

RESEARCH ARTICLE OPEN ACCESS

Visual Exploration and Construction Strategies Underlying Performance in the Block Design Task in Autism

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Correspondence: Diu Alizée (alizee.diu@univ-tlse2.fr)**Received:** 11 January 2026 | **Revised:** 14 March 2026 | **Accepted:** 31 March 2026**Keywords:** autism | block design task | cognitive strategies | eye-tracking | visuospatial reasoning

ABSTRACT

Visuospatial reasoning in autism is often linked to superior performance on tasks such as the Block Design Task (BDT). While different strategies have been described in the general population, no study has examined how these strategies relate to performance in autistic individuals, even though the task is widely used to characterize their visuospatial profile. To address this gap, the present study examined not only overall scores but also the underlying strategies used by autistic (ASD) and neurotypical (TD) adults during the BDT. Forty-one participants (ASD = 18; TD = 23) completed the standard BDT while eye-tracking and behavioral data captured both visual exploration and construction strategies. Globally, structured strategies—both in visual exploration and construction—were found to be the most effective, as they were associated with higher success rates and faster completion times, consistent with previous findings. At the group level, our results revealed that autistic participants employed these analytic strategies more frequently than neurotypical individuals, along with a stronger alignment between visual and construction approaches. The consistent use of these strategies in the autistic group may help explain the enhanced visuospatial performance observed in our study after controlling for manual dexterity and reported in earlier studies. These findings emphasize the importance of looking beyond traditional performance measures such as accuracy and completion time, highlighting that cognitive strategies are key to understanding visuospatial reasoning.

1 | Introduction

Over the past decades, numerous studies have revealed strengths in perceptual processing in Autism Spectrum Disorder (ASD), especially for detecting and manipulating visual details. Visuospatial tasks have played a particularly central role in documenting these abilities and shaping cognitive theories of autism. As an example, in the Embedded Figures Test, autistic individuals consistently demonstrate superior performance by efficiently identifying simple figures hidden within complex visual configurations (Shah and Frith 1983). While these findings initially supported the development of the Weak Central Coherence (WCC; Frith and Happé 1994)

theory, which hypothesizes that autistic individuals exhibit a deficit in their capacity to integrate information into a coherent whole and thereby demonstrate a local processing bias, subsequent research has challenged this deficit-based interpretation. The Enhanced Perceptual Functioning model (EPF; Mottron et al. 2006), which also integrated empirical data from neuroimaging studies, proposed that superior low-level perceptual functioning in autism is associated with a preference for local processing without a fundamental deficit in global integration. This perspective offered a novel framework for understanding autistic cognition, emphasizing functional differences rather than impairments and highlighting perceptual strengths as fundamental characteristics of autism.

Batty Magali and Bouvet Lucie contributed equally.

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Summary

This study explored how autistic and non-autistic adults approach a clinical problem-solving task, focusing not only on their performance but also on the visual and motor strategies they use. We found that the most efficient strategy was used more frequently by autistic participants. These findings suggest that differences in thinking styles may help explain the strengths in visuospatial reasoning often observed in autistic individuals.

In this context, the block design task (BDT) originally developed by Kohs (1920) has also been a valuable tool for assessing visuospatial abilities in autism. It is a subtest in the Wechsler intelligence scales (Wechsler 2008, 2014) that involves rapidly and accurately reproducing a two-dimensional geometric design using red and white cubes, thus mobilizing different cognitive processes such as motor coordination, planning and working memory. Similarly to results from the Embedded Figures Test, early findings highlighted superior performance on the BDT in autism and contributed to the development of the cognitive models previously described (Happé 1994; Shah and Frith 1993). This visuospatial advantage has been observed in several studies (e.g., Morgan et al. 2003; Pellicano et al. 2006; Ropar and Mitchell 2001; White and Saldaña 2011) and supported by a meta-analysis which also highlights a large heterogeneity across individuals (Muth et al. 2014). In addition, this result extends beyond clinical populations, as studies in the general population have found that higher levels of autistic traits are associated with enhanced performance on the BDT (Grinter et al. 2009; Stewart et al. 2009), further supporting a link between autistic cognition and visuospatial strengths. As a result, individuals with autism often show a peak in visuospatial abilities which contrasts with comparatively weaker performance in other cognitive domains (Caron et al. 2006; Dawson et al. 2007; Koyama and Kurita 2008; Takayanagi et al. 2021). This notion has however been called into question and does not appear to characterize the entire autism spectrum. For example, individuals with high-functioning autism or those formerly diagnosed with Asperger syndrome under DSM-IV criteria seldom exhibit such a peak (de Jonge et al. 2009; Soulières, Dawson, et al. 2011a; Soulières, Zeffiro, et al. 2011b; Wilson 2023). These findings underscore the cognitive heterogeneity within the spectrum and highlight the need for a more nuanced understanding of visuospatial processing in autism.

To account for the variability in performance observed on the BDT, researchers have increasingly focused on the cognitive and neural mechanisms that may underlie this heterogeneity. One key line of investigation has examined how autistic individuals process visual information differently from neurotypical individuals, particularly in terms of their spontaneous focus on local details. In support of this, studies have shown that while neurotypical participants benefit from having complex patterns segmented into smaller components, autistic participants typically show no such improvement, suggesting that they naturally decompose global forms into parts without external prompts (Ropar and Mitchell 2001). Neuroimaging findings are consistent with this interpretation, as studies have demonstrated that autistic individuals often show increased activation in occipital

and parietal regions during visuospatial tasks. As these cerebral areas are typically involved in low-level visual processing and attentional control, they suggest a heightened reliance on low-level visual and perceptual processing mechanisms in autism (Degré-Pelletier et al. 2024; Gaffrey et al. 2007; Keehn et al. 2013). Using fMRI during the BDT, Bölte et al. (2008) found reduced activation in the right ventral V2 area, a region associated with shape integration and holistic processing. Together, these findings point to enhanced perceptual functioning in autism that may be underpinned by distinct cognitive strategies during visuospatial reasoning. Investigating these strategies could therefore provide valuable insights into the mechanisms underlying these superior performances and help explain why some individuals outperform others on the task.

Several distinct strategies for solving the BDT have been identified and described in the general population through behavioral observations and self-reports (Rozenchwajg 1991; Rozenchwajg and Corroyer 2001; Rozenchwajg and Huteau 1996; Schorr et al. 1982). Among them, the analytic strategy involves mentally decomposing the pattern into its constituent parts, identifying the face of each cube and placing them sequentially, often row by row or column by column. This approach reflects a local processing style and typically entails frequent visual glances at the model, as individuals repeatedly check for accuracy in cube placement. In contrast, the global strategy entails perceiving the design as a whole and attempting to reconstruct it through trial and error. This method is generally less efficient and associated with longer completion times. The third strategy described corresponds to the synthetic strategy. This one represents an intermediate and often optimal approach, where the design is segmented into meaningful visual patterns that guide cube placement. This strategy is believed to engage both local and global processing as the visual input is first segmented and its parts are then integrated into a coherent structure. It relies more heavily on visual working memory, resulting in fewer looks at the model and generally superior performance outcomes. Individual and developmental differences in strategy use have been reported, with older adults more often relying on the global strategy, possibly to compensate for age-related working memory decline (Rozenchwajg et al. 2005), while the synthetic strategy is more frequently used by individuals with higher visuospatial abilities and better performance (Rozenchwajg and Fenouillet 2012). Given the consistent observation of enhanced performance on the BDT in autistic individuals, it is possible that they tend to use strategies that emphasize analytic or synthetic approaches, in line with their attention to detail and strong visuospatial abilities. However, no studies to date have directly examined strategy use in autistic populations through an objective method, despite the valuable insights such research could offer into the cognitive processes behind their superior performance.

The present study aimed to investigate the cognitive mechanisms underlying superior performance on the BDT in autism by examining the visual and construction strategies used during task completion by autistic and non-autistic individuals. To this end, we used eye-tracking to record how participants visually explored the task. From these data, we calculated a composite score to reflect their inclination toward either an analytic or a global strategy, as defined in prior research (Diu et al. 2025). We also investigated construction

behavior by examining how participants placed the blocks on the grid: sequentially by row or column (analytic strategy), based on meaningful visual patterns (synthetic strategy), or with no apparent order (Gestalt-like or global approach). We hypothesized that autistic individuals would be more likely to adopt efficient strategies—namely, analytic and synthetic approaches—in both visual exploration and construction behavior. Specifically, we expected autistic participants to more frequently use row- or column-based (analytic) and pattern-based (synthetic) construction strategies, which have been associated with better performance on the task.

2 | Methods

2.1 | Participants

Participants were recruited either from the local university or via online platforms. Eligibility criteria included good verbal comprehension and normal or corrected-to-normal vision. Visual acuity was assessed using the Monoyer chart (3m) to ensure that visual impairments would not affect task performance. For the typically developing (TD) group, individuals were excluded if they reported a neurological or psychiatric condition, or if their score on the Autism Spectrum Quotient (AQ; Baron-Cohen et al. 2001) exceeded the clinical cutoff of 32. All participants in the ASD group had received a formal diagnosis according to DSM-IV or DSM-5 criteria, confirmed by a doctor and supported by standardized assessments such as the Autism Diagnostic Observation Schedule–Second Edition (ADOS-2; Lord et al. 2012), or the Autism Diagnostic Interview–Revised (ADI-R; Rutter et al. 2003).

A total of 51 participants took part in the experiment, of whom 10 (6 TD, 4 ASD) were excluded because they failed to complete at least two nine-cube items or because the eye-tracking signal quality was too weak (i.e., below 60% of recording). The final sample therefore included 41 adults aged 18–40 years (TD = 23; ASD = 18). Group characteristics are reported in Table 1. The

groups were matched on age ($U = 186, p = 0.579$), sex distribution ($\chi^2(1) = 0.717, p = 0.397$), education level ($U = 189, p = 0.624$), nonverbal intelligence as measured by Raven's Standard Progressive Matrices (Raven et al. 1998), and verbal comprehension assessed with the Similarities ($t(39) = 0.304, p = 0.763$) and Vocabulary ($t(39) = -0.561, p = 0.578$) subtests of the Wechsler Adult Intelligence Scale (WAIS-IV; Wechsler 2008).

2.2 | Procedure

The experiment was conducted in a quiet, distraction-free room to ensure optimal concentration. After giving informed consent, participants first underwent a visual acuity test followed by the manual dexterity assessment. They then completed the BDT and the Standard Progressive Matrices, with the order of these two tasks randomized across participants. Participants from the TD group completed the Autistic Quotient questionnaire (Baron-Cohen et al. 2001) via the online platform LimeSurvey to screen for potential ASD and/or high autistic traits. The BDT was performed while participants wore an eye-tracking device to record their visual behavior. They were seated approximately 45 cm from the stimulus book which was placed on a stand tilted at approximately 60° to ensure optimal eye-tracking recording. For each participant, a calibration was conducted before the task, allowing free head movement during the session. Instructions were given using the first item as a training trial. All participants received a gift voucher as compensation. The study was part of a larger research project that has received the approval of the University of Toulouse's ethics committee (#2021-446) and that follows the General Data Protection Regulation (GDPR).

2.3 | Manual Dexterity Assessment

Manual dexterity was assessed using the Purdue Pegboard Test (Tiffin and Asher 1948), a standardized measure of fine motor skills and bimanual coordination. The apparatus consisted of a board with two parallel rows of holes and a tray

TABLE 1 | Descriptive characteristics of participants in the TD and ASD Groups.

Characteristics	TD group (n = 23)	ASD group (n = 18)
Age (years)	25.1 (4.92)	26.7 (6.38)
Sex (female %)	52%	39%
Education level (% per level)	[1] 4.3% [2] 30.4% [3] 8.7% [4] 30.4% [5] 26.1%	[1] 5.5% [2] 33.3% [3] 16.7% [4] 22.2% [5] 22.2%
Nonverbal intelligence		
RSPM scores	50.8 (4.85)	52.7 (3.95)
Verbal comprehension		
Similarities WAIS-IV	14.7 (2.22)	14.9 (2.04)
Vocabulary WAIS-IV	13.9 (2.89)	13.3 (4.35)

Note: Values are means (SD) or percentages for categorical variables. Education level corresponds to French national degree classifications: [1] = trade/technical qualification, [2] = high school diploma, [3] = two-year post-secondary diploma, [4] = bachelor's degree, [5] = master's degree.

containing small metal pegs, collars, and washers. The test comprised four timed subtests: inserting as many pegs as possible using (1) the dominant hand, (2) the non-dominant hand, (3) both hands simultaneously, and lastly, (4) assembling sequences of pegs, collars, and washers with both hands. Each trial lasted 30 s for the placement tasks and 60 s for the assembly task. Scores from each subtest were recorded as the number of correct placements or assemblies, and their sum was used in the analysis. This measure allowed us to control for potential differences in manual motor skills that may influence performance on the BDT, which similarly involves rapid and precise hand movements.

2.4 | BDT

The original BDT subtest from the Wechsler Adult Intelligence Scale—Fourth Edition (WAIS-IV; Wechsler 2008) was used. Participants were instructed to reproduce geometric designs using red and white cubes, based on patterns shown one at a time. Each cube had six faces with two fully red, two fully white, and two diagonally divided into red and white. In accordance with standard clinical procedures for adult populations, the task began at item 5 and ended at item 14, unless two consecutive failures occurred, in which case the task was stopped. The first six items (items 5 to 10) involved reproducing simple patterns using four cubes within 60 s, while the last four items (items 11 to 14) required constructing more complex designs with nine cubes within 120 s. According to the WAIS-IV guidelines, a total raw score was obtained combining accuracy and completion time of each item (with bonus points awarded for faster performance) and a standardized age-corrected score was calculated for each participant. In addition, the mean item resolution time at four and nine-cube items was calculated for each participant in order to consider resolution time as a performance indicator.

2.5 | Strategies Identification Through Eye-Tracking Records

Data were collected using SMI ETG 2w (version 2.6) mobile eye-tracking glasses to record participants' gaze behavior in conditions closely aligned with those of clinical assessments. The system, combined with iView ETG software, captured the visual scene while tracking binocular gaze position via infrared cameras at a sampling rate of approximately 60 Hz (one image every 16 milliseconds). The device was suitable for participants wearing contact lenses or corrective lenses within ± 4 diopters. Before starting the task, a three-point calibration was performed for each participant to ensure precise eye-tracking. Raw eye-tracking data were processed using BeGaze 3.7 software (SensoMotoric Instruments). The software's Semantic Gaze Mapping tool was used to manually map fixations onto reference images of each item, a necessary step given that the visual scene shifted with participants' head movements. When necessary, an offset correction was applied after data acquisition to adjust for small drifts in gaze alignment (Holmqvist et al. 2012). Two Areas of Interest (AOIs) were defined on each reference image: the model area (the geometric design participants had to reproduce) and the response area (where participants took and

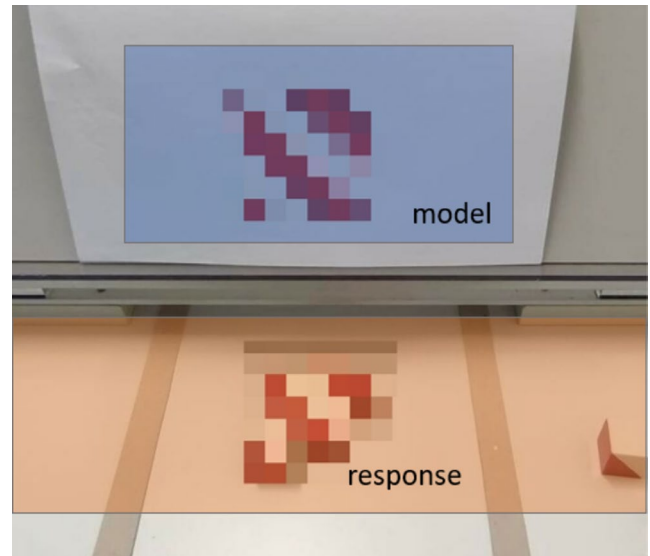


FIGURE 1 | Illustration of the areas of interest (AOIs) for a BDT item. *Note:* The model AOI (top) includes the geometric pattern that participants were instructed to reproduce. The response AOI (bottom) encompasses the area where participants selected and placed the cubes during the task. The model and the construction were pixelated due to copyright.

placed the cubes) as shown in Figure 1. These AOIs were slightly enlarged relative to their actual elements to accommodate minor slippage of the eye-tracking glasses, and their size and position remained consistent across all items.

Analyses to investigate visual and construction strategies focused on the nine-cube items only. Eye-tracking analyses excluding items with insufficient signal quality ($< 60\%$ valid data) corresponding to one item for 4 different participants (2 in the TD group, 2 in the ASD group). Extracted variables included the *item resolution time* (from first gaze at the model to final answer), the *exploration percentage* within each AOI (time spent in AOIs relative to the item resolution time), and the *number of gaze transitions* between these AOIs. A *composite score* based on these eye-tracking measures to reflect visual exploration strategy was calculated for each item as follows:

$$\text{Composite score} = \frac{\text{model area exploration time [\%]}}{\text{response area exploration time [\%]}} \times \frac{\text{item resolution time [s]}}{\text{number of gaze transitions}}$$

This score combines the relative allocation of visual attention between the model and response areas with the frequency of gaze transitions between them. Lower scores therefore reflect a more analytic visual strategy, characterized by relatively greater exploration of the response area and more frequent gaze transitions between the model and response areas. Conversely, higher scores reflect a more global-like visual exploration, characterized by fewer gaze transitions and longer exploration phases within each area (see Figure 2). *Mean composite scores* were also computed per participant to assess overall strategic tendencies on nine-cube items.

Concerning the *construction strategy*, the order or sequence in which the cubes were placed was extracted for each item from

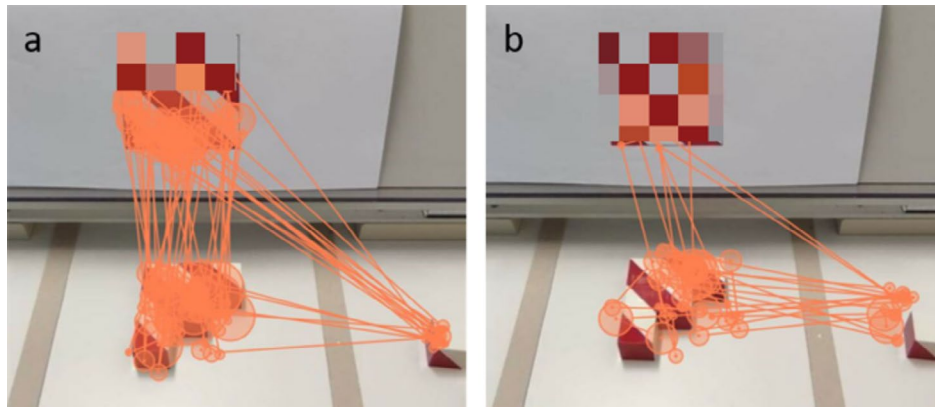


FIGURE 2 | Scan paths associated with low (a) and High (b) composite score. Panel (a) shows the scan path of a participant with a low composite score (217.96), reflecting a global visual exploration strategy. Panel (b) shows the scan path of a participant with a high composite score (1091.94), reflecting an analytical visual exploration strategy. Some areas were pixelated due to copyright. Scan paths were extracted from data through BeGaze software.

the video recordings. Three different construction strategies were identified: a linear placement (by row or column) was classified as analytic-like construction, a pattern-based placement (involving meaningful subunits or blocks) as synthetic-like construction, and unordered placement (without a structured sequence) as global-like construction.

2.6 | Statistical Analyses

All statistical analyses were performed using Jamovi (version 2.6.17), which was also used to generate all figures. The significance level was set at $\alpha=0.05$. A sensitivity power analysis was conducted using G*Power (Faul et al. 2007) based on the main between-group comparison design ($n=23$ vs. 18, $\alpha=0.05$, power=0.80), indicating that the present sample allowed detection of large effects only (minimum detectable effect size: $d=0.90$). Normality and homogeneity of variance were assessed using Shapiro–Wilk and Levene’s tests, respectively. Where relevant, effect sizes are reported alongside test statistics, using Cohen’s d for t -tests, rank-biserial correlations (r) for Mann–Whitney tests, and Cramer’s V for chi-square analyses.

Group comparisons of BDT performance (both raw and standardized scores) as well as resolution time and manual dexterity (Purdue Pegboard Test) were analyzed using independent samples t -tests. When assumptions of normality were violated, non-parametric Mann–Whitney U tests were used instead, as was the case for resolution times on four- and nine-cube items. To further examine group differences in BDT performance, ANCOVAs were conducted on raw and standardized scores with manual dexterity included as a covariate.

To examine visual exploration strategies, composite scores were compared between successful and failed items, as well as between groups, using Mann–Whitney U tests due to the non-normal distribution of these variables.

Associations between categorical variables such as construction strategy and success level or group variables were assessed using

Fisher’s exact test as some frequencies in contingency tables were below 5. The effect of construction strategy on item resolution time was analyzed using a Kruskal–Wallis test, followed by Dwass–Steel–Critchlow–Fligner post hoc comparisons.

Finally, the relationship between visual exploration strategies and construction strategies was tested using a Kruskal–Wallis analysis, as composite scores did not meet the assumptions for parametric testing. Additionally, three Mann–Whitney U tests were conducted to compare composite scores between groups within each construction strategy, with Bonferroni correction applied to account for multiple comparisons (adjusted $\alpha=0.017$).

The dataset used for the statistical analyses is provided in the [Supporting Information](#).

3 | Results

3.1 | Performance Level

Performance on the BDT was first examined in terms of accuracy and resolution time across groups. No significant differences were found in total BDT raw scores, $t(39)=1.36$, $p=0.181$, between ASD ($M=54.8$, $SD=7.53$) and TD ($M=51.0$, $SD=9.70$) groups, although a trend was observed in favor of the ASD group. The same trend was obtained for standard scores, $t(39)=1.52$, $p=0.138$, regarding ASD ($M=11.9$, $SD=3.23$) and TD groups ($M=10.5$, $SD=2.86$). The average resolution time was similar between groups, for both four-cube, $U=186$, $p=0.581$, and nine-cube items, $U=165$, $p=0.276$. Interestingly, these performance tendencies were observed despite significantly lower manual dexterity scores in the ASD group ($M=70.2$, $SD=10.34$) than in the TD group ($M=78.2$, $SD=8.03$), as measured by the Purdue Pegboard Test, $t(39)=1.52$, $p=0.008$, $d=0.884$. After controlling for raw BDT scores, a significant group effect emerged for raw BDT scores, $F(1, 38)=4.82$, $p=0.034$, whereas no significant effect was observed for standardized scores, $F(1, 38)=0.06$, $p=0.806$.

3.2 | Visual Exploration Strategy

To investigate visual processing strategies, eye-tracking data were analyzed for the most complex items, that is nine-cube items. A composite score was calculated for each item to reflect an analytic strategy when low and a global strategy when high. As expected, composite scores were significantly higher on failed items ($M=878$, $SD=1023$, $N=32$) than on successfully completed ones ($M=543$, $SD=352$, $N=127$), $U=1516$, $p=0.027$, $r=-0.254$, suggesting that global visual exploration is associated with reduced performance. In addition, comparative analyses by group showed that ASD participants ($M=515$, $SD=293$) had significantly lower composite scores than TD participants ($M=685$, $SD=706$), $U=2458$, $p=0.023$, $r=0.211$, indicating a more analytic visual exploration style in autism (see Figure 3). This difference remained significant even when restricting the analysis to correctly completed items only, $U=1397$, $p=0.003$, $r=0.304$. This result suggests that autistic participants engaged more systematically in analytic gaze behavior regardless of performance outcome. Thus, and although overall task performance did not differ significantly between groups, the visual strategy appeared to be more analytic among autistic individuals.

3.3 | Construction Strategy

Based on the order in which participants placed the cubes during nine-cube items, three distinct strategies were identified: a global-like strategy (i.e., unordered placement), a synthetic-like strategy (i.e., placement by subunits or patterns) and an analytic-like strategy (i.e., cube-by-cube linear strategy). Table 2 summarizes the distribution of construction strategies across items and their associated performance. Regarding the performance, Fisher's exact test indicated that success rates differed significantly across these strategies, $p<0.001$ (see Table 2). The global-like strategy was

associated with the lowest success rate, while the synthetic-like and the analytic-like strategies led to the highest.

The construction strategy was also found to influence the resolution time, $\chi^2(2)=43.3$, $p<0.001$. Post hoc pairwise comparisons showed that the global-like strategy required significantly more time than the synthetic-like strategy, $W=-8.36$, $p<0.001$, and the analytic-like strategy, $W=-7.92$, $p<0.001$, but showed no significant difference between the synthetic-like and analytic-like strategies, $W=-0.23$, $p=0.985$. These results suggest that structured strategies (synthetic or analytic) not only lead to higher success rates but also allow for more efficient task completion.

Group comparisons of proportion using Fisher's exact test revealed significant differences in strategy use, $p<0.001$ (see Figure 4). ASD participants used the global-like strategy less frequently (5.7% vs. 47.7%) and were more likely to employ the synthetic-like strategy (64.3% vs. 33.7%) than their TD counterparts. Remarkably, no participant in the ASD group successfully

TABLE 2 | Construction strategy characteristics for nine-cube items.

Construction strategy	N (%)	Success rate	Resolution time [s] (M ± SE)
Global-like	46 (28.9%)	50.0%	84.70 (± 27.15)
Synthetic-like	75 (47.2%)	89.3%	49.90 (± 24.71)
Analytic-like	38 (23.9%)	97.4%	46.32 (± 17.38)

Note: A total of 159 items were analyzed.

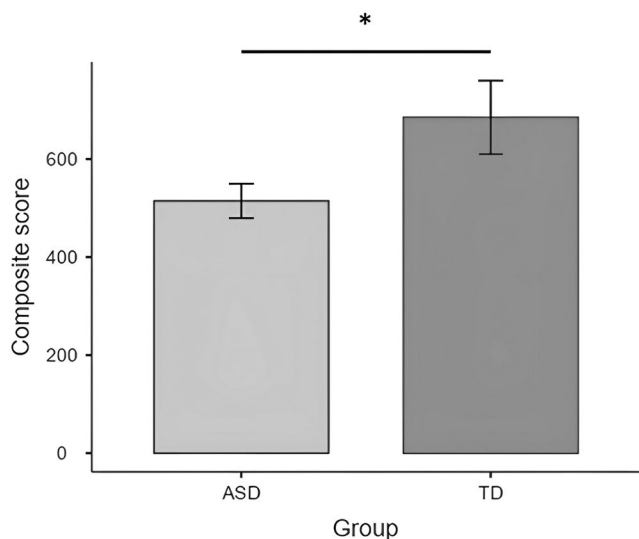


FIGURE 3 | Mean composite score on items by group. Note: The bar plot illustrates the mean item composite score for each group ($N_{ASD}=70$, $N_{TD}=89$). Error bars represent standard error of the mean (SEM). Statistical significance of the Mann–Whitney test is reported (* $p<0.05$, ** $p<0.01$, *** $p<0.001$, ns).

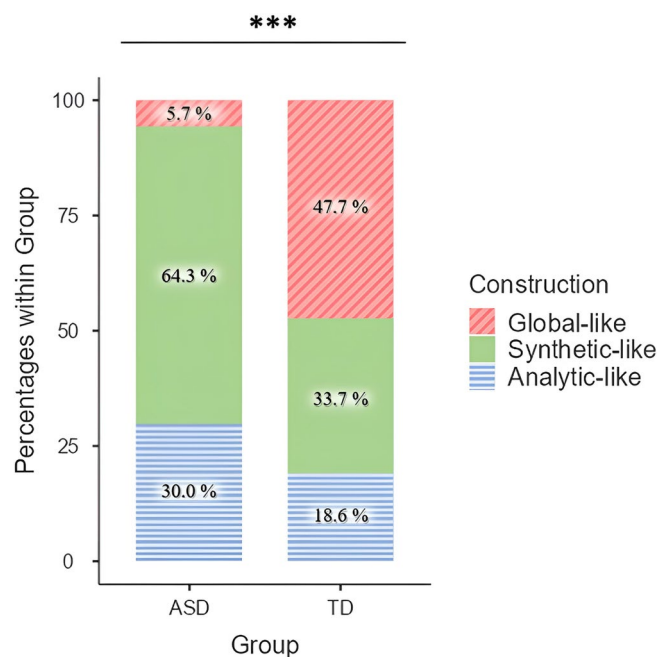


FIGURE 4 | Percentage of construction strategies use for items by group. Note: Bars represent the number of items completed using each construction strategy in the ASD and TD groups. All nine-cube items were considered, without regarding the success level. Statistical significance of Fisher's exact test is reported (* $p<0.05$, ** $p<0.01$, *** $p<0.001$, ns).

completed an item using the global-like strategy. These findings suggest a more systematic and effective approach to construction in the ASD group.

3.4 | Interaction Between Visual and Construction Strategies

Finally, we investigated whether the visual exploration strategy interacted with the construction strategy to influence performance on the items. Analyses revealed no significant interaction between the two, indicating that visual exploration composite scores did not systematically vary according to construction strategy across the full sample, $\chi^2(2) = 0.031, p = 0.985$. Considering the group, comparisons of composite scores between ASD and TD participants for each construction type indicated no significant difference for the global-like strategy, $U = 65, p = 0.486, r = -0.226$, nor for the synthetic-like strategy, $U = 562, p = 0.225, r = 0.167$. However, they revealed a strong difference for the analytic-like strategy, $U = 50, p < 0.001, r = 0.720$, with higher scores reflecting a global strategy observed in the TD group (see Figure 5). These results suggest that, in the TD group, visual exploration does not strictly align with the construction strategy, as participants tend to adopt a global-like exploration strategy even when engaging in analytic construction. In contrast, ASD individuals show greater consistency between analytic visual exploration and analytic construction strategies.

4 | Discussion

Visuospatial abilities in autism have long been the focus of cognitive research, particularly through tasks such as the BDT, where findings suggest superior performance in autistic individuals compared to neurotypical controls (e.g., Happé 1994; Shah and Frith 1993). These observations contributed to the emergence of explicative models such as the EPF model (Mottron et al. 2006), which emphasizes a cognitive style oriented toward local and detail-based processing. As previous work in general contexts has shown that some resolution strategies are more efficient in performing the BDT, it becomes particularly relevant to ask whether autistic individuals differ in their strategies. In

the present study, we sought to examine this question by investigating both visual exploration and construction strategies using eye-tracking during administration of the standard version of the BDT. Rather than just focusing on raw and standardized scores, our aim was to explore how autistic and non-autistic adults approach the task, and whether these strategies differ between groups and relate to task success.

Surprisingly, our results revealed no significant difference in overall performance on the BDT between the autistic and neurotypical groups even if subtle trends toward better performance for autistic individuals were observed. This finding is consistent with previous studies that also failed to find a significant group difference (Bölte et al. 2008; de Jonge et al. 2009), suggesting that superior visuospatial abilities in autism may not always translate into higher performance. However, controlling for motor ability in our study revealed a group difference in raw BDT scores, suggesting that motor difficulties in the autistic group may partly mask performance differences between groups. Compensatory mechanisms, including enhanced visuospatial reasoning or more efficient strategy use, may help maintain overall performance.

Analyses of both visual exploration and construction behavior confirmed that certain strategies were more effective than others in completing the BDT. In terms of visual processing, analytic-like exploration was associated with greater success, while global-like exploration was more frequently observed in failed trials. This finding is consistent with earlier studies indicating that detail-focused visual strategies, such as the analytic strategy, enhance accuracy in BDT (e.g., Rozenchwajg and Corroyer 2001; Rozenchwajg and Huteau 1996). However, we found no clear difference in effectiveness between the synthetic and analytical strategies as described in these previous BDT studies. This difference in results could be related to methodological differences, as some studies used an adapted version of the BDT, which did not include the same items as the original task (Rozenchwajg and Corroyer 2001; Rozenchwajg and Fenouillet 2012). Although visual exploration and construction behavior were analyzed independently, both point in the same direction, as participants who engaged in more analytic-like behaviors tended to perform better in terms of accuracy and resolution time. These two success factors are central to the BDT scoring system, which rewards not only correct solutions but also the speed with which they are achieved through a point-bonus notation (Wechsler 2008). Together, these results highlight the key role of strategic approach in explaining performance heterogeneity in BDT.

When comparing groups, autistic participants consistently favored the more effective strategies, such as synthetic and analytic strategies. In visual exploration, they displayed significantly more analytic gaze behavior than neurotypical participants, regardless of performance outcome. Similarly, for the construction, they relied predominantly on synthetic and analytic-like strategies. While no overall interaction was found between visual exploration and construction strategies across participants, autistic individuals specifically exhibited a stronger alignment between the analytic construction strategy and an analytic visual exploration pattern. This consistent use of structured and systematic approaches in the ASD group aligns with

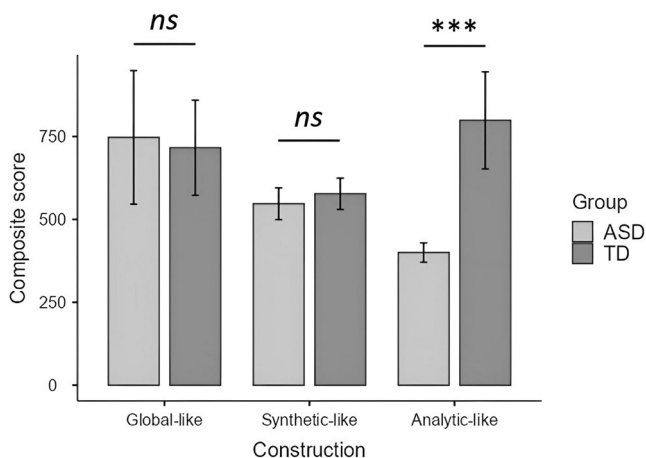


FIGURE 5 | Mean composite score of items by construction strategy and group. Note: Error bars represent standard error of the mean (SEM).

previous evidence of a local processing bias in autism (Mottron et al. 2006) and suggests that autistic participants tend to process visuospatial information in a more segmented and detail-focused manner, independently of performance accuracy.

Although no significant performance difference was observed between autistic and neurotypical participants in our study, the analysis of strategy use provides important insights into the underlying mechanisms of visuospatial reasoning in autism. Previous research has often referred to peaks of ability in autism as indicative of enhanced perceptual or analytic processes (e.g., Caron et al. 2006; Soulières, Dawson, et al. 2011a; Stevenson and Gernsbacher 2013). In this light, our findings suggest that even in the absence of superior performance, autistic individuals engage in strategies that align with this enhanced perceptual processing. This supports the idea that task success may depend on how internal resources are mobilized to meet task demands. These reasoning strategies in autism may rely on a distinct cognitive profile, potentially offering advantages in tasks where perceptual details and internal structure are key. However, such benefits may be modulated by other factors, including executive resources, processing speed, or manual dexterity. In our sample, autistic participants exhibited reduced manual dexterity compared to neurotypical controls, which may have influenced their performance despite the use of effective perceptual strategies. This observation may also help explain why some previous studies, if manual dexterity was not explicitly controlled yet unintentionally matched between groups, reported better performance in autistic individuals.

Several limitations should be considered when interpreting the present findings. First, we did not account for the order of item presentation or potential differences in difficulty, which may be influenced not only by item complexity but also by the types of patterns to be reproduced. Moreover, our analyses focused exclusively on the nine-cube items, and it would be valuable for future research to investigate whether the differences observed here also apply to the four-cube items. Our approach to analyzing strategy use both in visual exploration and construction did not allow us to capture possible within-task or within-trial shifts in strategies. This limitation may have led to an underestimation of the dynamic nature of problem solving and affected the interpretation of our results. Finally, the relatively small sample size limited statistical sensitivity, such that only large between-group effects could be reliably detected. Smaller but potentially meaningful differences may therefore have remained undetected, such as differences in overall BDT performance between groups. Larger samples would help clarify these findings.

Future research should more closely examine intra-individual variability in strategy use, to better understand how individuals may flexibly shift between different approaches across tasks or contexts. In parallel, the well-documented inter-individual variability in autism, such as differences between individuals formerly diagnosed with Asperger syndrome and others on the spectrum, also warrants further investigation, as it may contribute to distinct patterns of cognitive processing and strategy preference. It would also be valuable to examine the different types of errors made during construction (Dunn et al. 2021; Joy et al. 2001) and whether these errors are associated with specific patterns of visual exploration or construction strategies in

autism. Additionally, we did not investigate underlying cognitive resources such as memory and attention, but studying how these relate to different strategic profiles could help us better understand what drives performance and how cognitive abilities interact with strategy use. From a developmental perspective, exploring how strategy use changes across the lifespan in autism would provide important insights into whether these patterns represent early traits, adaptive compensations, or learned behaviors.

In conclusion, the present study sheds new light on the cognitive mechanisms underlying visuospatial reasoning in autism. Our results demonstrate that certain strategies—particularly analytic and synthetic approaches—are associated with greater performance in the BDT, and that autistic individuals tend to adopt these effective strategies more consistently than neurotypical participants. These findings reinforce the idea that performance in autism cannot be fully understood without considering the cognitive style and strategic engagement underlying task resolution. In doing so, our study contributes to a more refined understanding of the so-called “peaks” observed in autism, suggesting that they may arise not only from enhanced perceptual capacities but also from distinct, structured modes of problem solving. Investigating these cognitive dynamics in greater depth, especially through the lens of intra-individual variability, represents a key step toward more personalized and accurate models of autistic cognition. Identifying cognitive profiles that favor certain strategies could inform interventions tailored to support learning and problem solving in autistic individuals.

Acknowledgments

We sincerely thank all the participants for generously giving their time to take part in this study. We also warmly thank Justine Nadon and Gabrielle Tétreault, students from the University of Quebec at Montreal (UQAM), Canada, for their valuable insights and assistance in preliminary analysis. Open access publication funding provided by COUPERIN CY26.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that supports the findings of this study are available in the [Supporting Information](#) of this article.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** Supporting Information