. 1990; 53(4):329–339.

- Evans JD, Bond GR, Meyer PS, Kim HW, Lysaker PH, Gibson PJ, Tunis S. Cognitive and clinical predictors of success in vocational rehabilitation in schizophrenia. *Schizophrenia Research*. 2004; 70(2-3):331–42.10.1016/j.schres.2004.01.011 [PubMed: 15329308]
- Fusar-Poli P, Deste G, Smieskova R, Barlati S, Yung AR, Howes O, Borgwardt S. Cognitive functioning in prodromal psychosis: A meta-analysis. *Archives of General Psychiatry*. 2012; 69(6): 562–71.10.1001/archgenpsychiatry.2011.1592 [PubMed: 22664547]
- Goldberg TE, Goldman RS, Burdick KE, Malhotra AK, Lencz T, Patel RC, Robinson DG. Cognitive improvement after treatment with second-generation antipsychotic medications in first-episode schizophrenia: Is it a practice effect? *Archives of General Psychiatry*. 2007; 64(10):1115–22.10.1001/archpsyc.64.10.1115 [PubMed: 17909123]
- Green MF. What are the functional consequences of neurocognitive deficits in schizophrenia? *The American Journal of Psychiatry*. 1996; 153(3):321–330. [PubMed: 8610818]
- Green MF, Kern RS, Heaton RK. Longitudinal studies of cognition and functional outcome in schizophrenia: Implications for MATRICS. *Schizophrenia Research*. 2004; 72(1):41–51.10.1016/j.schres.2004.09.009 [PubMed: 15531406]
- Green MF, Kern RS, Braff DL, Mintz J. Neurocognitive deficits and functional outcome in schizophrenia: Are we measuring the “right stuff”? *Schizophrenia Bulletin*. 2000; 26(1):119–36. [PubMed: 10755673]
- Hahn B, Robinson BM, Kaiser ST, Matveeva TM, Harvey AN, Luck SJ, Gold JM. Kraepelin and bleuler had it right: People with schizophrenia have deficits sustaining attention over time. *Journal of Abnormal Psychology*. 2012; 121(3):641–8.10.1037/a0028492 [PubMed: 22686867]
- Kay SR, Fiszbein A, Opler LA. The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophrenia Bulletin*. 1987; 13(2):261–276. [PubMed: 3616518]
- Kraepelin, E. *Dementia praecox and paraphrenia*. Barclay, RM., translator; Robertson, GM., editor. New York, NY: Krieger; 1971. (Original work published 1909-1913; original translation of selected portions published in 1919)
- Keefe RS, Bilder RM, Davis SM, Harvey PD, Palmer BW, Gold JM. Neurocognitive Working Group. Neurocognitive effects of antipsychotic medications in patients with chronic schizophrenia in the CATIE trial. *Archives of General Psychiatry*. 2007; 64(6):633–47.10.1001/archpsyc.64.6.633 [PubMed: 17548746]
- Keefe RS, Poe M, Walker TM, Kang JW, Harvey PD. The schizophrenia cognition rating scale: An interview-based assessment and its relationship to cognition, real-world functioning, and functional capacity. *The American Journal of Psychiatry*. 2006; 163(3):426–32.10.1176/appi.ajp.163.3.426 [PubMed: 16513863]
- Kern RS, Nuechterlein KH, Green MF, Baade LE, Fenton WS, Gold JM, Marder SR. The MATRICS consensus cognitive battery, part 2: Co-Norming and standardization. *The American Journal of Psychiatry*. 2008; 165(2):214–20.10.1176/appi.ajp.2007.07010043 [PubMed: 18172018]
- Kupper Z, Hoffmann H. Course patterns of psychosocial functioning in schizophrenia patients attending a vocational rehabilitation program. *Schizophrenia Bulletin*. 2000; 26(3):681–98. [PubMed: 10993406]
- Lane HY, Lin CH, Green MF, Helleman G, Huang CC, Chen PW, Tsai GE. Add-on treatment of benzoate for schizophrenia: A randomized, double-blind, placebo-controlled trial of d-amino acid oxidase inhibitor. *JAMA Psychiatry*. 2013; 70(12):1267–1275.10.1001/jamapsychiatry.2013.2159. [PubMed: 24089054]
- Lieberman, RP.; Wallace, CJ. *Social and Independent Living Skills: Basic Conversation Skills Module*. Camarillo, CA: Author; 1990.
- Lindenmayer JP, Bernstein-Hyman R, Grochowski S. A new five factor model of schizophrenia. *Psychiatric Quarterly*. 1994; 65:299–322. [PubMed: 7831416]
- McDermott BE. Development of an instrument for assessing self-efficacy in schizophrenic spectrum disorders. *Journal of Clinical Psychology*. 1995; 51(3):320–31. [PubMed: 7560131]
- McGurk SR, Twamley EW, Sitzer DI, McHugo GJ, Mueser KT. A meta-analysis of cognitive remediation in schizophrenia. *The American Journal of Psychiatry*. 2007; 164(12):1791–802.10.1176/appi.ajp.2007.07060906 [PubMed: 18056233]

- Medalia A, Choi J. Cognitive remediation in schizophrenia. *Neuropsychology Review*. 2009; 19(3): 353–64.10.1007/s11065-009-9097-y [PubMed: 19444614]
- Menditto AA, Baldwin LJ, O'Neal LG. Social-learning procedures for increasing attention and improving basic skills in severely regressed institutionalized patients. *Journal of Behavior Therapy and Experimental Psychiatry*. 1991; 22(4):265–269.10.1016/0005-7916(91)90043-5 [PubMed: 1823661]
- Millan MJ, Agid Y, Brüne M, Bullmore ET, Carter CS, Clayton NS, Young LJ. Cognitive dysfunction in psychiatric disorders: Characteristics, causes and the quest for improved therapy. *Nature Reviews Drug Discovery*. 2012; 11(2):141–68.10.1038/nrd3628
- Müller MJ, Wetzel H. Improvement of inter-rater reliability of PANSS items and subscales by a standardized rater training. *Acta Psychiatrica Scandinavica*. 1998; 98(2):135–9. [PubMed: 9718240]
- Nuechterlein KH. Reaction time and attention in schizophrenia: A critical evaluation of the data and theories. *Schizophrenia Bulletin*. 1977; 3(3):373–428. [PubMed: 335494]
- Nuechterlein KH, Green MF, Kern RS, Baade LE, Barch DM, Cohen JD, Marder SR. The MATRICS consensus cognitive battery, part 1: Test selection, reliability, and validity. *The American Journal of Psychiatry*. 2008; 165(2):203–13.10.1176/appi.ajp.2007.07010042 [PubMed: 18172019]
- Oie M, Sundet K, Ueland T. Neurocognition and functional outcome in early-onset schizophrenia and attention-deficit/hyperactivity disorder: A 13-year follow-up. *Neuropsychology*. 2011; 25(1):25–35.10.1037/a0020855 [PubMed: 21090901]
- Pearlin LI, Schooler C. The structure of coping. *Journal of Health and Social Behavior*. 1978; 19(1):2–21. Retrieved from <http://www.jstor.org/stable/2136319>. [PubMed: 649936]
- Pratt SI, Mueser KT, Smith TE, Lu W. Self-Efficacy and psychosocial functioning in schizophrenia: A mediational analysis. *Schizophrenia Research*. 2005; 78(2-3):187–97.10.1016/j.schres.2005.02.014 [PubMed: 16154054]
- Ritsner MS. Predicting quality of life impairment in chronic schizophrenia from cognitive variables. *Quality of Life Research : An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. 2007; 16(6):929–37.10.1007/s11136-007-9195-3
- Rosenfield S. Labeling mental illness: The effects of received services and perceived stigma on life satisfaction. *American Sociological Review*. 1997; 62(4):660–672.
- Semple SJ, Patterson TL, Shaw WS, Grant I, Moscona S, Jeste DV. Self-perceived interpersonal competence in older schizophrenia patients: The role of patient characteristics and psychosocial factors. *Acta Psychiatrica Scandinavica*. 1999; 100:126–135. [PubMed: 10480198]
- Silverstein SM. Bridging the gap between extrinsic and intrinsic motivation in the cognitive remediation of schizophrenia. *Schizophrenia Bulletin*. 2010; 36(5):949–56.10.1093/schbul/sbp160 [PubMed: 20064900]
- Silverstein SM, Wilkniss SM. At issue: The future of cognitive rehabilitation of schizophrenia. *Schizophrenia Bulletin*. 2004; 30(4):679–92. [PubMed: 15954183]
- Silverstein SM, Hatashita-Wong M, Solak BA, Uhlhaas P, Landa Y, Wilkniss SM, Smith TE. Effectiveness of a two-phase cognitive rehabilitation intervention for severely impaired schizophrenia patients. *Psychological Medicine*. 2005; 35(6):829–37. [PubMed: 15997603]
- Silverstein SM, Pierce DL, Saytes M, Hems L, Schenkel L, Streaker N. Behavioral treatment of attentional dysfunction in chronic, treatment-refractory schizophrenia. *The Psychiatric Quarterly*. 1998; 69(2):95–105. [PubMed: 9627927]
- Silverstein SM, Spaulding WD, Menditto AA, Savitz A, Liberman RP, Berten S, Starobin H. Attention shaping: A reward-based learning method to enhance skills training outcomes in schizophrenia. *Schizophrenia Bulletin*. 2009; 35(1):222–32.10.1093/schbul/sbm150 [PubMed: 18212327]
- Silverstein SM, Valone C, Jewell TC, Corry R, Nghiem K, Saytes M, Portrude S. Integrating Shaping and Skills Training Techniques in the Treatment of Chronic Treatment Refractory Individuals with Schizophrenia. *American Journal of Psychiatric Rehabilitation*. 1999; 3(1):41–58.10.1080/10973439908408373
- Silverstein SM, Wallace CJ, Schenkel LS. The micro-module learning tests: Work-Sample assessments of responsiveness to skills training. *Schizophrenia Bulletin*. 2005; 31(1):73–83.10.1093/schbul/sbi008 [PubMed: 15888427]

- Silverstein SM, Wong MH, Wilkniss SM, Bloch A, Smith TE, Savitz A, Terkelsen K. Behavioral rehabilitation of the “treatment-refractory” schizophrenia patient: Conceptual foundations, interventions, interpersonal techniques, and outcome data. *Psychological Services*. 2006; 3:145–169.
- Sohlberg, M.; Johnson, L.; Paule, L.; Raskin, S.; Mateer, C. Attention Process Training: A program to address attentional deficits for persons with mild cognitive dysfunction (an upper extension of the APT-I). 2nd. Wake Forest, NC: Lash & Associates Publishing/Training Inc.; 2001.
- Spaulding WD, Storms L, Goodrich V, Sullivan M. Applications of experimental psychopathology in psychiatric rehabilitation. *Schizophrenia Bulletin*. 1986; 12(4):560–77. [PubMed: 2880393]
- Thiel, H. *Applied Economic Forecasting*. Amsterdam, NY: North Holland; 1966.
- Wallace CJ, Liberman RP, MacKain SJ, Blackwell G, Eckman TA. Effectiveness and replicability of modules for teaching social and instrumental skills to the severely mentally ill. *American Journal of Psychiatry*. 1992; 149(5):654–658. [PubMed: 1575257]
- Wallace CJ, Liberman RP, Tauber R, Wallace J. The independent living skills survey: A comprehensive measure of the community functioning of severely and persistently mentally ill individuals. *Schizophrenia Bulletin*. 2000; 26(3):631–658. [PubMed: 10993403]
- Wykes T, Steel C, Everitt B, Tarrier N. Cognitive behavior therapy for schizophrenia: Effect sizes, clinical models, and methodological rigor. *Schizophrenia Bulletin*. 2008; 34(3):523–37.10.1093/schbul/sbm114 [PubMed: 17962231]
- Zachary RA, Crumpton E, Spiegel DE. Estimating WAIS-R IQ from the shipley institute of living scale. *Journal of Clinical Psychology*. 1985; 41(4):532–540.
- Zachary RA, Paulson MJ, Gorsuch RL. Estimating WAIS IQ from the shipley institute of living scale using continuously adjusted age norms. *Journal of Clinical Psychology*. 1985; 41(6):820–31. [PubMed: 4078008]

Figure 1. Effectiveness Trial Of Attention Shaping For Schizophrenia

Table 1
Means, standard deviations, and percentages for demographic variables for all study groups

	ASP (n = 43) Mean (SD)	Control (n = 38) Mean (SD)	ASP Super Responders (n =16) Mean (SD)	ASP Responders (n =26) Mean (SD)
Age	45.12 (11.28)	42.71 (12.03)	43.44 (12.86)	46.12 (10.57)
Years of education	11.88 (1.82)	12.08 (1.99)	12.00 (1.79)	11.81 (1.90)
Estimated IQ	83.90 (11.91)	87.92 (12.92)	83.06 (10.87)	84.75 (12.90)
Number of groups attended	34.67 (12.87)	29.79 (11.74)	40.06 (14.10)	32.46 (10.12)
Percent White	62.8	63.2	43.8	73.1
Percent male	69.8	78.9	68.8	69.2

Table 2
Means, standard deviations, and comparisons between ASP and control groups for all study variables

Measure	AS Group (n = 43)		Control Group (n = 38)		Posttreatment Difference	Main Effect of Time	η^2_p	Group x Time Interaction	η^2_p
	Pretreatment Mean (SD)	Posttreatment Mean (SD)	Pretreatment Mean (SD)	Post Treatment Mean (SD)					
Attentiveness In group									
Total Minutes of attentiveness	16.97 (7.51)	27.38 (8.55)	22.09 (9.67)	17.22 (9.87)	7.19 5(79) **	9.01 (79) **	.102	68.34 (79) ****	.464
Mean duration of attentiveness	2.07 (0.72)	5.65 (5.51)	2.65 (1.15)	2.48 (1.39)	7.69 (60.77) **	15.24 (79) ****	.162	18.57 (79) ****	.190
Slope total minutes of attentiveness	-	.096(.102)	-	-.052 (.064)	-	-	-	-	-
Slope mean duration of attentiveness	-	.056 (.083)	-	-.003 (.025)	-	-	-	-	-
RMSE total minutes of attentiveness	-	37.47 (18.86)	-	32.22 (21.25)	-	-	-	-	-
RMSE mean duration of attentiveness	-	15.82 (35.51)	-	1.64 (2.54)	-	-	-	-	-
Attentiveness nonstudy group									
Total minutes of attentiveness	8.91 (6.69)	19.36 (11.62)	12.38 (5.01)	10.88 (9.64)	1.51 (17)	4.06 (17)	.193	7.23 (17) *	.298
Mean duration of attentiveness	1.27 (.538)	3.23 (2.64)	2.14 (.562)	1.85 (.852)	-11.90 (17) **	3.66 (17)	.177	6.64 (17) *	.281
PANSS									
Positive	10.35 (4.22)	9.03 (4.28)	9.13 (3.25)	9.34 (3.81)	1.76 (61.64)	1.84 (64)	.028	3.58 (64)	.053
Negative	14.59 (6.13)	12.97 (5.80)	15.22 (6.58)	14.88 (6.52)	.162 (64)	2.95 (64)	.044	1.25 (64)	.019
Cognitive	12.65 (4.11)	11.62 (4.48)	10.63 (4.04)	11.70 (3.28)	3.88 (62)	.002 (62)	.001	5.57 (62) *	.082
Excitement	6.76 (2.09)	7.06 (2.85)	6.53 (2.05)	7.09 (2.04)	.898 (64)	1.94 (64)	.209	0.19 (64)	.003
Depression	10.55 (3.99)	9.67 (3.94)	9.78 (3.77)	11.81 (3.77)	.629 (63)	1.11 (63)	.017	7.09 (63) *	.101
MCCB	14.32 (10.53)	19.68 (9.83)	22.70 (13.17)	22.55 (12.98)	5.62 (43) *	8.42 (43) **	.164	9.42 (43) **	.180
SCoRS	5.81 (2.11)	5.33 (2.25)	5.38 (2.42)	5.19 (2.44)	.440 (46)	1.02 (46)	.022	.192 (46)	.004
BCSM-T	22.20 (10.10)	47.16 (20.72)	24.86 (12.70)	50.75 (28.02)	.806 (57)	107.01 (57) ****	.652	.035 (57)	.001
MMLT	41.25 (18.75)	56.25 (13.79)	56.38 (21.18)	60.49 (19.94)	8.88 (60) **	31.44 (60) ****	.344	10.22 (60) **	.146
AIPSS	44.95 (14.62)	50.81 (20.02)	43.15 (20.61)	50.24 (21.66)	.140 (52)	11.19 (52) **	.177	.101 (52)	.002
SISS	5.89 (1.50)	6.50 (1.57)	6.08 (2.07)	6.45 (1.31)	.155 (56)	2.27 (56)	.039	.135 (64)	.002
ICQ	59.34 (14.34)	60.40 (12.79)	63.09 (12.74)	65.12 (12.99)	1.25 (64)	1.52 (64)	.023	.152 (64)	.002

Measure	AS Group (n = 43)		Control Group (n = 38)		Pretreatment Difference	Posttreatment Difference	Main Effect of Time	η^2_p	Group x Time Interaction	η^2_p
	Pretreatment Mean (SD)	Posttreatment Mean (SD)	Pretreatment Mean (SD)	Post Treatment Mean (SD)						
MS	19.40 (3.17)	19.64 (3.32)	19.72 (3.98)	19.89 (3.80)	.154 (.76)	.093 (.76)	.237 (.76)	.003	.007 (.76)	.001
APT-II	25.08 (9.47)	22.19 (12.40)	24.37 (12.04)	23.00 (10.79)	.073 (.64)	.078 (.64)	3.27 (.64)	.049	.419 (.64)	.007
IL-SI	21.34 (4.75)	24.43 (5.42)	24.20 (6.27)	25.53 (5.96)	4.18 (53.54)*	.611 (.63)	11.76 (.63)***	.157	.185 (.63)	.179

All between-group comparisons are reported as *F*-tests.

*
p < .05,
**
p < .01,

p < .001.

MCCB = MATRICS Consensus Cognitive Battery; SCoRS = Schizophrenia Cognition Rating Scale; BCSM-T = UCLA Comprehensive Module Test for the Basic Conversational Skills Module; MML-T = Micro-Module Learning Test; AIPSS = Assessment of Interpersonal Problem Solving Skills; SESS = Self-Efficacy – Social Situations Subscale; ICQ = Interpersonal Competence Questionnaire; MS = Mastery Scale; APT = Attention Process Training Test II; IL-SI = Independent Living Skills Inventory.

<PQ: In the above figures –.052 and –.003, the decimal point doesn't show up.>

Table 3
Means, standard deviations, and comparisons between ASP super responder and responder groups for all study variables

Measure	<TSH>ASP Super Responders (n = 16)</TSH>		ASP Responders (n = 26)		Posttreatment Difference	Main Effect of Time	η^2_p	Group x Time Interaction	η^2_p
	Pretreatment Mean (SD)	Posttreatment Mean (SD)	Pretreatment Mean (SD)	Post treatment Mean (SD)					
attentiveness in group									
Total minutes of attentiveness	17.56 (7.17)	33.22 (5.84)	16.52 (7.95)	24.13 (8.15)	.183 (40)	80.24(40)***	.667	9.58 (40) **	.193
Mean duration of attentiveness	2.20 (.710)	9.13 (7.59)	2.00 (.740)	3.65 (2.01)	.752 (40)	33.81(40)***	.458	12.78 (40) ***	.242
Slope total minutes of attentiveness	-	.144 (.109)	-	.065 (.086)	-	6.76 (40) *	-	-	-
Slope mean duration of attentiveness	-	.125 (.100)	-	.014 (.021)	-	18.99(15.80)***	-	-	-
RMSE total minutes of attentiveness	-	38.36 (15.97)	-	36.91 (20.73)	-	.057 (40)	-	-	-
RMSE duration of attentiveness	-	35.46 (51.39)	-	3.73 (9.19)	-	5.98 (15.59) *	-	-	-
PANSS									
Positive	11.62 (4.96)	9.00 (4.55)	9.40 (3.60)	8.50 (3.49)	2.22 (31)	.127 (31)	.189	1.72 (31)	.052
Negative	15.15 (6.01)	11.23 (5.46)	14.45 (6.41)	14.25 (5.95)	.010 (31)	2.16 (31)	.212	6.80 (31) *	.180
Cognitive	12.85 (4.24)	11.69 (4.44)	12.30 (4.11)	11.35 (4.61)	-.369 (31)	.045 (31)	.068	.021 (31)	.001
Excitement	6.15 (2.23)	6.85 (2.38)	7.25 (1.94)	7.35 (3.15)	2.22 (31)	.242 (31)	.018	.314 (31)	.010
Depression	9.77 (3.90)	10.62 (4.19)	11.32 (4.00)	9.16 (3.82)	1.19 (30)	1.04 (30)	.018	2.89 (30)	.088
MCCB	14.18 (11.16)	20.18 (10.15)	12.43 (10.43)	19.29 (9.95)	.003 (23)	16.91(23)***	.424	.187 (23)	.008
SCoRS	5.60 (2.41)	3.50 (1.96)	5.88 (2.03)	6.31 (1.66)	.098 (24)	15.37 (24) ***	.161	12.58**	.344
BCSM-T	19.78 (7.98)	61.59 (20.06)	23.78 (11.33)	39.89 (16.21)	1.14 (30)	11.22 (30) **	.834	29.71 (30) ***	.498
MMLT	43.17 (19.71)	59.38 (14.38)	39.84 (18.43)	53.95 (13.26)	.248 (31)	1.25 (31)	.474	.134 (31)	.004
AIPSS	46.25 (16.65)	58.35 (22.49)	43.74 (12.90)	43.78 (14.90)	.208 (27)	4.28 (27) *	.182	5.93 (27) *	.180
SESS	5.76 (1.48)	7.13 (.176)	5.99 (1.59)	5.99 (1.28)	.173 (29)	4.36 (29) *	.083	2.67 (29)	.113
ICQ	61.67 (16.14)	66.13 (10.01)	58.00 (13.20)	56.06 (13.52)	.533 (32)	5.81 (32) *	.017	3.49 (32)	.098
MS	19.06 (3.55)	20.19 (4.00)	19.60 (3.03)	19.24 (2.89)	.268 (39)	.774 (39)	.010	1.52 (39)	.037
APT-II	21.94 (9.09)	15.81 (10.59)	27.58 (9.46)	27.26 (11.85)	3.20 (33)	8.94 (33) **	.081	2.38 (33)	.067

Measure	<TSH>ASP Super Responders (n = 16)</TSH>		ASP Responders (n = 26)		Posttreatment Difference	Main Effect of Time	η^2_p	Group x Time Interaction	η^2_p
	Pretreatment Mean (SD)	Posttreatment Mean (SD)	Pretreatment Mean (SD)	Post treatment Mean (SD)					
IL-SI	22.19 (4.74)	25.69 (5.53)	20.72 (4.90)	23.44 (5.37)	.781 (32)	11.17 (32)**	.259	.175 (32)	.005

<TFN>All between-group comparisons are reported as *F*-tests.

*
p < .05,
**
p < .01,

p < .001.

MCCB = MATRICS Consensus Cognitive Battery; SCoRS = Schizophrenia Cognition Rating Scale; BCSM-T = UCLA Comprehensive Module Test for the Basic Conversational Skills Module; MML-T = Micro-Module Learning Test; AIPSS = Assessment of Interpersonal Problem Solving Skills; SESS = Self-Efficacy – Social Situations Subscale; ICQ = Interpersonal Competence Questionnaire; MS = Mastery Scale; APT = Attention Process Training Test II; IL-SI = Independent Living Skills Inventory.</TFN>