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Precocious realists: perceptual and cognitive characteristics associated with drawing talent in non-autistic children

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A local processing bias in the block design task and in drawing strategy has been used to account for realistic drawing skill in individuals with autism. We investigated whether the same kind of local processing bias is seen in typically developing children with unusual skill in realistic graphic representation. Forty-three 5–11-year-olds who drew a still life completed a version of the block design task in both standard and segmented form, were tested for their memory for the block design items, and were given the Kaufmann Brief Intelligence Test-II. Children were classified as gifted, moderately gifted or typical on the basis of the level of realism in their drawings. Similar to autistic individuals, the gifted group showed a local processing bias in the block design task. But unlike autistic individuals, the gifted group showed a global advantage in the visual memory task and did not use a local drawing strategy; in addition, their graphic realism skill was related to verbal IQ. Differences in the extent of local processing bias in autistic and typically developing children with drawing talent are discussed.

Keywords: art; gifted; autism

A realistic drawing does not *copy* information from the world onto paper: even the most highly realistic drawing is an abstraction that differs considerably from the image formed on the retina with a stationary eye (Gombrich 1960; Kennedy 1974; Gibson 1979; Gregory 1997). It is not possible to transfer the infinite gradations in colour and light, or the enormous array of detail in our three-dimensional visual world, onto a two-dimensional surface, and thus much information must be omitted. In addition, the most realistic drawings also must *distort* in order to convey the illusion of realism: a table top drawn with lines that converge is a distortion—an actual table's edges are parallel—and yet the distorted table top conveys the impression of an actual table receding into depth. A viewer-specific rather than object-specific representation must be drawn for the picture to look realistic.

Individuals differ in their ability to draw realistically, and these differences can be seen in very early childhood, prior to any kind of drawing instruction (Golomb 1992; Winner 1996; Milbrath 1998). Children who are gifted in realistic drawing and who are able to create life-like representations (hereafter referred to as precocious realists) create drawings that differ in many respects from the drawings of typical children. Here, we outline some of the most important differences, discuss the role of culture in influencing the type of realistic style adopted, ponder why it is that we see early gifts in realistic representation but not in abstract expressionism, and consider some of the

cognitive and perceptual skills associated with precocious realism in typically developing as well as autistic individuals with drawing talent. We argue that the precocious realists and autistic savants are similar in important (though not all) respects.

1. CHARACTERISTICS OF DRAWINGS BY NON-AUTISTIC PRECOCIOUS REALISTS

(a) *Graphic representation, not action representation*

While typical children begin to draw recognizable shapes representing objects in the world at around the age of 3 or 4 (Kellogg 1969; Matthews 1984; Golomb 1992), some children produce their first representational drawings at the age of 2. The typical child who made the drawing in [figure 1](#) moved the brush in circular motions while labelling his painting an aeroplane: his drawing *represents* an aeroplane, but the representation was in the *action* and the labelling rather than in the final product. Matthews (1984) refers to this kind of drawing as an 'action representation', and contrasts it to a 'graphic representation' ([figure 2](#)), where it is clear what the drawing represents *after* the process of creating the drawing is complete.

(b) *Line as contour or edge*

[Figure 3](#) is a drawing of two apples by a precocious realist aged 2 years and two months; [figure 4](#) is a drawing of two apples by a typical child of precisely the same age. In [figure 3](#), the lines stand for the contour of the apples. In [figure 4](#), each line stands for an apple, with no regard for the apple's contour. For this child, a line simply stands for 'thingness'.

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One contribution of 18 to a Discussion Meeting Issue 'Autism and talent'.



Figure 1. Action representation by a 2-year-old. From Matthews (1984), 'Children Drawing: Are Young Children Really Scribbling' *Early Child Development and Care*, Taylor and Francis, Ltd., <http://www.informaworld.com>, reprinted with permission from the publisher.

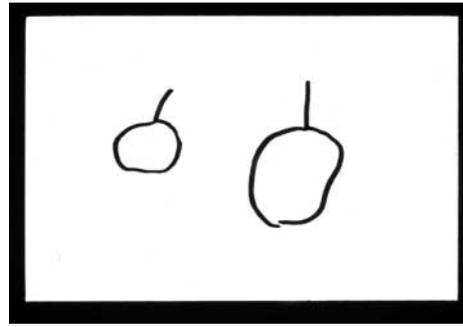


Figure 3. Two apples drawn by a precocious realist, age 2.2. From Winner (1996).



Figure 4. Age-typical representation of two apples, age 2.2. From Winner (1996).



Figure 2. Balloons drawn by a precocious realist, age 2. From Winner (1996).

(c) Differentiated shape

Figure 5 shows the familiar tadpole representation of a human, typical of children at age 3. The head and body are not differentiated, and arms and legs come out of a central circular form. By contrast, figure 6 shows a drawing by Grace, a child with an extraordinary ability to draw people realistically as early as age 2. In place of the simple, schematic, flat forms found in typical child art, Grace has produced a differentiated human form suggesting an effort to understand how objects are structured.

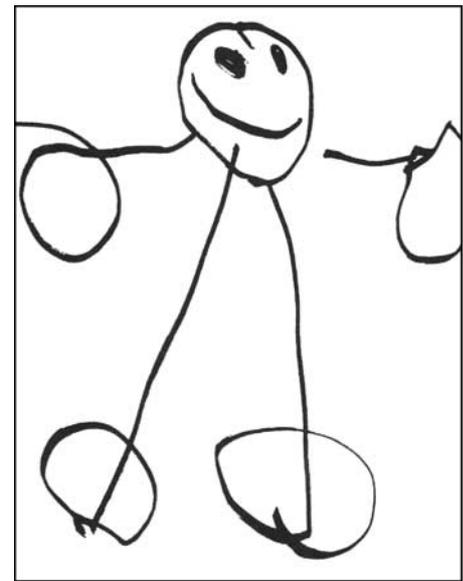


Figure 5. Tadpole human, age 3. From Winner (1996).

(d) Proportion

Milbrath (1998) found that artistically gifted children succeed in drawing human figures in proportion between the ages of 4 and 10. The non-gifted children that she studied were still unable to capture proportion by age 14 (which was the oldest age at which she observed their drawings).

(e) Illusion of depth

Typically, children in Western culture do not begin to try to depict volume and depth until middle childhood, and do not use even primitive perspective until adolescence (Willats 1977). But some children invent



Figure 6. Dancing figure drawn by Grace, precocious realist, age 3. From Winner (1996). Reprinted with permission from Jennifer and Alan Pekrul.

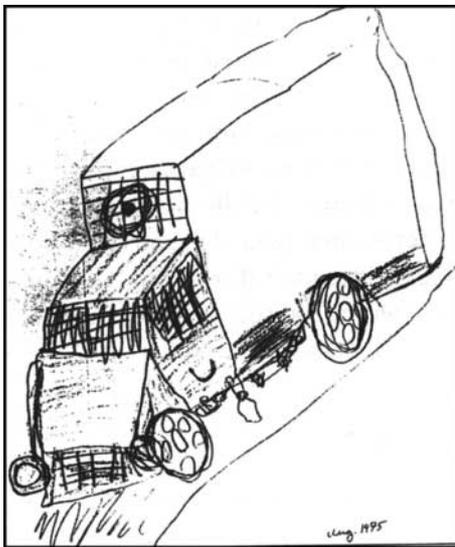


Figure 7. Truck by Eitan, age 3.7, showing perspective. From Golomb (1992). Reprinted with permission from Claire Golomb.

primitive perspective systems as early as 3 years of age. Figure 7 shows a truck drawn by a child aged 3 years and seven months, in which he has represented the third dimension by parallel oblique lines (Golomb 1992). Artistically gifted children begin to make viewer-specific drawings long before ordinary children do so (Milbrath 1998). Their drawings show figures in non-canonical positions (e.g. three-quarter views of faces by age 7, back views, profiles) as well as figures distorted and foreshortened by perspective.

(f) *Ease of drawing*

Precocious realists draw quickly and with ease (Gordon 1987; Paine 1987; Pariser 1991, 1992/93; Milbrath 1998). They do not labour and erase. The young Picasso could draw anything upon demand, and liked to start a figure from non-canonical places, for instance, by drawing a dog beginning with the ear (Richardson 1991).



Figure 8. Cat by Yani, age 3. Reprinted with permission from Wang Shiqiang.

(g) *Realism in juvenilia of great artists*

The ability to draw realistically at an earlier than average age also marks the childhoods of those who go on to become established artists, but we only have evidence for this from artists born into a Western artistic tradition. Gordon (1987) studied the childhood works of 31 Israeli artists and found that all stood out for their ability to draw realistically. The desire and ability to draw realistically at an early age also characterized the childhoods of a group of sculptors (Sloane & Sosniak 1985).

Picasso provides a clear example of the ability to draw highly realistically at an early age. He claimed that he bypassed the typical stage of early drawings in which children draw in a fanciful, playful and non-realistic manner. 'I have never done children's drawings. Never' (Richardson 1991, p. 29). When he went to see a show of child art, he noted, 'As a child I would never have been able to participate in a show of this kind: at age 12, I drew like Raphael' (Richardson 1991, p. 29). And he recalled specific examples of this adult-like style: 'Even when I was very small, I remember one of my first drawings. I was perhaps six... In my father's house there was a statue of Hercules with his club in the corridor, and I drew Hercules. But it wasn't a child's drawing. It was a real drawing, representing Hercules with his club' (Richardson 1991, p. 29). At 11, Picasso enrolled in his father's academic drawing class, in which students had to make detailed renderings of plaster casts. While most students considered this drudgery, Picasso loved it.

2. THE INFLUENCE OF THE CULTURE'S ARTISTIC CONVENTIONS ON DRAWINGS BY NON-AUTISTIC PRECOCIOUS REALISTS

A comparison between ink drawings by Yani (figure 8), a Chinese child considered a prodigy in painting (Zhensun & Low 1991), and the drawings in figures 2, 3 and 6 underscores the role of the culture's artistic conventions (the domain) in shaping the drawings of even very young children gifted in drawing. By the time she was four, Yani had developed a sense of the adult art world, and could make the kind of art valued by the art 'field' in her culture, i.e. the art historians, the museum curators, etc. She used the classical Chinese wash technique: she did not draw outlines around her shapes, and she painted in the allusionistic, impressionistic, abbreviated style of Chinese ink paintings.

Thus, as Goldsmith (1992) points out, the technical sophistication of her work reveals itself along dimensions different from those of Western children.

We might be tempted to view Grace as the greater realist compared to Yani. However, both child artists mastered the conventions of their culture's art. Grace mastered the use of line as contour or edge, surely a convention, and has conveyed depth through the technique of occlusion (the leg is in front of the skirt and hence part of the skirt is occluded by the leg); Yani mastered the use of thick brush stroke to capture the shape of the cat, with no attempt at creating the illusion of the third dimension.

How can we account for the differences between the drawings of Grace and Yani? We suggest that the differences derive from the pictures these children see. Even 2-year-olds have been exposed to drawings and paintings in the representational style favoured by their culture: children see pictures in magazines, pictures hung on the wall and pictures in the books that are read to them. Western children are more likely to see realistic drawings and cartoons; Chinese children are more likely to see representational works that are drawn in the allusionistic brush and ink style of Chinese classical art. These two children have an astonishing mimetic ability that enables them to internalize the style of the art to which they were exposed and then to generate paintings in that style. These children were not copying specific drawings; rather they were able to extract the style of the drawings to which they had been exposed. Thus, the domain—the body of works that make up the history of painting in one's culture—exerts as powerful an influence on child prodigies as on adult artists. It is unlikely that either Grace or Yani could have painted as they did without the influence of their respective traditions.

What unites all children with artistic gifts, we argue, is not the ability or proclivity to draw in the style of Western realism, but rather the ability to master one or more of the culture's norms of visual representation at a very early age. At the heart of artistic talent is the ability to master one's culture's representational conventions, whether the convention is Western-style realism in the case of Grace or Eitan, or Chinese-style allusionistic brush painting in the case of Yani. It is a mistake to be blinded by our Western eyes and see Western-style realism as the prime sign of artistic talent, when this style is but one of the many possible representational conventions that artistically gifted children master so early and so independently.

3. WHY ARE THERE NO ABSTRACT EXPRESSIONIST PRODIGIES?

In 2007, a movie called 'My Kid Could Paint That' was released in the United States. This movie told the story of Marla Olmstead, a 4-year-old whose canvases have been selling for many thousands of dollars. She has been hailed as an abstract expressionist child prodigy. Perhaps people are willing to pay high sums for her paintings because they believe that she is the next Kandinsky or the next de Kooning. Her website <http://www.marlaolmstead.com> has a painting entitled *Darlene's Bikini* that is superficially similar to a painting by Willem de Kooning (figure 9).



Figure 9. Painting by Willem de Kooning. Reprinted with permission from The Willem de Kooning Foundation/Artists Rights Society.



Figure 10. Painting by Dante Lamb. Reprinted with permission from Aimee Lamb.

Marla is not the only child in the US being touted as an abstract expressionist prodigy. For example, on the website of Dante Lamb, <http://www.dantelambart.com/about.html>, we read that Dante is the Guinness World Record holder for the 'youngest professional artist'. He began painting at the age of 2 and sold his first painting when he was just 3 years old. Since then, he has exhibited his work in several galleries in Georgia and Florida. He paints in the form of abstract expressionism. Figure 10 shows one of his paintings. Marla Olmstead was given excellent paints to use, and canvas to paint on. One reason why her work may have passed for adult abstract expressionism could be that these superior materials lent her paintings a professional appearance. If one looks through the materials to the forms, it becomes clear that her works as well as those of Dante Lamb are not different in any interesting respect from the works of 'typical' pre-schoolers. Some of the works by Marla seem more sophisticated and complex but there is a strong suspicion, developed in the movie, that someone else (perhaps her father) fraudulently completed Marla's painting.

The confusion between the abstract works of 3- and 4-year-olds who draw and paint at an age-typical level and the works of abstract expressionists derives from a misunderstanding of abstract art, and from the all too common view that 'anyone can do this'. The confusion is also played upon by the desire of parents to make their children famous and rich.

Why do we not find true abstract expressionist prodigies? Every domain in which child prodigies have been noted has been a fairly formal, structured, rule-governed domain, whether this be classical music, mathematics or realistic drawing. We do not see prodigies in philosophy or in novel writing, and we do not find them in the domain of abstract art. It appears that the kinds of domains that attract young prodigies are those with a formal set of rules to master. Perhaps it is more difficult to master (and to master well) an ill-defined domain such as abstract art with no rules to learn, rules such as geometric perspective, shading, colour mixing, etc.

4. DO ARTISTIC SAVANTS WITH AUTISM SHARE CHARACTERISTICS WITH NON-AUTISTIC PRECOCIOUS REALISTS?

It is striking that all of the characteristics summarized above that we see in the drawings of non-autistic precocious realists have also been noted in the drawings of artistic savants with autism (Selfe 1977, 1983; O'Connor & Hermelin 1987, 1988, 1990; Wiltshire 1987, 1989, 1991; Mottron & Belleville 1993, 1995; Pring & Hermelin 1993; Pring *et al.* 1995). Artistic savants draw realistically, no abstract expressionist savants have been reported, and culture influences the realistic style of artistic savants, as can be seen in the drawing by a Japanese savant painted in the allusionistic style of Japanese brush paintings (Morishima & Brown 1977). Figure 11 shows an extremely realistic and precise drawing by a Western savant artist with autism, E.C., studied by Mottron & Belleville (1993), and figure 12 shows an ink drawing of a frog by the Japanese adult savant with autism. The shape of the frog is accurately captured, but there are no lines around its edges, and no attempt to show depth. The drawing by the Japanese savant has more in common with the drawing by Yani than with the drawings of Western savants, and this shows the powerful influence of cultural models, even for savants whose skills exist independent of any kind of general intelligence. The parallels in the drawings of non-autistic and autistic individuals with artistic giftedness strongly suggest that what we see in autistic savants' drawings is primarily a function of their talent rather than their diagnosis.

In what follows, we examine the cognitive characteristics of non-autistic precocious realists in order to determine whether these characteristics are similar to those seen in individuals with autism.

5. COGNITIVE SKILLS ASSOCIATED WITH PRECOCIOUS REALISM IN NON-AUTISTIC CHILDREN

Autistic savant artists have below average IQ, allowing us to conclude that their talent in drawing is IQ independent (Selfe 1977, 1983; O'Connor & Hermelin

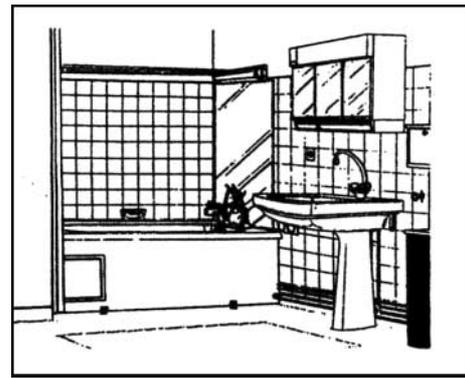


Figure 11. Drawing by savant, E.C. From Mottron & Belleville (1993). Reprinted with permission from Laurent Mottron.

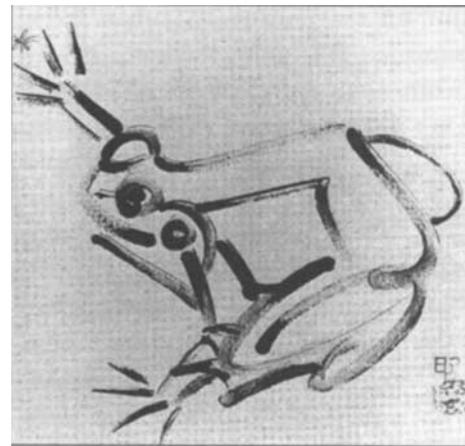


Figure 12. Ink drawing of a frog by a Japanese adult savant. From Morishima & Brown (1977). Reprinted with permission from the American Association on Intellectual and Developmental Disabilities.

1987, 1988, 1990; Wiltshire 1987, 1989, 1991; Pring & Hermelin 1993; Pring *et al.* 1995). They also use a local drawing strategy, focusing on details rather than the overall shapes and layout of shapes on a page (Mottron & Belleville 1993; Mottron *et al.* 1999). In the study that we report below, we investigated whether these two characteristics can be seen in non-autistic precocious realists (Drake *et al.* submitted). We predicted that precocious realism in non-autistic individuals would be IQ independent, and that they would use a more local drawing strategy than children not selected for realistic drawing talent.

Autistic individuals (not selected for drawing talent but instead selected for block design talent) have been shown to excel in mental segmentation (analysing a global whole into its constituent parts and doing this mentally), and in their ability to recall patterns that are not organized into a gestalt (Caron *et al.* 2006). Autistic individuals with drawing talent have also been shown to excel in mental segmentation (Pring *et al.* 1995). We investigated whether these two characteristics can be seen in non-autistic precocious realists. Given that artists excel on the hidden figures task, in which one must focus on details and overlook the whole (Getzels & Csikszentmihalyi 1976), we predicted

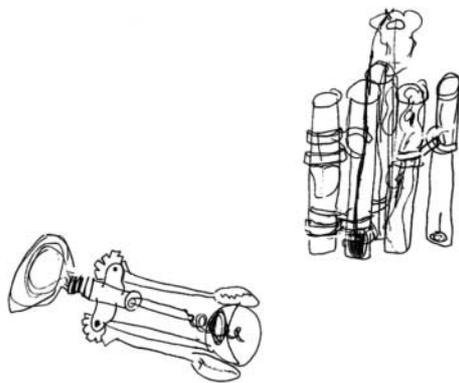


Figure 13. Gifted drawing, age 6.

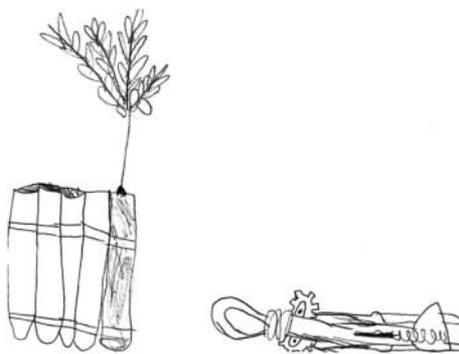


Figure 14. Moderately gifted drawing, age 6.

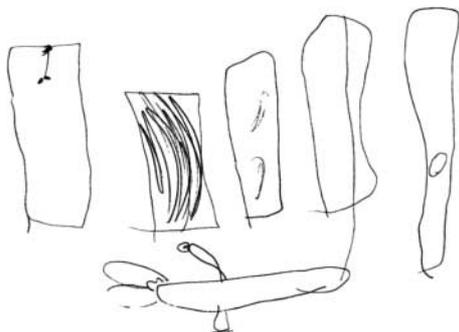


Figure 15. Typical drawing, age 6.

that our non-autistic precocious realists would excel in mental segmentation and in memory for non-wholistically organized visual designs.

We asked 43 children in the age range of 5–11 to sketch a still life containing two complex objects: a vase made up of six connected transparent cylinders and a corkscrew. We videotaped the drawings as they were produced and then classified the drawings in terms of level of realism using a detailed coding scheme. Fifteen children were classified as gifted in realism, 13 as moderately gifted and 15 as age-typical, and the realism scores of these three groups differed significantly from one another. See figures 13–15 for a sample drawing from each group. Table 1 presents the characteristics of the three groups of participants.

(a) IQ

Drawing savants have low IQs, demonstrating the independence of drawing skill and IQ. Do precocious realists also show no advantage in IQ? To answer this question we administered the verbal and non-verbal

Table 1. Descriptive characteristics (means (standard deviations)) of each group of children.

	gifted	moderately gifted	typical
<i>n</i>	15	13	15
age	9;2 (1;5)	8;8 (1;3)	8;11 (1;8)
realism score			
6- to 8-year-olds	0.55 (0.12)	0.30 (0.05)	0.04 (0.05)
<i>n</i>	6	5	5
9- to 10-year-olds	0.74 (0.10)	0.46 (0.08)	0.27 (0.09)
<i>n</i>	9	8	10

Table 2. Mean IQ (and standard deviations) for each group of children.

	gifted	moderately gifted	typical
<i>n</i>	15	13	15
verbal IQ	120.7 (11.2)	112.8 (10.3)	113.6 (13.7)
non-verbal IQ	133.9 (12.9)	116.9 (13.5)	110.9 (13.9)

sections of the Kaufman Brief Intelligence Test-II (Kaufman & Kaufman 2004). Table 2 presents the means and standard deviations for verbal and non-verbal IQ by group.

Not surprisingly, the gifted group was distinguished by their non-verbal IQ, scoring significantly higher than both of the other two groups. The gifted group also scored significantly higher than both of the other groups on verbal IQ. Thus, the relationship between the drawing ability in typically developing gifted children does not obey the same relationship with crystallized intelligence as it does for autistic draughtsmen, in whom realistic drawing talent flourishes alongside below average IQ.

(b) Visual analysis

The block design task assesses the ability to analyse a design into its parts: a design must be copied using blocks, each one of which is a component of the design. Autistic individuals perform well on this test (Lockyer & Rutter 1970; Ohta 1987; Venter *et al.* 1992; Shah & Frith 1993) and benefit less than non-autistic individuals from the presentation of the block design task in a form in which the units are spatially segmented from one another (Shah & Frith 1993). From this finding, it has been concluded that autistic individuals have the ability to spontaneously mentally segment a gestalt into its constituent parts, and that they are characterized by weak central coherence, with the whole less salient for them than the parts.

Similar findings were reported by Caron *et al.* (2006) in a study comparing autistic and typically developing individuals with and without a talent for block design. Caron *et al.* administered a version of the block design task the items of which varied in the level of perceptual cohesiveness. In those with minimal perceptual cohesiveness, the boundary between red and white always co-occurred with the edge separating two blocks, making it easy to see each block as a unit (figure 16). Minimally cohesive items are easily solvable using a local strategy,

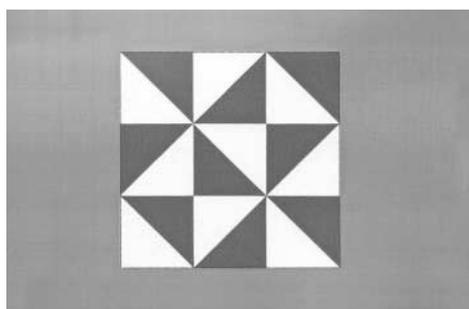


Figure 16. Minimally cohesive item. Reprinted with permission from Laurent Mottron.

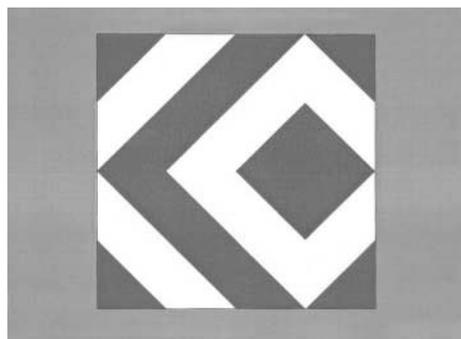


Figure 17. Maximally cohesive item. Reprinted with permission from Laurent Mottron.

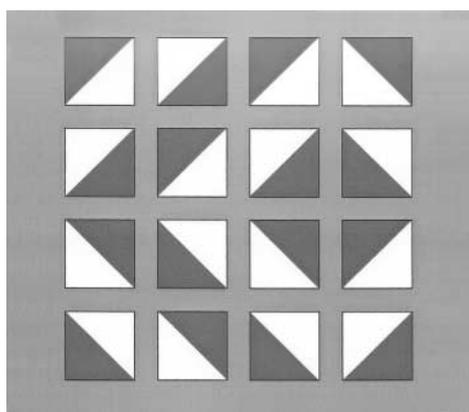


Figure 18. Segmented version of figure 17. Reprinted with permission from Laurent Mottron.

matching each square to a block, and do not require the ability to analyse a whole into its parts since the parts are given. In those with maximal perceptual cohesiveness, the boundary between red and white never co-occurred with the edge separating two blocks, making it difficult to see each block as a unit (figure 17). Maximally cohesive items require analysis of a whole into its parts by mental segmentation (dividing the design mentally into its units of blocks) since the edges do not provide segmentation information. Those intermediate in perceptual cohesiveness had an intermediate number of same coloured adjacencies.

This task was presented in two forms, following Caron *et al.* (2006)—first in unsegmented form, and then in segmented form with the blocks separated from one another by one-third of the width of each block, as in Shah & Frith (1993) (figures 17 and 18). Perceptual cohesiveness and segmentation interact: greater perceptual cohesiveness increases task difficulty

due to the lack of edge cues; segmentation eliminates this difficulty by providing edge cues through spatial separation. Thus, the items requiring the greatest level of visual analysis were those presented in unsegmented form with maximal perceptual cohesiveness. Skill in visual analysis is demonstrated if individuals do as well on the unsegmented as the segmented version, particularly for the items with maximum perceptual cohesiveness.

Caron *et al.* (2006) present a graph showing that both the autistic and typically developing individuals with a talent for block design were slowed minimally or not at all when perceptual cohesiveness of the designs in the unsegmented condition was increased. This was in contrast to the autistic and typical individuals with no block design talent, for whom the increased cohesiveness slowed their performance. Caron *et al.*'s graph also shows that their typically developing individuals were slowed more by the presentation of the task in unsegmented form than were the autistic individuals. These findings show that skill in visual analysis is not dependent on diagnosis but rather on visual-spatial talent.

We sought to replicate this finding by administering Caron *et al.*'s block design task to our three groups of non-autistic children.

(i) *No benefit from segmentation*

We found a three-way interaction (group \times segmentation \times item type): segmentation did not render the tasks easier for any of the groups when the items were minimally cohesive or intermediate in cohesiveness. But for the most difficult items—the maximally cohesive ones—segmentation rendered the task easier for the typical and the moderately gifted group, but had *no* effect on the performance of the gifted group. As hypothesized, the gifted group performed as well on the unsegmented global items as they did on the segmented global items. They were able to mentally analyse/segment the cohesive items and did not need the help of external segmentation. They performed like the autistic individuals with a talent for block design reported by Caron *et al.* (2006).

(ii) *No decrement from increasing perceptual cohesiveness*

On unsegmented items, our gifted group performed equally well on items of all three levels of cohesiveness; for the other two groups, each level of cohesiveness depressed performance (figure 19). Thus, increasing perceptual cohesiveness did not interfere with the visual analysis abilities of the gifted group. Again, our gifted group performed like the autistic individuals with a talent for block design reported by Caron *et al.* (2006).

(c) *Visual memory*

Several previous studies have demonstrated an association between the heightened visual memory skill and artistic ability, both instructed visual memory in adult artists (Winner & Casey 1993), and incidental visual memory in children gifted in realism (Rosenblatt & Winner 1988). Caron *et al.* (2006) assessed incidental visual memory for the block design items to determine whether their autistic sample showed the global advantage in memory seen in typical individuals—recalling the cohesive items better than the fragmented ones. A finding of a diminished global memory

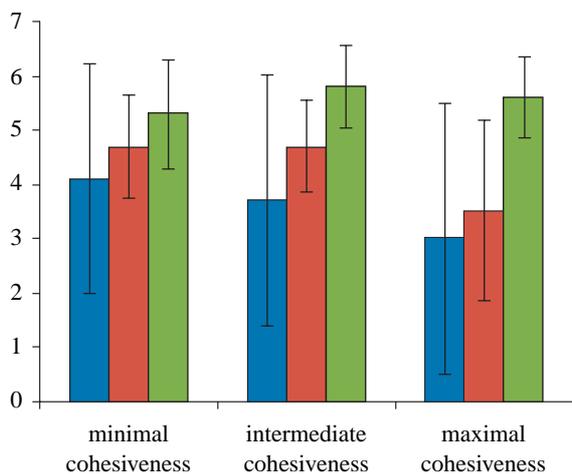


Figure 19. Accuracy scores on unsegmented version of the block design task for each group as a function of the level of perceptual cohesiveness. Minimal cohesive items: gifted > typical, $p=0.29$; intermediate and maximal cohesive items: gifted > typical and moderately gifted. Minimal cohesive items > maximal cohesive items for the typical and moderately gifted; intermediate cohesive items > maximal cohesive items for the moderately gifted; minimal = intermediate = maximal cohesive items for the gifted group (blue, typical; red, moderately gifted; green, gifted).

advantage in individuals with autism would provide support for the weak central coherence theory of autism; skill in recalling both the cohesive and fragmented designs would provide support for Caron *et al.*'s view that autistic individuals have enhanced perceptual processing at both the local and global levels. Results showed that both autistic and typically developing individuals had a global advantage—they remembered the more cohesive designs better than the fragmented ones. But the global advantage in memory was weaker for both the autistic and typical individuals with block design talent. With block design skill came the ability to remember the most difficult items—difficult because they were fragmented, not global.

We attempted to replicate this finding in our sample, using Caron *et al.*'s visual memory test, administered 30 min after completion of the block design test. Children were presented with 36 designs on a computer, one at a time, and were asked to indicate by a key press whether they had seen the design picture before. Half of the designs were from the block design test they had taken; half were distractors (matched to non-distractors in perceptual cohesiveness and size).

Giftedness scores predicted memory for the maximally cohesive items, but not for those low in perceptual cohesiveness. Thus, we conclude that our precocious realists showed superior visual memory. However, they behaved differently from the autistic individuals with block design talent as well as the adult artists studied by Caron *et al.* (2006). While Caron *et al.* found that the global advantage in memory was weaker for both the autistic and typical individuals with block design talent, our gifted sample did not show a weaker global advantage compared with the other two groups. It is possible that their lack of superior performance on the difficult fragmented designs is due to the fact that our participants were children, and the autistic individuals and artists studied by Caron *et al.* were adults.

(d) *Drawing strategy*

We examined whether precocious realists show the kind of local drawing strategy described by Mottron & Belleville (1993) in their analysis of the realistic drawing savant, E.C. E.C. used a drawing strategy referred to as 'construction by local progression' (Mottron & Belleville 1993, p. 29). E.C. did not draw the global shape of a figure first but instead began his drawings with a detail, adding contiguous elements, and often moving on to an adjacent part before completing a part already begun. Each new line was in spatial contiguity with the preceding one—as if he were drawing shapes such as tracing a pattern, without reference to the representational meaning of what he was drawing. Such a focus on detail rather than global organization would be consistent with the kind of realistic detail observed in E.C.'s drawings. A similar focus on detail rather than the global form was reported by Mottron *et al.* (1999) with a sample of 10 autistic individuals.

Mottron found that this strategy was specific to E.C. and did not extend to gifted artists who were not savants. We attempted to replicate these findings, testing whether non-savant children gifted in realistic drawing ever use E.C.'s local strategy. No child in any group used the kind of contiguity strategy shown by E.C. Some children sketched in all six cylinders before adding the details on each cylinder, while others drew each cylinder in all its detail before moving on to the next. But in no case did a child ever move from an uncompleted detail on one cylinder to a part of another cylinder connected by proximity. A local strategy may thus be specific to savant realists. We are now extending our study to autistic children to determine whether this strategy characterizes autistic children in general, or only those with skill in realism.

6. CONCLUDING THOUGHTS

While the children in our study were sampled from those taking after-school art classes, they were by no means all gifted child artists. Parents enrol their children in sports, music and art lessons simply to enrich their children's education. Based on our scoring system, only one-third of the children we sampled were gifted in realistic drawing and 34 per cent scored as typical or non-gifted. While a random sample of the population would likely have yielded a smaller percentage of gifted children, the important point to note is that we were able to find a group of non-gifted children to use for comparison purposes.

Our findings show that precocious realists are in some ways unlike artistic savants, and in other respects very similar. One way in which our precocious realists were unlike drawing savants was that their talent is not independent of verbal IQ: the gifted group scored significantly higher in verbal IQ than did the other groups. While one might conclude therefore that verbal IQ differences can explain the superiority of the gifted group, four of the children in the gifted group had only average verbal IQs (ranging from 101 to 113). Thus, an above average verbal IQ is not *necessary* for above average realistic drawing skill in typically developing children.

Our precocious realists were also entirely unlike artistic savants in their drawing strategy. Not one child classified as gifted in drawing, and not one in the other two groups, used a local proximity strategy. Thus, we conclude that a local proximity strategy is used by drawing savants but not by typical children with a gift for realistic drawing. While Mottron *et al.* (1999) found that autistic individuals without drawing talent used the local proximity strategy, we do not know whether there are differences in drawing strategies between those autistic individuals with and without drawing talent. Whether this strategy characterizes autistic individuals in general, irrespective of the realistic drawing talent, is now under investigation in our laboratory.

Our precocious realists showed the same kind of heightened visual analysis skill (as evidenced by their mental segmentation skill) as did the autistic individuals with a block design peak studied by Caron *et al.* (2006), as well as the same kind of heightened visual memory. They did not, however, show the enhanced visual memory for the fragmented items showed by Caron *et al.*'s (2006) participants. We conclude that skill in visual analysis and visual memory both appear to underlie a talent for realism in drawing, with visual analysis perhaps the stronger of these two skills.

It might be considered surprising that a talent for realism predicts superior ability in the block design task. Matching a two-dimensional picture with a two-dimensional pattern of blocks is quite different from translating from a three-dimensional still life to a two-dimensional surface representation (as was required by the still life drawing task). However, both tasks require that one look carefully at the model and analyse it into its component parts. Apparently, children gifted in using their visual analysis skills to build a two-dimensional representation of a two-dimensional model are also gifted in using these skills to construct a two-dimensional representation of a three-dimensional model.

Taken together, these findings demonstrate that heightened visual analysis and visual memory are associated with—and may be causally implicated in—precocious drawing ability. However, unlike autistic individuals, precocious realists do not store fragmented designs in memory at a superior level, they do not use a local drawing strategy, and they do not have below average IQs. Our future work will examine the generality of these findings to a large sample of autistic individuals with and without a talent for realistic graphic representation.

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