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Are children with Asperger syndrome creative in divergent thinking and feeling? A brief report

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ABSTRACT

This study investigates whether children with Asperger syndrome (AS) show superior competence in creativity, and it examines the relationship between nonverbal creativity and nonverbal IQ and vocabulary size. Sixteen (16) children with AS and forty-two (42) typically developing peers completed the exercises in divergent thinking and feeling from a creativity assessment packet. The results revealed that the participants with AS scored significantly higher in originality and elaboration, compared to their peers. Nonverbal divergent thinking was correlated to nonverbal IQ for participants with AS. It was observed that participants with AS drew the 12 incomplete figures mostly in the areas which interest them. This result may indicate better performances in originality and lesser performances in flexibility. The study suggests that opportunities to develop expertise in the subjects in which they are absorbed may be necessary for children with AS.

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1. Introduction

It has been reported that one in 10 persons with autism show some savant skills in categories of music, art, calendar calculations, mathematics, mechanical, or spatial skills (Treffert, 2009). Why are some people with autism predisposed to such extraordinary abilities? Their cognitive styles of attention to detail, exemplar-based memory encoding, and veridical representations are proposed as starting engines for talent (Happé & Vital, 2009). Enhanced perceptions of pattern generation and detection have also been shown to contribute to savant performance (Mottron, Dawson, & Soulières, 2009). In addition, sensory hypersensitivity, which leads to excellent attention to detail, is suggested in the association between autism and talent (Baron-Cohen, Ashwin, Ashwin, Tavassoli, & Chakrabarti, 2009).

Asperger syndrome (AS), one of autism spectrum disorders, is a neurodevelopmental disorder that is characterized by abnormal functioning in social interactions, and restricted repetitive and stereotyped patterns of behavior, interests and activities (APA, 1994). People with AS have features such as creativity. Asperger (1944/1991) proposed that his patients' characteristics could promote high-level skill development. The characteristics of AS, such as perseverance, drive for perfection, concrete intelligence, and the ability to disregard social conventions, may be prerequisites for certain forms of new thinking and creativity (Gillberg, 2002). People with AS frequently possess the abilities to focus intensely on a single topic, remarkable capacities for persistence and observation, and high levels of energy and motivation (Fitzgerald, 2004). These traits may link people with AS to creativity. Fung (2009) described Asperger-like characteristics of the French

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composer Erik Satie, including perfectionism, perseverance, hatred of conventions and heightened sensitivity. Fung stated that those characteristics enabled Satie to devise his own original musical idiom.

However, little research has investigated the creativity of people with AS. Craig and Baron-Cohen (1999) conducted experiments to explore the creativity of 4 groups of participants, including children with autism, AS, mild learning disabilities, and typically developing children. The results measured by the instrument of the Torrance Tests of Creative Thinking revealed that both participants with autism and AS were impaired in the condition of parallel lines, but the participants with AS performed better in the condition of incomplete figures. In addition, in the measurements of originality and flexibility, both participants with autism and AS produced significantly fewer statistically rare responses, and generated responses from fewer categories than did the control groups. The researchers concluded that the creativity of children with autism and AS tended to be reality-based, rather than imaginative.

Are imagination and creativity interchangeable terms, or is imagination the source of creativity? Gaut (2003) claims that the imagination serves as a vehicle for active creativity, but he does not conclude that creativity requires imagination. He does, however, suggest that there is a constitutive connection between imagination and creativity. Except for less imaginative attributes, do individuals with AS show superior competence in creativity? This is the first question addressed in the current study. Based on the research reviewed, we hypothesized that participants with AS in the study would show greater creativity than typically developing peers.

The relationship between intelligence and creativity has long been a topic of debate. According to Torrance (1964), the correlation between creativity and IQ is below .30, and the correlation between high IQ and creativity is even lower. Guilford (1962) proposed that creative individuals possess divergent thinking abilities that traditional IQ tests do not measure. Richards (1976) and Runco and Albert (1986), however, showed the contrasting result that creativity is correlated to IQ scores. There is no evidence to support a correlation between creativity and IQ for people with AS. In the current study, we measured verbal intelligence of the vocabulary level. Therefore, the second issue investigated by the study is the relationship between nonverbal creativity and nonverbal intelligence, as well as nonverbal creativity and vocabulary size for participants. We hypothesized that nonverbal creativity of participants with AS would correlate to nonverbal intelligence, but not to vocabulary size.

2. Method

2.1. Participants

Two groups of participants were included in the study. The experimental group consisted of 16 male children with AS, who were recruited from a local association of parents of high-functioning children with autism and Asperger syndrome. The study designed to have male and female participants with AS. However, there was no female child with AS who volunteered as a participant in the study. In order to control factors of gender and socio-economic status, the control group consisted of 42 typically developing male children recruited from the schools of the participants with AS. Mean ages of participants in the experimental group and control group were 10.6 (range = 10.5–11.7 years) and 10.4 (range = 10.2–11.9 years), respectively. Participants in the experimental group were diagnosed by psychiatrists as AS according to DSM-IV criteria, and they were free of other psychiatric disorders, such as ADHD or affective disorders, prior to acceptance into the study. Participants in the control group had a history of typical neurological development, and no one in their families was reported to have psychiatric conditions.

2.2. Measures

2.2.1. Creativity assessment packet

A creativity assessment packet (CAP) (Williams, 1980) was employed for the current study. CAP is a test packet that consists of three tasks: an exercise in divergent thinking, an exercise in divergent feeling, and the Williams scale. The exercise in divergent thinking includes 12 incomplete figures as stimuli to draw. The examinee is asked to complete the figures in an original way and create a title within a 20-min time limit. The completed drawings are assessed on domains of fluency, openness, flexibility, originality and elaboration. The scoring standards are as followed: each drawing with an easily recognizable figure is scored 1 point for fluency; higher scores in openness are for drawings with sealed stimuli; the more categories of the 12 which the drawings exhibit, the higher the scores will be given in flexibility; the more unique the drawing, the higher the scores in originality; the more symmetrical the drawings, the lower the score in elaboration. The titles are scored based on length, complexity, creativity and humor. In addition to the exercise in divergent thinking, the exercise in divergent feeling is a self-rating creativity questionnaire of 50 items. The scale has scores for curiosity, imagination, complexity, and risk-taking. Consider an item such as: "If the final page of a storybook is missing, I will make up the story's ending myself." The examinee will respond to 3 options: agree, partially agree, or disagree. The Williams scale is an observational rating scale, which is filled out by teachers or parents to evaluate the creative behavior of their children. Since the Williams scale does not comprise the direct product of participants, the scale was not employed in the current study. Lin and Wang (1999) developed the Mandarin edition of the CAP and established its good internal consistency (.765–.877) and test-retest reliability (.489–.810).

Table 1
Mean scores, *t*-test results and power analysis of the participants in divergent thinking.

Six factors	AS group (n = 16)		Control group (n = 42)		<i>t</i>	Sig.	Power
	<i>M</i>	SD	<i>M</i>	SD			
Fluency	10.94	2.41	11.22	1.36	−0.56	.58	.12
Openness	18.00	7.68	22.33	4.28	−2.73**	.01	.70
Flexibility	5.78	1.78	9.57	1.65	−7.65***	.00	.82
Originality	15.56	4.65	11.97	3.96	2.94**	.01	.76
Elaboration	11.56	5.68	8.75	3.84	2.17*	.03	.45
Titles	12.13	0.72	13.15	2.75	−1.46	.15	.06

* $p < .05$ (two-tailed).

** $p < .01$ (two-tailed).

*** $p < .001$ (two-tailed).

2.2.2. Tests of nonverbal intelligence and peabody picture vocabulary test

The Test of Nonverbal Intelligence, Third Edition (TONI-3) (Brown, Sherbenou, & Johnson, 1997) and the Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn & Dunn, 1981) were used to measure nonverbal intelligence and vocabulary size. The TONI-3 is a norm-referenced measure of intelligence, aptitude, abstract reasoning, and problem solving. It is completely free of the use of language. The examinee can point or nod to indicate response choices. The PPVT-R is a norm-referenced measure of receptive vocabulary and a screening test of verbal ability. The examinee chooses one from four pictures as his response to each vocabulary.

2.3. Procedure

Participants completed the exercises in divergent thinking and divergent feeling individually in a quiet room at the Department of Special Education at the National Kaohsiung Normal University. The participants were instructed for the exercise in divergent thinking as follows: “Here are 12 incomplete figures. You need to use each of them to complete a drawing. Don’t worry about how well you can draw, but the more uniquely the better, and the more categories of the 12 drawings that are included the better. Use your imagination and have fun.” Participants were also asked to title their drawings. Participants were signaled at 5-min intervals to prevent them from spending too much time on figures in which they were interested. After finishing the exercise in divergent thinking, one researcher would read aloud the 50 questions to the participants in the exercise in divergent feeling. The researcher would explain the meaning of the questions if the participant had comprehension difficulties. The participants then marked their answers on their own. Upon completing the test sessions, all participants’ top three favorite interests were collected in order to analyze drawing contents between groups.

2.4. Scoring

Based on criteria of the CAP, the 12 drawings were scored manually by 2 raters, blind to which drawing belonged to which participants. The 2 raters were certified special education teachers, and they had received training in administering the CAP. Inter-rater reliability was analyzed by the rank correlation coefficient of Spearman. The results showed a significant reliability on fluency, openness, flexibility, originality, elaboration, and title; r_s between 1.00 and .86, $p < .01$.

3. Results

The scores of the 2 groups of participants on the 6 factors in the exercise in divergent thinking and the 4 factors in the exercise in divergent feeling were compared. Independent *t*-test (two-tailed) was applied to analyze the data. Table 1 provides the mean scores, *t*-test results and power analysis, of the participants in divergent thinking. The results of the independent *t*-test reveal that the scores of the participants with AS in originality ($p < .01$) and elaboration ($p < .05$) are significantly higher than the scores of the control group. On the other hand, the scores of participants with AS, in openness

Table 2
Mean scores, *t*-test results and power analysis of participants in divergent feeling.

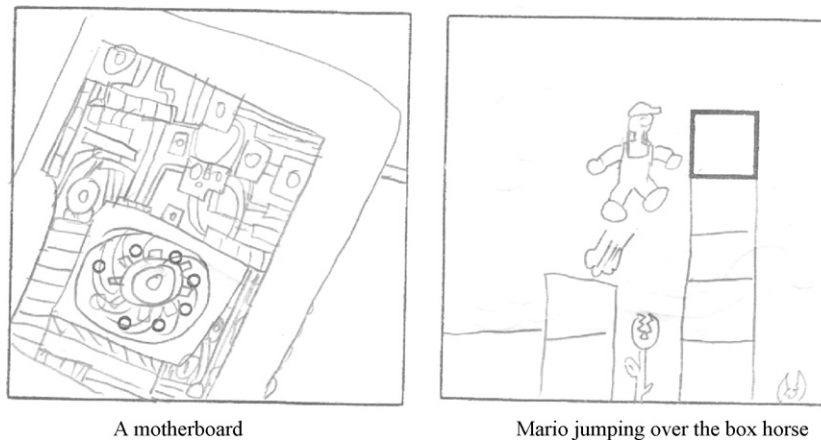
Four factors	AS group (n = 16)		Control group (n = 42)		<i>t</i>	Sig.	Power
	<i>M</i>	SD	<i>M</i>	SD			
Risk-taking	24.31	4.30	25.32	3.13	−1.16	.25	.14
Curiosity	28.06	3.73	29.27	3.41	−1.18	.24	.20
Imagination	24.13	4.98	28.53	4.12	−3.43***	.00	.82
Complexity	25.88	2.60	26.79	2.85	−1.11	.27	.21

*** $p < .001$ (two-tailed).

Table 3

Correlation between nonverbal divergent thinking/feeling and TONI/PPVT-R.

	AS group		Control group	
	TONI	PPVT-R	TONI	PPVT-R
Divergent thinking	.620*	.440	.412	.335
Divergent feeling	.110	.057	.364	.247

* $p < .05$ (two-tailed).**Fig. 1.** Examples of the drawings of one participant. A motherboard; Mario jumping over the box horse.

($p < .01$) and flexibility ($p < .001$) are significantly lower than those of controls. **Table 2** shows the mean scores, t -test results and power analysis, of the participants in divergent feeling. The participants with AS scored ($p < .001$) significantly lower on a t -test than that of controls.

Measured by TONI, the mean nonverbal intelligence of the participants with AS was 99.3 (SD = 15.4), and the control group was 98.7 (SD = 13.1). The mean vocabulary size measured by PPVT-R was 117.8 (SD = 14.2) for participants with AS and 118.4 (SD = 11.5) for the control group—using Taiwanese norms. The nonverbal divergent thinking was significantly correlated to nonverbal IQ ($p < .05$) for participants with AS. **Table 3** lists the correlation between nonverbal divergent thinking/feeling and TONI/PPVT-R for the AS and control groups.

4. Discussion

The performance of children with AS on the measurements of elaboration and originality were significantly better than the age-matched typically developing peers. In measurements of openness and flexibility, children with AS were below of their peers. Most participants with AS drew elegantly and in detail (see **Fig. 1**). In **Fig. 1**, the drawing of a motherboard showed great elaboration, and the Mario jumping over the box horse got high scores in originality. In order to draw in detail, it requires minute sensory input and accurate memory. The extraordinary memory of people with autism has been described via such terms such as automatic, mechanical, concrete and habit-like (Treffert, 2009). Baron-Cohen et al. (2009) suggest that the association between autism and talent starts with hypersensitivity, which gives rise to excellent attention to detail. The excellent attention to detail may result from the cognitive style with respect to weak central coherence, which leads to the conclusion that people with autism are drawn to detailed information, in favor of local features over global ones. Therefore, elaboration of participants with AS in the study may be one manifestation of their sensitive sensory apparatus, their remarkable memory, and their weak central coherence.

People with AS often possess idiosyncratic interests on which they can spend countless hours and devote endless effort. In the current study participants with AS drew 12 incomplete figures, mostly in their subjects of interest. A participant, for instance, who was absorbed in the subject of biology, drew figures solely about bacteria, viruses, amoeba, and dust mites. The specific and narrow areas of interests of the participants with AS may contribute to their great originality, but this narrowness may also result in their poor performance in flexibility. Difficulty in theory of mind is another possible explanation for their good originality. Mind-blindness facilitates people with autism to think their own thoughts, regardless of what others think (Happé & Vital, 2009), and this may make them unique.

Flexibility measures categories of drawings, and openness measures spatial configuration and how well the incomplete figures are embedded in the drawings. Other than restricted interests, the reduced flexibility and openness of participants with AS may relate to executive dysfunction and weak central coherence. Within the domain of executive function, flexibility

and organization are the most prominent deficits in children with high-functioning autism and AS (Kenworthy et al., 2005). According to their lower scores in flexibility, it is speculated that although they were encouraged to draw in plentiful categories, participants with AS may have difficulty shifting their attention to different categories for the 12 drawings. Their detail-focused cognitive style may hinder them from drawing integrally.

In the area of imagination, the participants with AS showed significantly lower results than did their peers in the exercise of divergent feeling. These results agree with those of Craig and Baron-Cohen (1999). The current study shows that the nonverbal divergent thinking of the participants with AS is correlated to their nonverbal IQ. The result supports the threshold theory of the nonverbal aspect of the relationship between creativity and intelligence. The threshold theory assumes that there is some correlation between intelligence and the creative potential below a critical level (usually about 120). There is no correlation above 120 (Simonton, 1994; Walberg & Herbig, 1991).

In the measurement of nonverbal divergent thinking, this study finds that the participants with AS scored significantly higher than their peers in originality, even though their drawings were circumscribed by their particular interests. Hans Asperger (1944/1991) found in each of his patients “a special interest which enables them to achieve quite extraordinary levels of performance in a certain area” (p. 45). Considering that a crucial part of creativity is a deep love for and enjoyment of the tasks undertaken (Torrance, 1995), children with AS have an advantage. However, in order to go further than repetition, opportunities to develop expertise in their absorbed subjects may need to be provided. A future study, therefore, should investigate the instructional effects on the creativity of children with AS in their special interest areas. One of potential limitations of the study was the fact that it was comprised of only males participants with AS, thus not giving a complete picture of the whole AS population. Another limitation of the study might be that participants can draw the 12 incomplete figures freely, so the performance of participants with AS in originality and elaboration may simply reflect depth of knowledge in the domains of their interests. It is suggested that creativity of people with AS can be studied further by using tasks in assigned domains.

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