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Associations between autistic traits and creativity domains in the average adult population

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Abstract

The present study aimed to research links between autistic traits and creativity in the average adult population. The sample consisted of 108 adults, 60 females, 48 males, age 18-66 (M=34,90; SD=10,85), from 20 different social media pages who participated in the study through self-report questionnaires about autistic traits and creativity. The result shows that the autistic traits of difficulties in imagination and difficulties in social skills has associations with difficulties in creativity, while the autistic trait of attention to detail has associations with benefits in creativity. The creativity domains, differences between men and women and the method of self-report are discussed.

Keywords
Autism, Subclinical Traits, Creativity, Domains, Self-report, Gender

Introduction

The current study aims to research associations between Autistic traits and Creativity. This introduction first presents autistic traits, then creativity and finally both together.

Autism is a set of neurodevelopmental conditions (Lai, Lombardo & Baron-Cohen, 2014). Autism is characterised by limitations in verbal and non-verbal communication (Wigram & Gold, 2006; Baron-Cohen, Wheelwright, Skinner, Martin & Clubley, 2001; Jankowskaa, Omela´nczuka, Czerwonkaa, Karwowskib, 2018; Best, Arora, Porter, & Doherty, 2015) impairments in social behaviour (Best et al., 2015) and unusually restricted, repetitive behaviour, special interests (Lai et al. 2014; Jankowskaa et al., 2018; Best et al., 2015), limited interests and activities, (Jankowskaa et al., 2018; Best et al., 2015) and limited imagination (Baron-Cohen, et al., 2001; Best et al., 2015). Individuals with autism have atypical cognitive profiles, such as impaired social cognition and social perception, executive dysfunction and atypical perceptual and information processing (Lai et al., 2014).

Early signs of autism in small children are difficulties in joint attention (shared focus on an object) and limited pretend play, atypical implicit perspective taking, reciprocal affective behaviour, decreased response to own name, decreased imitation, delayed verbal and non-verbal communication, motor delay, unusually repetitive behaviours, atypical visuomotor exploration and inflexibility in disengaging visual attention (Lai et al., 2014). Autistic traits for adults can be summarized as five areas: difficulties in social skills, difficulties in communication skills, difficulties in imagination, exceptional attention to detail, difficulties in attention-switching/strong focus of attention (Baron-Cohen et al., 2001).

Asperger syndrome (AS) has the same criterias as autism but with no history of cognitive or language delay (Baron-Cohen, et al., 2001). High-functioning autism (HFA) is autism in individuals who has ability to communicate enough to speak, read, write and understand discussion (Baron-Cohen, et al., 2001). Since the traits between different individuals can vary, it is called autism spectrum disorder (ASD) (Baron-Cohen, et al., 2001; Best et al., 2015). The prevalence of Autism is about 1% around the world (Lai et al., 2014). Studies has tried to find medical causes / cure for autism without success (Dean, Gray, Villagonzalo, Dodd, Mohebbi, Vick, Tonge, & Michael Berk, 2017). Studies of twins and families have shown that the cause of autism seem to be by hereditary (Baron-Cohen, et al., 2001).

Autism affects more male than female individuals (Lai et al., 2014). This has led to females with Autism being under-researched (Lai, Lombardo, Ruigrok, Chakrabarti, Wheelwright, Auyeung, Allison, Consortium, MRC. AIMS. & Baron-Cohen, 2012). It has also been shown that significantly more males than females in the general population show moderate levels of “autistic traits” (Baron-Cohen et al., 2001).

Among students in scientific fields; differences between men and women in autistic traits could be found between the sciences but not within the sciences (Baron-Cohen, et al., 2001). It has been demonstrated that there are behavioral sex differences between male and female autistic high-functioning adults. Females has displayed fewer autistic behaviors during interpersonal interaction, but nevertheless reported more autistic traits and sensory issues (Lai et al., 2014). These results show that females with autism could be camouflaging of social-communication difficulties (Lai et al., 2012). Regardless of sex, adults with autism showed impaired facial emotion recognition abilities relative to neurotypical adults (Lai et al., 2012) and this supports that autistic people have difficulties in interpreting others (Lai et al., 2012). IQ and Social economical status do not appear to influence autistic traits in the general population (Baron-Cohen et al., 2001).

The degree of autistic traits at a subclinical level is called the broader autism phenotype (BAP) and can be defined as autistic traits found in the average population (Jankowskaa et al. 2018). Since autistic traits vary among average people it is possible to measure links between autistic traits and other variables in random samples (Jankowskaa et al., 2018). The results can however differ from a sample of autistic diagnosed people (Baron-Cohen et al., 2001).

One study investigated a self-administered instruments for measuring the degree to which an adult with normal intelligence has the traits associated with the autistic spectrum, called The Autistic-Spectrum Quotient (AQ). It is important to underline that the AQ is not diagnostic (Baron-Cohen, et al., 2001). In order to participate the participants had to be able to understand the questions and discuss and estimate their own preferences (Baron-Cohen, et al., 2001). In the creation of the AQ the assessment was made that adults with Asperger syndrome (AS) or high-functioning autism (HFA) were able to do participate. The study found that the AS or HFA scored significantly higher than controls when answering the questions in this questionnaire. It is an easy to use and easy to score questionnaire of 50 questions (Baron-Cohen et al., 2001). The same questionnaire will be used in the present study in order to measure autistic traits.

The current study aims to research associations between Autistic traits and Creativity. Creativity has been defined as ideas as well as products that are novel and useful (Piffer, 2012). This means that suggestions must be new and realistic to be defined as creative (Piffer, 2012) because current definitions of creativity involve both usefulness and novelty (Best, et al., 2015). A more extended version of the definition of creativity is the generation of original, appropriate, useful, and valuable ideas, products, or solutions (Carruthers, MacLean & Willis, 2018). Creativity includes combining ideas to form new solutions, multiple responses to a problem and the invention of novel concepts (Carruthers et al., 2018). Generation of novel ideas is required for creative problem solving (Best, et al., 2015) and creativity also involves the generation of original ideas (Carruthers et al., 2018).

There has been an ongoing debate on what creativity is and how this differ from for example intellectual ability (Kaufman, 2012). Intelligence will come into play in different ways for creativity in different areas, (Kaufman, 2012). There has been confusion about clarity of its definition because different ways to measure creativity gives different results (Piffer, 2012). Many different types of measurements have been used in order to measure creativity (Piffer, 2012). The measurements has been self-report measurements, were the participants estimate their own creativity (Kaufman, 2012), or divergent thinking tasks (Best, et al., 2015), were the creativity has been estimated for the participants based on their creative ability. Divergent thinking tasks are contested as a direct measure of creativity (Best, et al., 2015) while self-report is an indirect way to measure creativity, since it involves the participants self-esteem (Kaufman, 2012). Self-reported creativity is also related to the participants personality traits (Kaufman, 2012; Jankowskaa et al., 2018).

Historically there has been many domains measured in order to create a measurement of creativity (Kaufman, 2012). In order to gather creativity traits into five domains; the Kaufman Domains of Creativity Scale (K-DOCS) (Kaufman, 2012) was made to measure creativity. This study (Kaufman, 2012) gathered creativity domains from previous studies and generated five broad areas in creativity: Self/Everyday, Scholarly, Performance (encompassing writing and music), Mechanical/Scientific, and Artistic creativity (Kaufman, 2012). These areas are based on self-reported creativity (Kaufman, 2012).

The approach in the K-DOCS (Kaufman, 2012) is that previous measurements has contained to many domains and that the K-DOCS (Kaufman, 2012) summarize the categories into fewer domains. The participants were students at a public state university in California (Kaufman, 2012). When the measurement started it was 94 items that was reduced into 50 after a factor analyze identified the best factor structure. The goal was to build on past work and and make a self-report, behavior-based creativity rating scale that reflects a domain-specific perspective (Kaufman, 2012). The 5 domains of creativity are also compared the big 5 factor personality trait theory (Kaufman, 2012).
This can be compared with studies based on creativity task tests that measures the creativity dimensions: fluency (the number of responses, minus repetitions); flexibility (the number of different categories the responses cover) and originality (the statistical rarity of the responses based on standardized norms) (Craig & Baron-Cohen, 1999; Best, et al., 2015). These dimensions have been used with addition of elaboration (Diener et al., 2014) and also divergent thinking has been added as a dimension of creativity (Jankowskaa et al., 2018). Divergent thinking has also been called a cognitive component of creativity (Best et al., 2015). Another study presents three dimensions of creativity: novelty, appropriateness and impact (Piffer, 2012).

Current approaches define creativity as a construct that involves both cognitive and personality traits (Jankowskaa et al., 2018). Since divergent thinking tasks test measure the cognitive traits and self-report scales measures the creative personality traits, it is required to use both divergent thinking task tests and self-report scales in order to measure creativity (Jankowskaa et al., 2018). The cognitive traits could also be considered to be dynamical to some extent, while the personality traits is not measured in a dynamical approach (Jankowskaa et al., 2018; Piffer, 2012; Kaufman, 2012).

There are different tests of divergent thinking and Creative Self-report Scales (Piffer, 2012) and one overall criticising article (Piffer, 2012) have shared several examples of discussion around the difficulties in measuring creativity and have brought examples from previous studies. The participants estimate their own creativity in self-report tests and this means that the participants also define what creativity is. In divergent thinking task tests its defined in advance what creativity is in accordance with the creativity dimensions. The K-DOCS (Kaufman, 2012) is the instrument that is used in the current study in order to measure creativity. This means that only self-report will be used in order to measure creativity in the current study.

The current study aims to research associations between Autistic traits and Creativity and the link between autism and creativity has been attracting scholarly attention for decades (Jankowskaa et al., 2018). Studies have shown impoverished creativity in autism (Craig & Baron-Cohen, 1999; Piffer, 2012). But many people with autism embraces activities typically associated with creative expression, including visual art, music, poetry and theatre (Roth, 2018). Self-reported Autistic traits are also associated with high numbers of unusual responses on divergent thinking tasks (Best, et al., 2015). This could be indicating that autistic people has great ability to think in new and creative ways. Studies shows that imaginative creativity is more difficult than reality-based creativity for people with autism (Craig & Baron-Cohen, 1999; Jankowskaa et al., 2018). But if impaired imagination is a trait in autism, one study suggest it could seem paradoxical that there are cases of people with autism who are known for their fields of special interest (Best et al., 2015).

In autism research, creativity is defined in various ways, but mainly measured in cognitive approach (Jankowskaa et al., 2018). This means that the research has measured: divergent thinking, fluency, flexibility, originality, and elaboration; creative imagination, or verbal creativity, in the participants generation of novel metaphors (Jankowskaa et al., 2018). It has been said that studies have shown decreased creativity in autistic people because the measurements was made for non-autistic people. (Diener, Wright, Smith & Wright, 2014) In order to measure creativity in autistic persons, one study of creativity focused on the visual-spatial abilities of youth with autism spectrum disorders (ASD) using 3D modeling software (Diener et al., 2014).

It was a divergent thinking task test in a 3D image format measuring creative dimensions. Results suggest that this assessment process could be used as a visual-spatial creativity measure for youth with ASD. This result shows that there are ways to measure creativity in autistic people and confirms that different measurement methods gives different results (Piffer, 2012).

Another association between Autistic traits and Creativity is the link between attention and creativity. There is some evidence that creative people may have poorer attention and are generally more distracted than others (Carruthers et al., 2018) but findings has also shown that originality, a dimension of creativity, was positively related to self-reported concentration (Carruthers et al., 2018). Attention is defined as the process by which information from one's senses is selected for further processing (Carruthers et al., 2018). Attention may have positive as well as negative links to creativity (Carruthers et al., 2018) Difficulties in Attention switching and strong attention to detail are traits in Autism (Baron-Cohen et al., 2001). This distinction in attention may also be one of the reasons for the different results in different studies of links between Autism and Creativity.

Another link between autistic traits and creativity is that autistic people are found to respond positively to music therapy intervention (Wigram & Gold, 2006; Wan, Bazen, Baars, Libenson, Zipse, Zuk, Nordon, & Schlaug, 2011; Mateos-Moreno & Atencia-Dona, 2013) The outcomes has been found to facilitate motivation, communication skills, turn-taking and social interaction, joint attention as well as reduces repetitive patterns (Wigram & Gold, 2006; Kim, Wigram & Gold, 2008). Significant effects were found in studies even with extremely small samples (Wigram & Gold, 2006). Autistic children showed significant improvements in verbal communication skills even after a short time of music therapy (Groß, Linden & Ostermann, 2010; Wan et al., 2011). This may indicate that creativity promotes the learning of communication for people with autism. Creativity is helpful to people with autism but the question is if associations between autism and creativity can be found.

One study showed that high levels of autistic traits were significantly associated with lower fluency scores on the divergent thinking tasks (Best et al., 2015). However, autistic traits were associated with high numbers of unusual responses on the divergent thinking tasks (Best et al., 2015). The question is whether people with autistic traits have cognitive styles conducive to creativity or whether they are disadvantaged by the cognitive style of the autistic traits (Best et al., 2015). One study show similar performance in understanding novel metaphors in both adults with ASD and controls, whereas adults with ASD generated more creative metaphors relative to the control group (Kasirer & Mashal, 2014). In addition, scores on a test of non- verbal intelligence contributed to the prediction of metaphor generation (Kasirer & Mashal, 2014).

Some researchers demonstrated better performance of individuals with ASD in terms of originality and some researchers found the opposite (Jankowskaa et al., 2018). The links between ASD and originality are equivocal (Jankowskaa et al., 2018). A small number of research studies, suggest that generating original ideas may be challenging for autistic people (Roth, 2018). Yet a minority within this population has exceptional artistic gifts (Roth, 2018).

It has also been shown that autistic participants score below others in fluency but above others in originality (Best, et al., 2015). It has been demonstrated that while the latent factor of creativity composed of self-report scales was negatively linked to autistic traits, the latent factor of cognitive creativity was positively related to them (Jankowskaa et al., 2018). This supports that self-reported creativity do not always correlate with measured cognitive creativity (Pretz & McCollum, 2014). This corresponds with that perceptions of creativity can be quite different from actual ability (Kaufman, 2012). This could indicate that some creativity tests may underestimate the creativity of people with ASD (Diener et al., 2014).

Another study has shown that a group of people with Autism spectrum group produced more original and creative metaphors than the typically developing group (Kasirer & Mashal, 2014). Generation of novel ideas is required for creative problem solving and may be an adaptive advantage associated with autistic traits (Best et al., 2015). The superior production of unusual responses by people with high autistic traits should be construed as indicating they have some of the cognitive skills that confers the potential for creative problem solving (Best, et al., 2015).

Overall, the previous research showed that because of the different measure methods, there are unsystematic links between creativity and autism (Jankowskaa et al., 2018). One study (Baron-Cohen, et al., 2001) showed that autistic traits has not only shown to cause difficulties, but has also shown to be a benefit in Scientific skills. Based on the previous studies; the current study suggest that people with autistic traits may have their own version of creativity rather than just a lower or higher level of it. Of this reason the current study have chosen a domain specific measurement of creativity (Kaufman, 2012). This made it possible to research links between autistic traits and different domains of creativity. The current study will discuss results of weather autistic traits can cause difficulties in some creative domains of creativity and be a benefit in others.

Aims and hypotheses

The present study aimed to find out if autistic traits predicts creativity or domains of creativity in the average adult population. The study also aimed to find out if differences can be found between men and women.

One study (Jankowskaa et al., 2018) showed that self-reported creativity was negatively related to subclinical autistic traits, whereas cognitive creativity (creative thinking and creative imagination) was positively linked. The current study measured self-reported creativity and the first hypothesis in the current study is that autistic traits has a negative effect on self-reported creativity as a main factor.

It has also been shown that men score higher in autistic traits than women in a random sample (Baron-Cohen, et al., 2001). The second hypothesis is that men score higher than women in the measurement of autistic traits as a main factor.

Method

Participants

The participants were members of 20 Swedish social media groups found on facebook, selected by the snowball method. The data was collected via an anonymous online survey, since is has been successful to do so in a previous study (Best et. al., 2015). The link to this survey was posted in the social media groups. These groups was for students, professionals or for people generally interested in psychology, pedagogy, music therapy, computers, recycling, handicrafts, fire safety and technology. Each group had 100-900 members. The survey reached over 10000 social media users and aimed to get a consistent distribution of participants. Together with the link, the participants was informed that they had to be over 18 years old so that they could participate by their own chose. They were also informed of that they were anonymous and that the data was going to be used for the authors master thesis. If they followed the link they came to the questionnaire based on the two instruments attached in the appendix. The link to the survey was available for one week. 108 individuals (60 females, 48 males) participated in the study. The age range was 18- 66 years (M=34,90; SD= 10,85). People with diagnoses was not the target group for the present study. Instead the target group was the regular population. The survey was translated into Swedish.

Instrument

The current study combined two instruments in order to answer the hypotheses:
One modified version of a self-administered test made to measure the degree of autistic traits Autistic-Spectrum Quotient (AQ) (Baron-Cohen, et al., 2001) and one test made to measure self-reported creativity is Kaufman Domains of Creativity Scale (K-DOCS) (Kaufman, 2012). There were also demographic data of gender and age. The AQ Questions, Creativity Questions and Demographic questions are presented in the appendix.

Ethical rules was followed according to the American Psychological Association (2009). Therefore, the participants answered the questions with informed consent and they were anonymous. The participants was informed that the data would be used for this current study.

The Autistic-Spectrum Quotient (AQ) comprise 50 questions, containing 5 different areas with 10 questions each. The domains are: social skills (I find social situations easy), attention switching (I find it easy to do more than one thing at a time), attention to details (I tend to notice details that others do not), imagination (If I try to imagine something), and communication skills (I am good at social chit-chat).

The participants show autistic traits in the questionnaire if they estimate that they have difficulties in social skills, difficulties in communication skills, difficulties in imagination, exceptional attention to detail, difficulties in attention-switching/strong focus of attention. In the original study (Baron-Cohen et al., 2001), the participants answers was a forced-choice format, calculated into dummy variables. The options “Definitely agree” or “slightly agree” scored 1 point, while “Definitely disagree” or “slightly disagree” scored 0 points or vice versa (Baron-Cohen et al., 2001). The items were randomized to avoid a response bias. All items are presented in the appendix. In the original study, individuals scored in the range 0-50. The participants would get higher score depending on how many questions they score at, not depending on how much they score at each question. However, in the current study, the answers were converted into a scale of 1-5 for each question. This made it not possible to score 0 at any question, the score range was 50-250. It was not a forced choose since there was a middle option. The score for each participant was calculated on the sum of how much they scored at each question. The items were the participant would score with a disagreement was reversed after the data collection. Participants with lower level of autistic traits score highly on only 2 items (items 29 and 30) because these two questions serve to reduce the size of group differences (Baron-Cohen et al., 2001). The differences in calculation between the original AQ (Baron-Cohen et al., 2001) and the current version is the only modification of the instrument.

Kaufman Domains of Creativity Scale (K-DOCS) (Kaufman, 2012) was used to measure creativity. This questionnaire contains 50 questions, containing 5 different domains and each domain contains 10 questions each. The K-DOCS produced five factors of self-assessed creative behaviors: 1.Self/Everyday, 2.Scholarly, 3.Performance (encompassing writing and music), 4.Mechanical/Scientific, and 5.Artistic. The participants always score highly in creativity if they estimate their creativity as high, which means that no questions were reversed. The items were randomized to avoid a response bias. Instructions were as follows: “Compared to people of approximately your age and life experience, how creative would you rate yourself for each of the following acts? For acts that you have not specifically done, estimate your creative potential based on your performance on similar tasks.”1 Participants rated themselves on a 5-point Likert scale, with 1 being much less creative and 5 being much more creative.

Results

High score on AQ means high sum of self reported autistic traits. High score in K-DOCS means high sum on self reported creativity. Missing responses occurred only in a few cases. In these cases, the mean value of the dataset was used. Descriptive statistics are reported in Table 1.

Table1. Descriptive Statistics

	Females(*N*=60) ***M(SD)***	**Males(*N*=48)** ***M(SD)***	**Total(*N*=108)** ***M(SD)***
Autistic traits (AQ)			
Social skill	25.20(6.52)	27.58(7.02)	26.26(6.82)
Attention switching	27.93(6.53)	30.54(7.22)	29.09(6.94)
Attention to detail	29.55(7.97)	31.00(5.73)	30.19(7.07)
Communication	23.58(7.06)	26.29(8.35)	24.78(7.74)
Imagination	22.85(6.13)	27.50(6.43)	24.91(6.65)
Total AQ	128.22(26.15)	143.10(26.68)	134.83(27.29)
Creativity (K-DOCS)			
Self/ Everyday	40.90(6.27)	35.79(8.05)	38.63(7.53)
Scholarly	41.08(6.95)	40.85(7.14)	40.98(7.00)
Performance	28.57(10.40)	25.52(9.52)	27.21(10.08)
Mechanical/ Science	25.98(7.52)	34.00(7.89)	29.54(8.63)
Artistic	30.00(7.90)	27.33(8.00)	28.81(7.93)
Total K-DOCS	165.17(25.29)	163.39(24.10)	164.38(24.67)

Note: A modified version of AQ calculation was used. Total AQ min = 91, Total AQ max= 216, Total K-DOCS min= 118, Total K-DOCS max= 220, age min=18, age max=66, age M=34.90; SD=10.86

Gender

Age was equal distributed between the genders among the participants. An independent samples t-test showed that in the creative domain Self/ Everyday, women (M=40.90; SD=6.27) scored higher than men (M=35.79; SD=8.05), t=-3.61; p=<.001, while in the creativity domain Mechanical/ Science, men (M=34.00; SD=7.89) scored higher than women (M=25.98; SD=7.52), t=5.37; p=<.001. No significant differences between men and women was found in any of the other creativity domains. The differences between the women and men in the domains of creativity where differences was found took each other out so that no difference was found between women and men in creativity as a main factor.

The main factor of autistic traits showed significant different results between the genders. In an independent samples t-test, men (M=143.10; SD=26.68) scored significantly higher than women (M=128.22; SD=26,15), t=2.91, p=.04. This means that higher scores of autistic traits was found in the male group than in the female group. This result confirms the second hypotheses, that men score higher than women in autistic traits.

In the autistic trait domain difficulties in imagination, men (M=27.50; SD=6.43) scored significantly higher than women (M=22.85; SD=6.13), t=3.81, p =<.001. In the other autistic trait domains no significant differences between the genders was found. However, in the autistic trait domain attention switching men (M=30.54; SD=7.22) had a tendency to to score significantly higher than women (M=27.93; SD=6.53), t=1.95, p=.055. With more participants in the study, this difference could possible be significant.

A total number of 45 correlation calculations was made in the same sample of data. In order to avoid type 1 error a Bonferroni correction calculation was made and the result was that only the correlations significant at .001 remained significant. All significance levels are still presented in the correlation tables and in the results.

Bivariate correlations between Creativity (K-DOCS) and Autistic traits (AQ) are reported in Table 2. Pearson correlation calculation between Creative domains and Autistic traits was done in SPSS. The correlation of the main factors Autistic traits and Creativity was negative and significant:, r=-.32, p=<.001. This is the first result that confirms the first hypothesis of the current study, that autistic traits are negatively associated with self-reported creativity.

Table 2. Bivariate correlations between Creativity (K-DOCS) and Autistic traits (AQ)

K-DOCS	Self/ Everyday	Scholarly	Performance	Mechanical / Scientific	Artistic	Total Creativity
AQ						
Social skill	-.64***	-.13	-.35***	.15	-.27**	-.37***
Attention switching	-.49***	-.06	-.22*	.14	-.27**	-.28**
Attention to detail	-.09	.03	.07	.23*	-.09	.08
Communic-ation	-56***	-.07	-.28**	.18	-.22*	-.28**
Imagination	-.55***	-.25**	-.37***	.22*	-.39***	-.42***
Total AQ	-.61***	-.13	-.29**	.22*	-.30***	-.32***

Note: ***=significant at .001, ** = significant at .01 and * = significant at .05, n=108

The strongest negative correlations can be found between the social skill autistic domain and the self/everyday domain of creativity. The autistic domain social skills also correlate negatively with performance creativity, artistic creativity and total creativity. The autistic domain attention switching correlates negatively with self/everyday creativity, performance creativity, artistic creativity and total creativity. The autistic domain communication correlated negatively with self/everyday creativity, performance creativity, artistic creativity and total creativity. The autistic domain imagination correlated negatively with self/everyday creativity, scholarly creativity, performance creativity, artistic creativity and total creativity. The main factor of autistic traits correlated negatively with self/everyday creativity, performance creativity and artistic creativity.

Mechanical/Scientific Creativity had no negative correlations with autistic traits. Mechanical/Scientific Creativity correlated positively with Attention to detail and imagination. The other autistic trait domains do not correlate with Mechanical/Scientific Creativity. Mechanical/Scientific Creativity correlates positively with Autistic traits as a main factor. Attention to detail had, beside the positive correlation with Mechanical/Scientific, no other correlation with Creativity domains and no correlation with the main factor of creativity. Imagination correlates significantly negative with all domains except Mechanical/Scientific, were the correlation is positive instead.

Table 3. Bivariate correlations between Creativity domains (K-DOCS)

	Self/ Everyday	Scholarly	Performance	Mechanical / Science	Artistic
Scholarly	.43***				
Performance	.55***	.27**			
Mechanical / Science	-.09	.27**	-.04		
Artistic	.33***	.18	.39***	.03	
Total Creativity	.67***	.64***	.73***	.36***	.59***

Note: ***=significant at .001, ** = significant at .01 and * = significant at .05.

Bivariate correlations between Creativity domains (K-DOCS) are reported in Table 3.

Table 4. Bivariate correlations between Autistic traits (AQ)

	Social skills	Attention switching	Attention to detail	Communic-ation	Imagination
Attention switching	.69***				
Attention to detail	.25**	.35***			
Communic-ation	.81***	.73***	.32***		
Imagination	.55***	.62***	.26**	.57***	
Total AQ	.83***	.85***	.54***	.89***	.76***

Note: ***=significant at .001, ** = significant at .01 and * = significant at .05.

Bivariate correlations between Autistic traits (AQ) are reported in Table 4.
Some of the independent variables correlate significantly with each other but the variation inflation factor (VIF=1.0) shows that there is no multicollinearity.

Figure 1. Distribution in AQ scores in the original study

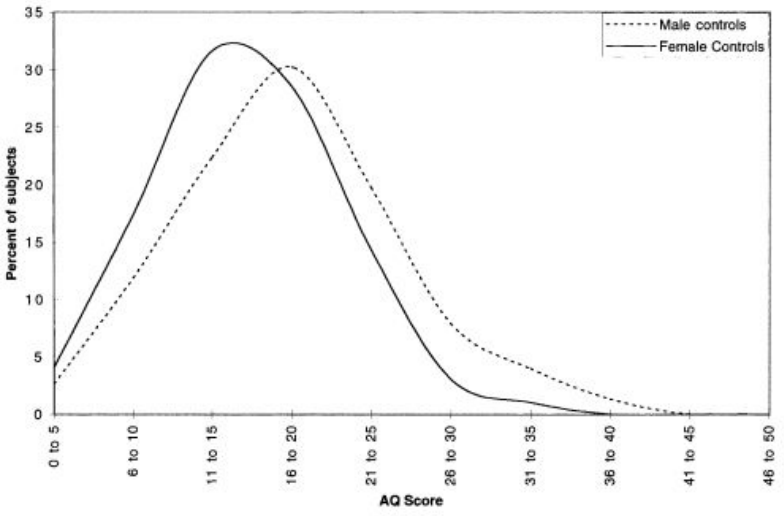
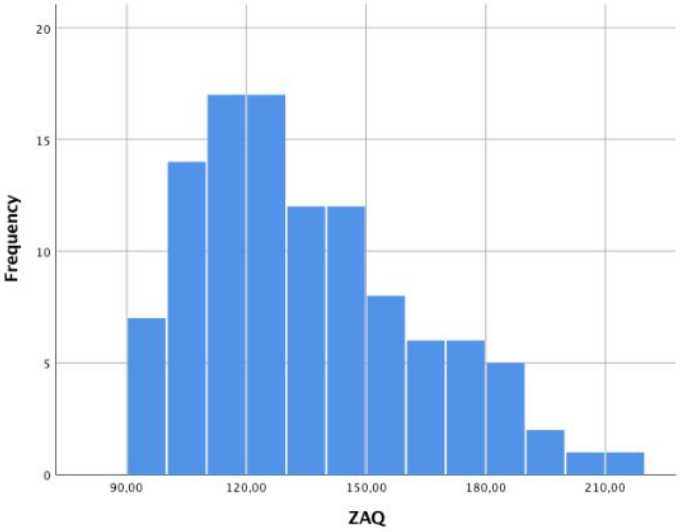


Fig. 2. AQ scores in male and female controls (Group 2).

Figure 2. Distribution in AQ scores in the current study



Distribution of scores

Histogram charts was made for the dataset and the distribution of scores for creativity was not following a consistent curve, but nevertheless with the same amount of participants on both sides of the mean. A test of normality in SPSS showed that the creativity scores was not significantly different from a normal distribution since the Shapiro-wilk test was not significant (p=.17). The distribution of scores for autistic traits was following a more consistent curve, but the most of the participants scored lower than the mean while fewer of the participants scored higher, and their high scores increased the mean. This made the distribution lean compared to a normal distribution and the Shapiro-Wilk test showed that the AQ scores was significantly different from a normal distribution (p=<.001). This correspond with the original study, were the distribution of the AQ data shares the same shape, even though another calculation scale was used (Baron-Cohen et al., 2001). The similarity in distribution of AQ scores is illustrated in comparison between figure 1 and figure 2.

Multiple regressions

Multiple linear regressions was made in order to find out if the five areas of autistic traits can be explanatory variables that the factor of creativity depend on. Six multiple regressions was made in order to find out if autistic traits can predict creativity. One multiple regression was made for each of the five creativity domains and one for the main factor of creativity. In each multiple regression there was two models in order to compare a two-predictor model with a seven-predictor model. The two-predictor model contained only age and sex, while the seven-predictor model contained also the five autistic trait domains. Since all the data wasn't normally distributed an interval estimate was made by confidence interval (CI) at a 95% confidence level in Bootstrap. In order to not make the models overfit, adjusted R2 was used to adjust for the number of predictors in the model.

Table 5. Multiple Regressions. Dependent variable: Creativity domain Self/Everyday

	B	*95% CI*	*SEB*	*p*
Model 1				
Age	.05	-.08, .17	.06	.49
Sex	5.22	2.46, 7.97	1.39	<.001
Model 2				
Age	.07	-.03, .17	.05	.15
Sex	2.9	.64, 5.12	1.13	.01
AQ				
Social Skill	-.55	-.82, -.27	.14	<.001
Attention switching	.06	-.18, .31	.13	.61
Attention to detail	.12	-.04, .28	.08	.15
Communication	-.07	-.32, .18	.13	.58
Imagination	-.27	-.49, -.06	.11	.01

Model 1:Adjusted R2=.10, R2 change=.12, F=7.08; p=<.001, F change=7.08; p=<.001, Model 2: Adjusted R2 =.48, R2 change=.39, F=15.19; p=<.001, F change=16.36; p=<.001

Multiple regressions with the Creativity domain Self/Everyday as dependent variable are reported in table 5. Women score significantly higher than men in the domain Self/Everyday Creativity and in model 1 the effect of sex appears large: Percentage of variation explained by the independent variables that affect the dependent variable: Model 1: 10%
In model 2, under control of the autistic traits, the effect of sex is not as large but is still significant. Difficulties in Social skills and Difficulties in Imagination has a negative effect on Self/Everyday Creativity. No other autistic traits show effect in this model. Percentage of variation explained by the independent variables that affect the dependent variable: Model 2: 48%

Table 6. Multiple Regressions. Dependent variable: Creativity domain Scholarly

	B	*95% CI*	*SEB*	*p*
Model 1				
Age	-.04	-.17, .08	.06	.52
Sex	.13	-2.59, 2.85	1.37	.93
Model 2				
Age	-.03	-.15, .10	.06	.67
Sex	-1.27	-4.11, 1.56	1.43	.38
AQ				
Social Skill	-.16	-.51, .19	.16	.37
Attention switching	.14	-.17, .45	.16	.38
Attention to detail	.06	-.14, .27	.10	.54
Communication	.12	-.20, .44	.16	.47
Imagination	-.39	-.67, -.12	.14	.01

Model 1: Adjusted R2=-.02, R2 change=<.01, F=.22; p=.80; F change=.22; p=.79, Model 2: Adjusted R2=.04, R2 change=.09, F= 1,58; p=.15, F change=2.12; p=.07

Multiple regressions with the Creativity domain Scholarly as dependent variable are reported in table 6. Model 1: No effects was found in this model. Model 2: The autistic trait Imagination has a negative association with Scholarly Creativity but this association is not enough for the model. No effects was found in this model.

Table 7. Multiple Regressions. Dependent variable: Creativity domain Performance

	B	*95% CI*	*SEB*	*p*
Model 1				
Age	.07	-.11, .25	.09	.45
Sex	3.21	-.67, 7.09	1.96	.10
Model 2				
Age	.10	-.07, .27	.09	.23
Sex	.88	-2.91, 4.68	1.91	.65
AQ				
Social Skill	-.54	-1.00, -.07	.23	.02
Attention switching	.23	-.19, .65	.21	.28
Attention to detail	.25	-.02, .52	.14	.07
Communication	.04	-.39, .47	.22	.84
Imagination	-.48	-.84, -.11	.18	.01

Model 1: Adjusted R2=.01, R2 change=.03, F=1.52; p=.22, F change=1.52; p=.22, Model 2: Adjusted R2=.17, R2 change=.19, F=4.13; p=<.001, F change=5.05; p=<001

Multiple regressions with the Creativity domain Performance as dependent variable are reported in table 7. Model 1: This model show no effect on performance Creativity
Model 2: Difficulties in Social skill and difficulties in Imagination has a negative effect on performance Creativity. Percentage of variation explained by the independent variables that affect the dependent variable: 17%

Table 8. Multiple Regressions. Dependent variable: Creativity domain Mechanical/Science

	B	*95% CI*	*SEB*	*p*
Model 1				
Age	.01	-.13, .14	.07	.92
Sex	-7,98	-10,96, -4.99	1.51	<.001
Model 2				
Age	-.01	-.15, .14	.07	.95
Sex	-7.53	-10.71, -4.35	-.44	<.001
AQ				
Social Skill	<.01	-.39, .39	.20	.99
Attention switching	-.13	-.48, .23	.18	.48
Attention to detail	.23	.01, .45	.11	.05
Communication	.11	-.25, .47	.18	.55
Imagination	.04	-.27, .35	.15	.80

Model 1: Adjusted R2= .20, R2 change=.21, F=14.29; p=<.001, F change=14.29; p=<.001, Model 2: Adjusted R2=.20, R2 change=.04, F= 4.88; p=<.001, F change=1.09; p=.37

Multiple regressions with the Creativity domain Mechanical/Scientific as dependent variable are reported in table 8. Men scored higher than women in the domain of Mechanical/Scientific Creativity and there was a significant effect of sex in Model 1. Percentage of variation explained by the independent variables that affect the dependent variable: Model 1: 20%.

The effect of sex remained as significant under control of autistic traits in Model 2. There was also a positive association between the Autistic trait Attention to detail and Mechanical/Scientific Creativity, but the difference between model 1 and model 2 was not significant. Percentage of variation explained by the independent variables that affect the dependent variable in Model 2: 20%

Table 9. Multiple Regressions. Dependent variable: Creativity domain Artistic

	B	*95% CI*	*SEB*	*p*
Model 1				
Age	-.02	-.16, .12	.07	.76
Sex	2.61	-.43, 5.66	1.54	.09
Model 2				
Age	-.02	-.16, .12	.07	.81
Sex	.53	-2.56, 3.62	1.56	.73
AQ				
Social Skill	-.19	-.58, .18	.19	.30
Attention switching	-.07	-.42, .27	.17	.30
Attention to detail	.01	-.21, .23	.11	.93
Communication	.17	-.17, .52	.18	.33
Imagination	-.41	-.71, -.12	.15	.01

Model 1: Adjusted R2=.01, R2 change=.03, F= 1.57, p=.21, F change= 1.57; p=.21, Model 2: Adjusted R2=.11, R2 change=.14, F= 2.91; p=.01, F change=3.37; p=.01

Multiple regressions with the Creativity domain Artistic as dependent variable are reported in table 9. Model 1: This model show no effect on Artistic Creativity. Model 2: This model shows that difficulties in imagination has a negative effect on Artistic creativity. Percentage of variation explained by the independent variables that affect the dependent variable: 11%

Table 10. Multiple Regressions. Dependent variable: Creativity domain Total Creativity

	B	*95% CI*	*SEB*	*p*
Model 1				
Age	-.06	-.50, .39	.22	.81
Sex	1.64	-8.00, 11.25	4.85	.74
Model 2				
Age	-.01	-.42, .39	.20	.94
Sex	-6.07	-15.08, 2.94	4.54	.19
AQ				
Social Skill	-1.15	-2.26, -.05	.56	.04
Attention switching	.05	-.95, 1.04	.50	.93
Attention to detail	.72	.09, 1.36	.32	.03
Communication	.40	-.61, 1.42	.51	.43
Imagination	-1.58	-2.44, -.71	.44	<.001

Model 1: Adjusted R2=-.02, R2 change=<.01, F=.09; p=.91, F change=.09; p=.91, Model 2: Adjusted R2=.22, R2 change=.27, F= 5.25; p=<.001, F change=7.30, p=<.001

Multiple regressions with Total Creativity as dependent variable are reported in table 10.
Model 1: This model show no effect on Total Creativity.
Model 2: Social skill and imagination has a negative effect on Total Creativity. Attention to detail has a positive effect on Total Creativity. Percentage of variation explained by the independent variables that affect the dependent variable: 22 %

Discussion

The present study aimed to find out if autistic traits predicts creativity or domains of creativity in the average adult population. The study also aimed to find out if differences can be found between men and women. Based on a previous study (Jankowskaa et al., 2018) the first hypothesis in the current study was that autistic traits has negative effect on self-reported creativity as a main factor. The result of the current study showed negative effect of autistic traits on self-reported creativity and this conforms the first hypothesis. All autistic areas did however not show a negative effect on creativity. The results of the multiple regressions showed that autistic traits had an overall negative effect on creativity but the negative result was based on only two of the five autistic areas. Difficulties in social skills and difficulties in imagination had a negative effect on total creativity. Attention switching and difficulities in communication showed no effect on total creativity, while attention to detail showed a positive effect on total creativity. This correspond with previous findings of unsystematic links between autistic traits and creativity (Jankowskaa et al., 2018). The effects of the autistic traits on the different creativity domains will be discussed further on.

Based on another previous study (Baron-Cohen et al., 2001) the second hypothesis was that men score higher than women in autistic traits. The result of the current study showed that men score higher than women in autistic traits and this confirms the second hypothesis. However, among the autistic areas, men scored higher than women only in the area of difficulties in imagination.

In domain comparison, the strongest negative correlation can be found between the social skill autistic domain and the self/everyday domain of creativity. This indicates that the situations that are most difficult for autistic persons are found in everyday situations. Several autistic features show negative links with creative areas, but there are exceptions. Mechanical/Scientific Creativity had no negative correlations with autistic traits. Mechanical/Scientific Creativity correlated positively with Attention to detail and imagination. The other autistic trait domains do not correlate with Mechanical/Scientific Creativity. Mechanical/Scientific Creativity correlates positively with Autistic traits as a main factor. This result confirms earlier studies that autistic conditions are associated with scientific skills (Baron-Cohen et al., 2001). The original study of AQ (Baron-Cohen et al., 2001) showed that scientist score higher than non scientist (Baron-Cohen et al., 2001). In comparison; the current study found a positive correlation between AQ and Mechanical/Scientific Creativity but this link did not remain in the multiple regression when other variables were controlled. The current study suggest, based on the original study (Baron-Cohen et al., 2001) that there may still be a connection but but all measurement methods may not capture this relationship. More studies are required in order to research these connections further.

An unexpected result in the current study may be the result regarding the autistic trait difficulties in communication. One of the definitions about autism is that Autism is characterised by limitations in verbal and non- verbal communication (Wigram & Gold, 2006; Baron-Cohen et al., 2001; Jankowskaa et al., 2018; Best et al., 2015). Difficulties in communication are associated with difficulties in creativity in the current study. However; in the multiple regression calculations the difficulties in communication show no effect on creativity as a main factor or any of the creativity domains while difficulties in Social skill and difficulties in imagination are the autistic traits that remains as negative for creativity. This indicates that communication is not the huge difficulty for people with autistic traits in creative situations. Imagination and social skills may be the real difficulties while correlation with communication difficulties may be more more like a spillover effect. More studies need to be done to determine this suggestion. Result of difficulties in imagination could also be discussed since there are cases of people with autism who are known for their fields of special interest (Best et al., 2015). It could possibly indicate that autistic people uses their imagination in other ways than how imagination is measured. So far, Studies have shown that Imaginative creativity is more difficult than reality-based creativity for children with autism (Craig & Baron-Cohen, 1999). The current study showed that imaginative difficulties was the major indication of difficulties in creativity. This supports that difficulties in imagination could be the the major reason for the impairments in creativity for people with high autistic trait scores. The current study made the measurement based on self-report but previous studies (Craig & Baron-Cohen, 1999) showed similar results with creativity tasks tests. The current study showed that difficulties in imagination correlates significantly negative with all domains except Mechanical/Scientific, were the correlation is positive instead. In the multiple regression calculations difficulties in imagination had a negative effect on all creativity domains except Mechanical/Scientific were no effect were found.

Another result worth discussing is the result around attention. Attention may have positive as well as negative links to creativity (Carruthers et al., 2018) and for that reason one study suggest that there is no link between attention and creativity (Carruthers et al., 2018). The current study has found a negative correlation between the autistic domain difficulties in attention switching and creativity. The current study has also found a positive correlation between attention to detail and creativity. People with Autism have been reported to show superior attention to detail (Lai et al., 2012; Baron-Cohen et al., 2001). Difficulties in Attention switching and strong attention to detail are traits in Autism (Baron-Cohen et al., 2001). This distinction in attention may also be one of the reasons for the different results in different studies of links between Autistic traits and Creativity. This also indicate that only one overall score could miss different versions of creativity. The current study focus on weather people with autistic traits may have their own version of creativity rather than just a lower or higher level of it, and using domain-specific instruments have given possibility to research different areas within the main factors.

The multiple regression calculations in the current study did however not show the same distinction in attention as effect on creativity as the correlation calculation did. It could indicate that there are no such links, but since previous studies found unsystematic links between creativity and autism (Jankowskaa et al., 2018; Best, et al., 2015) the current study suggest more research. A result worth highlighting is that even that Attention to detail was not enough as a positive factor for any of the domain models, it was enough as a positive factor in the model for the main factor of creativity. The current study suggest for future studies to research this relationship and other benefits with attention to detail further.

The current study also aimed to find out if differences can be found between men and women. The result shows that men scores significantly higher than women in the measurement of autistic traits and that corresponds with that men in the control group scored slightly but significantly higher than women in the control group, in the original study (Baron-Cohen, et al., 2001). The control group in the original study consisted of randomly chosen people (Baron-Cohen, et al., 2001) and the current study replicated the same relationship in a sample gathered by the snowball method. However; in the original study, the group of autistic people showed no differences between the genders while there was more males than females represented in that group (Baron-Cohen, et al., 2001). A limitation with the current study is that it did not contain a group of autistic people to compare with.

The current study shows that women score significantly higher than men in the domain Self/Everyday Creativity while men score higher than women in the domain of Mechanical/Scientific Creativity. The differences between the women and men in the domains of creativity take each other out so that there is no difference between women and men in creativity as a main factor in the current study. A limitation in comparison is that the original study of creativity (Kaufman, 2012) did not measure gender differences.

The highest score at the AQ was measured from a female participant who scored 216, the next highest was a male who scored 201. Both females and males could be found among the 5 participants with the highest scores. This was unexpected findings, because in the original study no women scored extremely highly (Baron-Cohen et al., 2001). Back to the current study; among the 5 participants with the lowest scores in the AQ test (score 95 or less) only females could be found. In the original study, both men and women were found among the lowest scores (Baron-Cohen, et al., 2001).

A strength with the present study is the stability in the two instruments consisting of the two questionnaires. The AQ has strong validity, since people with a diagnosis score highly on it (Baron-Cohen et al., 2001). The AQ has also excellent test–retest reliability (Baron-Cohen et al., 2001) and measures all of the five domains (social, communication, imagination, attention to detail, and attention switching) (Baron-Cohen et al., 2001).

The K-DOCS measures all five factors of self-assessed creative behaviors and all creativity domains (Self/Everyday, Scholarly, Performance, Mechanical/Scientific and Artistic) showed acceptable test–retest reliability (Kaufman, 2012). It also shows strong validity, since its domains were consistent with past research (Kaufman, 2012). A limitation with the K-DOCS is that the participants always score highly in creativity if they estimate their creativity as high, which means that no questions was reversed.

The AQ and K-DOCS are easy to compare since both contains 50 questions each and both questionnaires are also divided into 5 domains each containing 10 questions each. This is another strength with the present study because the questions about autistic traits and the questions about creativity are are of equal importance. Another similarity is that both instruments are based on self-report questions. All these similarities makes comparisons easy to make between the two instruments.

Several studies have used different tests of divergent thinking in combination with Creative Self-report Scales in order to measure creativity. A limitation in the current study is that only self-report scales were used. This means that the current study measured different areas but not dimensions of creativity. The way to measure Autistic traits in the current study shares the limitation of being based on only self-report but in the AQ it was probably less likely for the participants to know what their answers would result in.

A cross-sectional design was used for the present study and that complicates the possibility of prediction measurements compared to a longitudinal design. However, there are previous studies that have shown that autistic traits occur early in life (Lai et al., 2014) and that suggest that people are born with autistic traits. There are also more dynamical approaches of creativity (Jankowskaa et al., 2018). Therefore the current study suggest that Autistic traits may be the independent factor and and Creativity the dependent factor. At the same time, Creative interventions has in previous studies shown an effect on Autistic traits (Groß et al., 2010; Wan et al., 2011). This means that direction of the links between Autistic traits and Creativity needs to be researched and discussed further.

Because of the many correlation calculations in the current study, some results are less reliable. All results are still presented in order to make comparisons with previous studies possible. The current study suggest that results that correspond with previous studies are worth discussing since when similar results have been found in other samples the probability of an actual correlation increases.

Some changes were made in the calculation of AQ. In the original study, individuals scored in the range 0-50. The participants would get higher score depending on how many questions they score at, not depending on how much they score at each question. However, in the current study, the answers were converted into a scale of 1-5 for each question. This was done in order to be able to make correlation calculations and for the results to be easy to compare with the creativity scale. On the other hand, this made it harder to compare the descriptive statistics of the AQ in the current study with the AQ in the original study. Findings around how the variables relate to other areas and gender differences could still be compared with previous studies.

Another aspect to discuss is that the statistical calculation can not determine whether the questions in the questionnaire are biased. Therefore a biases discussion is important. Starting, the result of the current study showed that the autistic traits of difficulties in Social skill and difficulties in Imagination had negative effects on Creativity. In order to determine if other autistic traits may have a positive effect on Creativity it is necessary to question if the creativity domains demand social skills or imagination in general. In the Self/everyday creativity domain it may be unavoidable that social skill is important, but the creativity domains that are possible without social skills should not contain social requirements. For example, creativity question number 31 “playing music in public” involves both music and social activity; and goes under the category of performance. The participants who play music but never do it in public might score lower in the creative measurements than they should. The question is if there is a social bias in the creativity questions that complicates measurements of creativity outside of situations that requires social skills. In addition; autistic traits are negatively correlated with extraversion (Jankowskaa et al., 2018) but it may not always be a difficulty. For example; a creative scientist may not need to be extraverted (Kaufman, 2012).

The current study did not find any relationship between age and creativity. But there is also a part of the instruction to the participants that follows: “Compared to people of approximately your age and life experience, how creative would you rate yourself for each of the following acts?”. This means that the questionnaire was made to measure creativity with reduced impact of the persons age.

Another limitation with the K-DOCS is that it is quite easy for the participant to understand which alternatives that gives high creativity as a result. High creativity is probably a result that is also desired since it is not likely that someone wants to be a less creative person. This may be a bias. How participants may feel about this is also an ethical aspect, since the participants self-esteem may be challenged.

People may have a high opinion of themselves because they are creative or because they have unusually high levels of self-efficacy or self-esteem (or narcissism) (Kaufman, 2012) or vice versa. Creative self-efficacy is someone's own self-belief and judgements about their own creativity (Carruthers et al., 2018). Perceptions of creativity can be quite different from actual ability (Kaufman, 2012) because research on creative metacognition indicates that people do not necessarily have sharp self-insight into their own creativity (Kaufman, 2012). The K-DOCS is more focused on self-beliefs about one's abilities than a straightforward reporting of participation. In this way, the K-DOCS also incorporates the idea of creative self-efficacy, which can be a sign of lower levels of creativity (Kaufman, 2012). For this reason, more studies are required that examines the links between autistic traits and creativity in a form of both a cognitive (performance-based) and personality-related (self-report based) characteristics (Jankowskaa et al., 2018) because it has been demonstrated that while the latent factor of creativity composed of self-report scales was negatively linked to autistic traits, the latent factor of cognitive creativity was positively related to them (Jankowskaa et al., 2018). This can indicate that individuals who score higher in autistic traits tend to underestimate their creativity. (Jankowskaa et al., 2018). In addition to self-report, Divergent thinking tasks can be used, as they are contested as a direct measure of creativity (Best, et al., 2015). Several studies have shown examples of ways combine self-report measurements with other ways to measure creativity (Carruthers et al., 2018, Jankowskaa et al., 2018) and future studies could control the participants Self-esteem and self-efficacy in Self reported instruments and also continue the comparison with divergent thinking task tests in order to research these relationships further.

The current study had several comparisons were no link was found between the autistic domain and the creativity domain. A suggestion for future research could be to also measure if nonlinear links could be found.

Since difficulties in imagination was the area that mainly had negative associations with creativity, future intervention may also focus on how to strengthen the imagination for people with autism. Creative intervention like music therapy has been successful as intervention for people with autism in previous studies (Wigram & Gold, 2006; Kim, Wigram & Gold, 2008) and future studies could look into if this can strengthen the participants imagination.

More studies are required in this field in order to describe an autistic version of creativity. The benefits of attention to detail and connections between Scientific skills and autism needs to me researched with other measurement methods. A group of people with autism should participate together with a control group and beside of self-report should creativity task tests also be used. It should also be considered that domain-specific instruments gives the possibility to research different areas within the main factors.

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Appendix

Demographic Questions

1. Female_____ Male_____

2. Age _____

Kaufman Domains of Creativity Scale (K-DOCS)

Instructions were as follows: "Compared to people of approximately your age and life experience, how creative would you rate yourself for each of the following acts? For acts that you have not specifically done, estimate your creative potential based on your performance on similar tasks."

Items 1–11 comprise 1. Self/Everyday
Items 12–22 comprise 2. Scholarly
Items 23–32 comprise 3. Performance (encompassing writing and music)
Items 33–41 comprise 4. Mechanical/Scientific
Items 42–50 comprise 5. Artistic

Options: 1. Much less Creative 2. Less creative 3. Neither More or less Creative 4. More Creative 5. Much more Creative

The items were randomized to avoid a response bias.

1. Finding something fun to do when I have no money____
2. Helping other people cope with a difficult situation___
3. Teaching someone how to do something___
4. Maintaining a good balance between my work and my personal life___
5. Understanding how to make myself happy___
6. Being able to work through my personal problems in a healthy way___
7. Thinking of new ways to help people___
8. Choosing the best solution to a problem___
9. Planning a trip or event with friends that meets eceryone´s needs ___
10. Mediating a dispute or argument between two friends___
11. Getting people to feel relaxed and at ease___
12. Writing a nonfiction article for a newspaper, newsletter, or magazine___
13. Writing a letter to the editor___
14. Researching a topic using many different types of sources that may not be readily apparent___
15. Debating a controversial topic from my own perspective___
16. Responding to an issue in a context -appropriate way___
17. Gathering the best possible assortment of articles or papers to support a specific point of view _____
18. Arguing a side in a debate that I do not personally agree with _____
19. Analyzing the themes in a good book _____
20. Figuring out how to integrate critiques and suggestions while revising a work _____
21. Being able to offer constructive feedback based on my own reading of a paper _____
22. Coming up with a new way to think about an old debate _____
23. Writing a poem _____
24. Making up lyrics to a funny song _____
25. Making up rhymes _____
26. Composing an original song _____
27. Learning how to play a musical instrument _____
28. Shooting a fun video to air on YouTube _____
29. Singing in harmony _____
30. Spontaneously creating lyrics to a rap song _____
31. Playing music in public _____
32. Acting in a play _____
33. Carving something out of wood or similar material _____
34. Figuring out how to fix a frozen or buggy computer _____
35. Writing a computer program _____

36. Solving math puzzles_____
37. Taking apart machines and figuring out how they work _____
38. Building something mechanical (like a robot) _____
39. Helping to carry out or design a scientific experi- ment_____
40. Solving an algebraic or geometric proof _____
41. Constructing something out of metal, stone, or similar material _____
42. Drawing a picture of something I've never actually seen (like an alien) _____
43. Sketching a person or object _____
44. Doodling/drawing random or geometric designs _____
45. Making a scrapbook page out of my photographs _____
46. Taking a well-composed photograph using an interesting angle or approach _____
47. Making a sculpture or piece of pottery _____
48. Appreciating a beautiful painting _____
49. Coming up with my own interpretation of a classic work of art _____
50. Enjoying an art museum _____

The Autistic-Spectrum Quotient

The questions for each domains are:
social skill (items 1,11,13,15,22,36,44,45, 47,48); *attention switching* (items 2,4,10,16,25,32,34, 37,43,46); *attention to detail* (items 5,6,9,12,19,23,28, 29,30,49); *communication* (items 7,17,18,26,27,31,33, 35,38,39); *imagination* (items 3,8,14,20,21,24,40,41, 42,50).

Options in the current study: Definitely agree - slightly agree - neither agree or disagree - slightly disagree - definitely disagree

"Definitely agree" gives the higher score on the following items: 1, 2, 4, 5, 6, 7, 9, 12, 13, 16, 18, 19, 20, 21, 22, 23, 26, 33, 35, 39, 41, 42, 43, 45, 46.

"Definitely disagree" gives the higher score on the following items:
3, 8, 10, 11, 14, 15, 17, 24, 25, 27, 28, 29, 30, 31, 32, 34, 36, 37, 38, 40, 44, 47, 48, 49, 50.

The items were randomized to avoid a response bias.

1. I prefer to do things with others rather than on my own.___
2. I prefer to do things the same way over and over again.___
3. If I try to imagine something, I find it very easy to create a picture in my mind.___
4. I frequently get so strongly absorbed in one thing that I lose sight of other things.___
5. I often notice small sounds when others do not.___
6. I usually notice car number plates or similar strings of information.___
7. Other people frequently tell me that what I've said is impolite, even though I think it is polite.___
8. When I'm reading a story, I can easily imagine what the characters might look like.
9. I am fascinated by dates.___
10. In a social group, I can easily keep track of several different people's conversations.____
11. I find social situations easy.___
12. I tend to notice details that others do not.___
13. I would rather go to a library than a party.____
14. I find making up stories easy.___
15. I find myself drawn more strongly to people than to things.___
16. I tend to have very strong interests, which I get upset about if I can't pursue.___
17. I enjoy social chit-chat.___
18. When I talk, it isn't always easy for others to get a word in edgeways.___
19. I am fascinated by numbers.____
20. When I'm reading a story, I find it difficult to work out the characters' intentions.___
21. I don't particularly enjoy reading fiction.___
22. I find it hard to make new friends.___
23. I notice patterns in things all the time.___
24. I would rather go to the theatre than a museum.___
25. It does not upset me if my daily routine is distubed.___
26. I frequently find that I don't know how to keep a conversation going.___
27. I find it easy to "read between the lines" when someone is talking to me.___
28. I usually concentrate more on the whole picture, rather than the small details.___
29. I am not very good at remembering phone numbers.___
30. I don't usually notice small changes in a situation, or a person's appearance.___
31. I know how to tell if someone listening to me is getting bored.___
32. I find it easy to do more than one thing at once.___
33. When I talk on the phone, I'm not sure when it's my turn to speak.___
34. I enjoy doing things spontaneously.___
35. I am often the last to understand the point of a joke.___
36. I find it easy to work out what someone is thinking or feeling just by looking at their face.___
37. If there is an interruption, I can switch back to what I was doing very quickly.___
38. I am good at social chit-chat.___

39. People often tell me that I keep going on and on about the same thing.___
40. When I was young, I used to enjoy playing games involving pretending with other children.___
41. I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant, etc.).___
42. I find it difficult to imagine what it would be like to be someone else.___
43. I like to plan any activities I participate in carefully.___
44. I enjoy social occasions.____
45. I find it difficult to work out people's intentions.____
46. New situations make me anxious.___
47. I enjoy meeting new people.___
48. I am a good diplomat.___
49. I am not very good at remembering people's date of birth.___
50. I find it very easy to play games with children that involve pretending.___