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RESEARCH ARTICLE

Interaction between attentional allocation, social connectedness, and problem behaviors: a brief review and pilot data

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ABSTRACT

The present study investigated how a core, elementary cognitive process, attentional orienting is related to social connectedness and problem behaviors. Prior research links social cognition difficulties in autism and other attention-related conditions to deficits in visual attention. We reviewed this evidence and proposed a plausible experimental paradigm to clarify the interaction between attention and social function. We also present a pilot data supporting our proposition. Specifically, our study involved 30 participants who completed a modified version of attentional cuing task, the Adult Self-Report, and the Sociotype Questionnaire (SOCQ) to evaluate social functioning and attentional function. A mixed-model ANOVA showed a significant interaction between the magnitude of the cuing effect and ASR scores, suggesting reduced attentional benefits with higher levels of self-reported maladaptive behaviors. Further, we observed a significant negative correlation between ASR and SOCQ scores, indicating that individuals with higher problem behavior scores reported greater social difficulties. These findings contribute to the growing evidence that visual attention capabilities are linked to social adaptability, suggesting that visual attentional mechanisms may play a role in facilitating social interactions in adults. This study opens avenues for exploring visual attention's influence on social competency beyond clinical populations, providing insights into the visual-cognitive processes underpinning social functioning in typical development.

Keywords: Attention; social function; problem behavior; ASR; SOCQ

1. Introduction

Attention is one of the most fundamental constructs in psychology and neuroscience [1]. It is typically defined as the mechanism by which certain streams of information are prioritized over others, depending on their relevance to current goals or salience [2]. By serving as the brain's system for selecting sensory input, internal representations, and goal-directed actions, attention enables efficient and flexible navigation of complex environments. Its centrality to intelligent behavior is reflected not only in decades of research on perception, learning, and decision-making but also in developments in artificial intelligence. Despite differences in architecture, both biological and artificial systems share the principle of allocating limited processing resources to behaviorally significant information.

Although attention's role in perception and cognition is well established, less is known about how

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variability in attentional control relates to psychosocial functioning. Specifically, it remains unclear whether the ability to regulate attention is associated with everyday indices of well-being, such as emotional regulation or the maintenance of social relationships. Understanding these links is important, as it may clarify how subtle differences in cognitive control contribute to interpersonal behavior and psychological health.

Much of the existing research on attention and social functioning has focused on clinical populations, particularly individuals with autism spectrum disorder (ASD). A substantial body of work has compared attentional performance between typically developing (TD) individuals and those with ASD or elevated autistic traits. While these studies often employ similar task designs and attentional measures, their findings are inconsistent, with some reporting preserved orienting and others suggesting deficits.

A widely used paradigm in this literature is the cueing task, introduced by Posner [3]. In this task, a cue (e.g., an arrow or gaze direction) indicates the likely location of a target. Responses are typically faster and more accurate when the target appears at the cued location (valid trials) than at an uncued location (invalid trials), a difference known as the cueing effect. Cueing tasks can probe both exogenous attention (automatic, stimulus-driven orienting) and endogenous attention (voluntary, goal-directed orienting). They also allow investigation of social attention by using gaze cues. Comparing responses to valid and invalid cues across cue types reveals not only the efficiency of attentional orienting but also the flexibility of disengagement and reorienting.

Findings from cueing studies in ASD remain mixed. Some report intact exogenous orienting [4], while others find reduced cueing effects, particularly with non-social cues or short stimulus onset asynchronies [5]. Endogenous attention also shows variability: although some studies suggest preserved functioning [6, 7], others report reduced sensitivity or cue indifference in individuals with higher autistic traits [8].

For social cues, such as gaze, many studies show diminished responses in ASD compared with TD participants [9], though effects can normalize under longer viewing times [7]. Importantly, while symbolic cues are generally understood, translation into behavioral responses is often delayed or absent [5]. Sensitivity also appears to depend on cue type: individuals with higher autistic traits show heightened responsiveness to motion cues [10], whereas TD individuals are more responsive to socially meaningful cues [11].

Complementary evidence from the Attention Network Test (ANT) indicates that alerting functions are generally preserved, though reduced alerting efficiency has been linked to greater social deficits [12]. Orienting often shows reduced or delayed cueing effects [12], although not consistently across all studies [6]. Executive control appears most consistently impaired, with lower inhibitory control and more errors on flanker tasks [13], though these effects may be moderated by IQ [12].

Overall, the literature suggests that attentional differences in ASD and related traits cannot be explained by a single deficit profile. Inconsistencies across studies likely reflect differences in task design, cue type, and analysis methods. This underscores the need for more nuanced approaches, including dimensional analyses that move beyond binary group comparisons (ASD vs. TD). Stratifying participants by autism trait levels or social functioning indices may better capture individual variability and reveal direct links between attention and social outcomes.

Future studies would also benefit from incorporating multi-level attentional measures, such as intra-individual variability, error patterns, and eye-tracking, rather than focusing solely on mean reaction times. Additionally, most prior studies have relied on long stimulus presentation times, which may obscure difficulties in real-world settings where rapid shifts of attention are required [14]. Using shorter exposures

(<200 ms), analyzing speed–accuracy tradeoffs, and tracking temporal dynamics could improve ecological validity and provide deeper insights into attentional mechanisms.

Based on these considerations, we developed a modified cueing task. In this paradigm, participants performed a visual search in which they detected a target among distractors, preceded by spatial cues. To increase attentional demands, a dual-cue design was used, with two locations highlighted simultaneously. This reduced the likelihood of anticipatory eye movements and required participants to distribute attention covertly across multiple regions, thereby strengthening the measure's validity and ecological relevance. Using this paradigm, we investigated links between attentional control and psychosocial functioning in a non-clinical, neurotypical sample, allowing us to examine natural variability without the diagnostic confounds of clinical groups.

To assess psychosocial functioning, participants completed the Adult Self-Report (ASR) [15, 16], which measures adaptive functioning as well as a wide spectrum of emotional and behavioral difficulties. We also administered the Sociotype Questionnaire (SOCQ) [17], which evaluates the scope and quality of social networks across family, friends, acquaintances, and work/study peers. Together, these instruments provided complementary indices of psychosocial functioning to examine in relation to attentional control.

2. Materials and methods

All methods were in accordance with relevant guidelines and regulations. Specifically, all experimental protocols were approved by the Institutional Review Board of the authors' institution, and written informed consent was obtained from all participants.

2.1. Participants

A group of thirty adults (16 female, 14 male, mean age: 23.5) took part in the study and received monetary compensation. All participants had normal or corrected-to-normal vision and reported no difficulty performing the task. All participants were recruited from a non-clinical population, and none met clinical cutoffs on the ASR.

Stimuli

1. Visual task

The visual display consisted of two clusters of shapes presented opposite each other relative to the center of the screen (Figure 1). Each cluster contained four stimuli: a light circle, a dark circle, a light triangle, and a dark triangle. The **light grey triangle** served as the target stimulus. Clusters could appear along one of four possible orientations: two diagonals, the horizontal axis, or the vertical axis.

Participants were seated 30 cm from the screen and instructed to maintain fixation on a central dot that remained visible throughout the task. On each trial, two clusters appeared equidistant from the fixation point. Each cluster measured 1.2 × 1.2 cm. Circles had a diameter of 0.5 cm, and triangles were isosceles with a 0.5 cm base and 0.5 cm height.

Within each cluster, the composition of elements varied randomly across trials. For example, a cluster could contain four light grey circles, two dark grey triangles, or a mix of shapes and shades. The number of light grey triangles (the target) ranged randomly from 0 to 4, with a 20% probability assigned to each quantity. Participants were instructed to report whether at least one light grey triangle was present, pressing **'f'** for *absent* and **'j'** for *present*, regardless of how many targets appeared.

Before each task display, two circles appeared at the prospective cluster locations, serving as attentional cues. On 80% of trials, the target appeared at a cued location (valid trials), and on the remaining 20% it appeared elsewhere (*invalid trials*). In valid trials, the cues indicated the position of the forthcoming clusters; thus, both cues could be valid or only one valid. In invalid trials, both cues were misleading. When targets were present, light grey triangles could appear in one or both clusters. Because the number of targets was not central to the study's aims, this factor was excluded from the analyses. Stimulus pairs were displayed along one of four meridians (horizontal, vertical, or two diagonals rotated by 45°), positioned equidistant from the central fixation point. Their eccentricity varied randomly from 5° to 25° of visual angle in 5° increments. The task comprised 800 trials in total (40 trials per run across 20 runs).

2.2. Sociotype Questionnaire (SOCQ)

After the visual task, participants completed the Sociotype Questionnaire [17]. The Sociotype Questionnaire (SOCQ) consists of 32 items assessing relationship quality across four domains: family, friends, acquaintances, and study/workmates, with eight items per category. Example items include *"I speak and relate with my family"* (family), *"I have friends to tell and share problems"* (friends), *"I speak and relate satisfactorily with my peers"* (study/workmates), and *"It is easy for me to win support from acquaintances"* (acquaintances). To minimize response bias, the questionnaire employed a forced-choice format with both positively and negatively worded items, some of which were reverse-scored. Responses were rated on a 6-point Likert scale (0 = *never*, 5 = *always*). Each domain could yield a maximum of 40 points, and the overall SOCQ score (maximum = 160) was calculated as the sum across domains, with higher scores reflecting greater perceived social interaction.

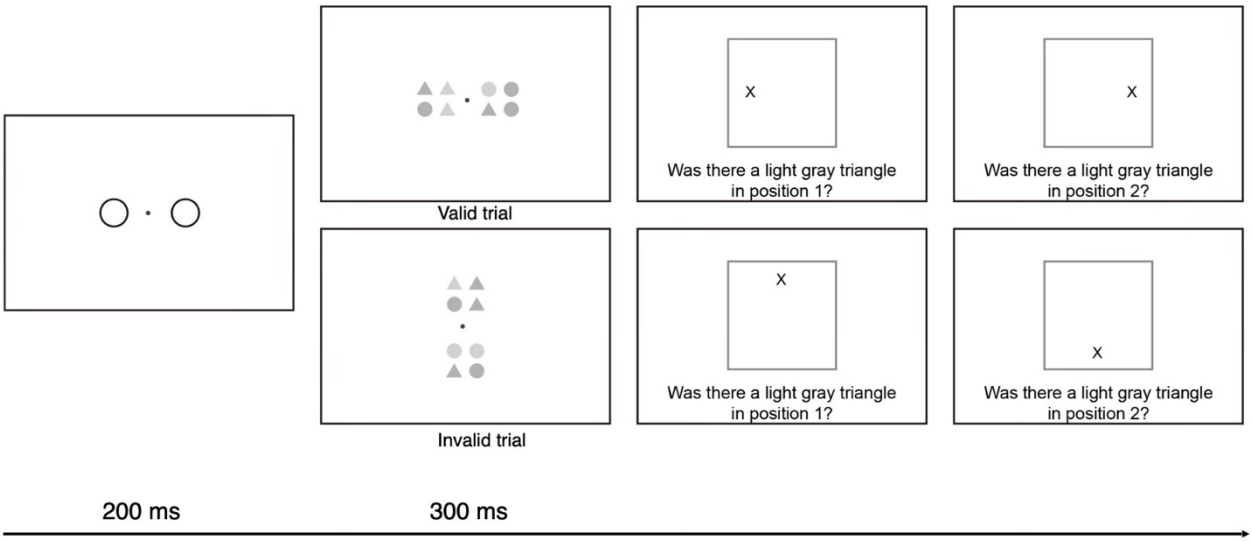

Figure 1. Trial design

2.3. Adult Self-Report (ASR)

The ASR includes 131 problem behavior items rated on a 3-point scale (0 = *not true*, 1 = *somewhat true*, 2 = *very true*), along with an Adjustment Scale and a Substance Use Scale. The problem behavior section consists of three domains: (a) Syndrome Scales, covering internalizing (e.g., anxiety, depression, withdrawal, somatic complaints), externalizing (e.g., aggression, rule-breaking, attention-seeking), and other problems (e.g., thinking and attention problems); (b) DSM-Oriented Scales, assessing DSM-based disorders such as depression, anxiety, ADHD, and antisocial personality disorder; and (c) a Crisis Questionnaire, evaluating acute crisis situations.

The Adjustment Scale assesses functioning in relationships, family, work, and education, while the Substance Use Scale measures problems related to smoking, alcohol, and drug use. For analysis, we used the Total Problems Score, derived from all problem behavior items, as an index of overall psychopathology [18].

2.4. Design and procedure

Participants completed the visual attention task in a quiet laboratory setting. The task consisted of 20 runs of 40 trials each (800 trials total) and lasted approximately 40 minutes. Notably, this experimental structure of dividing the task into 20 short runs with randomized trial orders was to prevent the possibility of practice effect. Participants were allowed to take brief breaks between runs to reduce fatigue. These features further reduce the likelihood that practice or fatigue systematically affected attentional cueing performance.

Independent variables were cue type (valid vs. invalid) and target distance (five eccentricities from fixation). Task performance was measured by accuracy across cue types. After completing the visual task, participants filled out the ASR and SOCQ questionnaires. For analysis, we used the global scores derived from both measures.

2.5. Data analysis

To assess whether attentional cueing benefits varied with psychosocial functioning, mixed-effects models were fitted with cue type (valid vs. invalid) as a fixed within-subject factor and ASR or SOCQ scores as continuous between-subject predictors. Random intercepts were included for participants. To increase statistical power, data were collapsed across target distances. Interaction terms (cue type × ASR; cue type × SOCQ) were tested to evaluate whether cueing effects differed as a function of individual differences. As a complementary approach, Pearson correlations were computed between the magnitude of the cueing effect (valid – invalid accuracy) and total ASR and SOCQ scores.

3. Results

The relationship between cueing effects, ASR scores, and SOCQ scores was examined (Figure 2). Mixed-model analysis revealed a significant interaction between cue type and ASR score, $F(1, 28) = 8.58$, $p < .01$. Follow-up correlation analyses confirmed that higher ASR scores were associated with smaller cueing effects, $r(28) = –.48$, $p < .01$.

A parallel analysis showed a significant interaction between cue type and SOCQ score, $F(1, 28) = 4.83$, $p < .05$. Consistent with this, higher SOCQ scores were positively correlated with larger cueing effects, $r(28) = .38$, $p < .05$. Finally, ASR and SOCQ scores were significantly correlated, $r(28) = –.54$, $p < .005$, indicating that greater problem behaviors were associated with reduced social functioning.

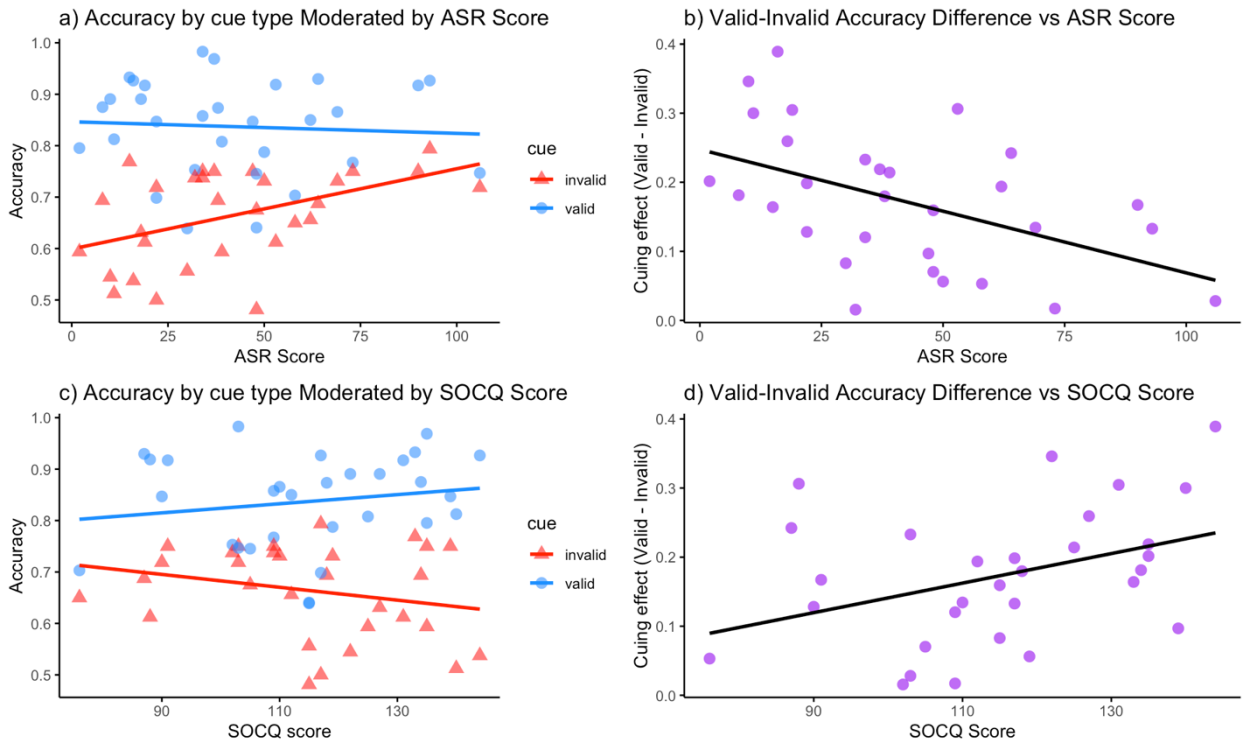

Figure 2. Visual task results. a) Accuracy by cue type moderated by ASR Score. b) Cuing effect (Valid-Invalid accuracy difference) vs. ASR Score. c) Accuracy by cue type moderated by SOCQ Score. c) d) Cuing effect (Valid-Invalid accuracy difference) vs. SOCQ score.

4. Discussion

The present study examined whether individual differences in attentional cueing are related to psychosocial functioning in a non-clinical adult population. Using a modified dual-cue paradigm, we found that higher levels of problem behaviors, as measured by the ASR, were associated with reduced attentional cueing effects. In contrast, greater social connectedness, indexed by SOCQ scores, was associated with enhanced cueing effects. Furthermore, ASR and SOCQ scores were inversely correlated, suggesting that attentional control may serve as a mechanism linking problematic behaviors to difficulties in social functioning.

These results extend prior research on attentional processes in clinical populations, particularly in ASD, to a broader non-clinical sample. Previous studies have documented inconsistent findings regarding whether attentional cueing is preserved or impaired in ASD [4-6, 8]. Our findings suggest that even within neurotypical populations, attentional variability is meaningfully related to psychosocial outcomes. In this sense, attentional control may represent a dimensional construct, influencing psychological well-being and social functioning beyond categorical diagnostic boundaries.

The negative association between ASR scores and cueing effects aligns with theories linking attentional dysregulation to externalizing and internalizing problems. Poor attentional control may reduce the efficiency of orienting to relevant cues, leading to maladaptive patterns of behavior and emotion regulation. Conversely, the positive relationship between SOCQ scores and cueing effects indicates that individuals who are better able to sustain and allocate attention may also maintain stronger social ties. Efficient cueing may facilitate responsiveness to socially relevant signals, thereby supporting relationship quality.

An important implication of these findings is that attentional cueing can serve as a sensitive behavioral index for psychosocial functioning in non-clinical populations. By employing a dual-cue design, we minimized confounds from eye movements and increased demands on endogenous control, thereby creating a task environment more reflective of real-world attentional challenges. The significant associations observed in this pilot study highlight the promise of this paradigm for probing the intersection of cognitive and social domains.

Based upon this association, future studies should also investigate potential mediating mechanisms underlying the observed associations. For instance, emotion regulation capacity or the speed and accuracy of social information processing may mediate the link between attentional control and social connectedness. Incorporating measures of affective reactivity, response inhibition, or gaze-following latency could help clarify these pathways and elucidate the cognitive-emotional processes bridging attention and social adaptation

Several limitations should be noted. First, it should be noted that the present study included a modest sample size of thirty young adults with relatively homogeneous demographic backgrounds. This limited diversity constrains the generalizability of our findings. Future studies should include larger and more demographically varied samples—spanning different age ranges, cultural contexts, and educational levels—to test whether the observed associations between attentional cueing and psychosocial functioning generalize across populations.

Second, the study relied on self-report measures of psychosocial functioning, which, although well validated, may be subject to response biases. Finally, the cross-sectional design precludes causal inferences; longitudinal studies are needed to determine whether attentional control predicts subsequent psychosocial outcomes.

Despite these limitations, the present study provides initial evidence that individual differences in attentional cueing are systematically related to problem behaviors and social functioning in non-clinical adults. Future research using larger samples, multimodal measures (e.g., eye-tracking, neural indices), and longitudinal designs will be critical in clarifying the role of attentional mechanisms in shaping psychosocial adjustment. Specifically, although our dual-cue paradigm minimized overt eye movements by requiring participants to maintain central fixation, future research could benefit from incorporating eye-tracking measures. Recording gaze data would allow direct quantification of covert and overt attention shifts, thereby eliminating potential confounds from undetected eye movements and offering a more precise index of attentional allocation.

5. Conclusion

In conclusion, this study provides preliminary evidence that individual differences in attentional cueing are linked to psychosocial functioning in non-clinical adults. Reduced cueing effects were associated with greater problem behaviors, whereas enhanced cueing effects were related to stronger social connectedness, suggesting that attentional control may serve as a cognitive mechanism bridging behavioral difficulties and social outcomes. Although limited by sample size, reliance on self-report, and cross-sectional design, these findings highlight the value of attentional cueing paradigms—particularly the dual-cue design—as sensitive tools for probing the intersection of cognition and social functioning. Future work employing larger samples and longitudinal, multimodal approaches will be essential for establishing the robustness and causal direction of these associations.

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Conflict of interest

The authors declare no conflict of interest

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