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Autism Phenotype and Big 5 Personality Expression: A Correlational Study Using Autism Quotient

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ABSTRACT

Autism-Spectrum is a multifaceted continuum of traits that negatively affects social and cognitive function. Some of these functions have indirect and direct parallels to certain personality traits. This leads to trending research claiming that the expression of autistic phenotype strength correlates negatively with all Big 5 personality traits, which this study attempts to validate in the adolescent population. A two-part, matched pairs self-report questionnaire was designed adapting two ten-item questionnaires that identify personality traits and autism phenotype expression using Autism Quotient (AQ) and Big 5 personality traits. Students in a special education program at a local high school were asked to take the questionnaire. In total, 10 students participated in the study. Using Pearson correlation, there were inconsistent results regarding the correlation between AQ and specific Big 5 Personality traits. This was further confirmed to not be significant using one-tailed linear regression t-tests for each personality trait.. This study hopes to lay the groundwork for future, larger-scale research using this format, hopefully within more randomized frameworks for generalization and more significant results.

Introduction

According to the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2022), Autism spectrum disorder (ASD) is a developemental disorder characterized by persistent deficiencies in communication and social interactions, along with repetitive behaviors. These traits can manifest in a variety of ways, but the most common of which include reduced emotional and contextual awareness, struggles with non-verbal communication, inflexable adherance to routines, and fixed interests. Some who are diagnosed with ASD are also comorbid for intellectual or language impairments.

Originally, the traits expressed by people with Autism Spectrum Disorder were seen as limited to people solely with “Classical Autism” as defined by Hans Aspergers and Leo Kanner. However, with the rise of the neurodiversity framework within psychology, the consolidation of formerly independent diagnoses such as of Aspergers Syndrome into ASD, and the growing idea that people with Autism themselves has a range of mental functioning, lead to the idea that these traits are not merely symptoms of ASD, but make up a *Phenotype* (collection of traits) that varies in expression from person to person, even if undetectable under current diagnostic criteria. This theory of the Broader Autistic Phenotype (BAP) has gained traction in recent years due to validation in studies involving family members of persons with ASD, along with certain cohort studies (Micali et al., 2004; Sasson et al., 2013a; De Groot & Van Strien, 2017).

Baron-Cohen et al. (2001) used early understandings of this theory to form the basis for the first quantitative, short form test for BAP expression in both ASD and non-ASD populations, called the Autism Quotient (AQ). Using certain clusters of traits associated with ASD, Baron-Cohen developed the test in such a way that

to get the highest score means someone fully expresses BAP related traits, while the lowest score means someone expresses little to no BAP related traits. Though originally designed to determine a quantitative "cut-off" for determining ASD diagnosis, AQ has gained broader use in studies related to austistic traits due to its flexibility

The creation of such quantitative tests has led to some testing to see whether BAP/ASD has an effect on other cognitive traits. One such group of traits is personality, which is the enduring characteristics and behavior that make up one's self. Though there are many theories about the definition of personality, the most popular among psychologists is Big 5 personality traits. In it, personality traits can be classified into 5 broad categories. This categorese categories are: extraversion (enthuastic and sociable), agreeableness (ability to get along with others), conscientiousness (ability to understand oneself and be self disciplined), emotional stability[1] (calm and not easily emotional), and openness to experience (willingness to explore new activities) (Huntington & Davis, n.d). Though understandings and tests of Big 5 personality were developed in the 1950s and 1960s (Tupes & Christal. 1958; Cattell & Mead 2008), the first modern test for Big 5 Personality was developed by Goldberg (1992).

Some BAP/ASD related traits seemingly having interwined relationships with Big 5 personality traits. An example including lower social welling being associated with both autism diagnosis in adults and lower extraversion (Maitland et al., 2021; Card & Skakoon-Sparling, 2023). This led to the investigation of the following research question: Is there an association between Autism expression and Big 5 Personality?

Austin (2005) was one of the first studies on this subject. Sampling undergraduate students, they found that higher autism quotient scores were associated with lower extraversion, agreeableness, and emotional stability scores. Schriber et al. (2014) found that when compared to neurotypical populations, adults diagnosed with autism tended to have lower scores compared to "typically developing" adults. This held true even when said self-reported scores were higher than scores done by parents of the same participants. Robinson et al. (2020) even found that such associations endured in autistic adults who engage in "camouflaging," or the intentional masking of their preceived autistic traits. The study of most help for this research is Lodi-Smith et al. (2019), and their meta-analysis of 14 studies under this topic (Including Austin and Schriber above). They found that for the correlational studies surveyed, there tended to be weak to moderate negative associations between autism expression score and Big 5 personality score. These trends followed when accounting for some bias effects in some studies.

This study will hopefully improve this research base by increasing the scope of the people surveyed and its replication ability. The studies surveyed do not cover people aged 14-18, and instead focus on either early adolescent or early to late adulthood samples. Along with that, the studies have an inconsistent usage of test varieties. More accessible ways of testing these associations can help determine more fluid autism diagnosis procedures, potentially leading to more individualized programs for adults with autism (Lodi-Smith, 2019, p. 561). This can alivate many complications autistic adults have dealing with "service cliffs" due to generalized state program requirements (Fairbank, 2023). These cliffs are attributed to leading to nearly 26% of autistic entering adulthood having no instiutional supports, with 28% of people in said group not able to support employment or further education within two years after graduating (Roux et al., 2015, p. 25).

Using this rationale and Lodi-Smith as a basis, the following general hypothesis was developed for this study:

If a special needs program was surveyed to find each student's autism quotient and big 5 personality traits, then there would likely be negative trends of associations between Autism Quotient and Big 5 personality using numerical tests for each.

Simply put, if the following hypothesis is supported, then as one's autism quotient score increases, they're quantitative expression of personality traits decreases. This contrasts with the formal Null hypothesis, which is that there are no significant associations.

Methods

A short form, two-part questionnaire was designed using google forms to test this hypothesis. The part of the questionnaire would be an AQ inventory, while the other would be a Big 5 Personality inventory. Using Numerical scaling, it was made so that AQ was the predictor variable, and Big 5 would be the criterion variable. From there, Correlational analysis will be done in order to find out whether the results are significant. The participants were members of a special education program at a suburban high school. It was decided to study this population because it would likely include a representative number of people with and without ASD diagnosis, while still having a larger than average mean AQ score.

The questionnaire was modeled tests off existing, short form versions of AQ and Big 5 personality inventories. For AQ, the 10-Item Autism Quotient (AQ-10) developed by Allison et al. (2012)[2] was used. Though none of the studies reviewed used this test, a cohort study (Lundin et al., 2019) was used to collaborate on its validity. For Big 5, the Ten Item Personality Inventory (TIPI) developed by Gosling et al. (2003)[3] was used. This Inventory had been already used in this field (Rodgers et al., 2018), and had been independently validated beforehand (Thørrisen & Sadeghi, 2023). For each inventory, the scoring guidelines and questions provided in the studies were used. When organizing the parts, a pseudo-matched pairs design[4] was used to organize the questionnaire. Demographic questions and Consent Agreements were added as requested.

All potential participants were asked during their specific special education class to complete the questionnaire by their teacher. Teaching assistants acted as proctors for the study, helping students out while they did the study. At the end of the data collection period, the results were moved onto google sheets and did the data analysis on desmos. The data collection period lasted for about 48 hours.

Results

10 students in total participated in the questionnaire. Demographically, the participants resemble the overall high school population at this high school location, being mostly caucasian (70%), male (70%), and identifying as cisgender male (60%). The participants were evenly distributed by grade levels 9-12. M = 10.3, SD = 1.1, Var = 1.21. Along with that, they were evenly distributed among special education classes and their period number during a 7 period school day. M = 2.5, SD = 1.12, Var = 1.25 (classes sampled were from period 1-4).

On a ten point scale, the average autism quotient score was 4.1 (SD = 1.6). However, the sample score was not determined to be significantly lower than the clinical cut off score for autism diagnosis, which for this test was six. $t(9) = -1.19$, $p = .132$. For each personality trait on a seven point scale, the average score ranged from 3.25 (extraversion) to 5.45 (Openess to Experience). The traits' values differed significantly from each other based on their averages using ANOVA testing in particular. $F(4,45) = 3.20$, $p = .021$. Below is personality data's full statistics and their distributions.

Table 1. Personality Trait Summary Statistics

Trait:	Mean (Standard Deviation)	95% confidence interval [-, +]
Extraversion	3.3 (2.1)	[1.97, 4.53]
Agreeableness	4.6 (1.6)	[3.59, 5.51]
Conscientiousness	4.2 (1.4)	[3.36, 5.04]

Emotional Stability	3.7 (1.5)	[2.73, 4.57]
Openness to Experience	5.5 (0.9)	[4.91, 5.99]

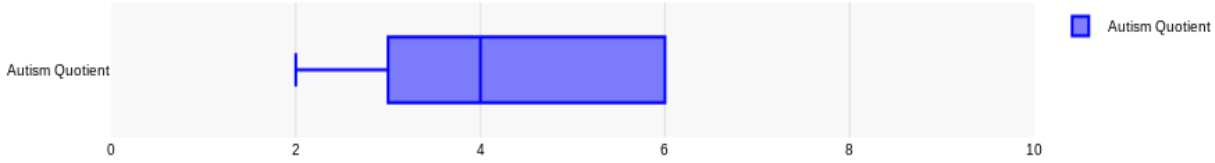

Figure 1. Distribution of Autism Quotient (Full line = Median)

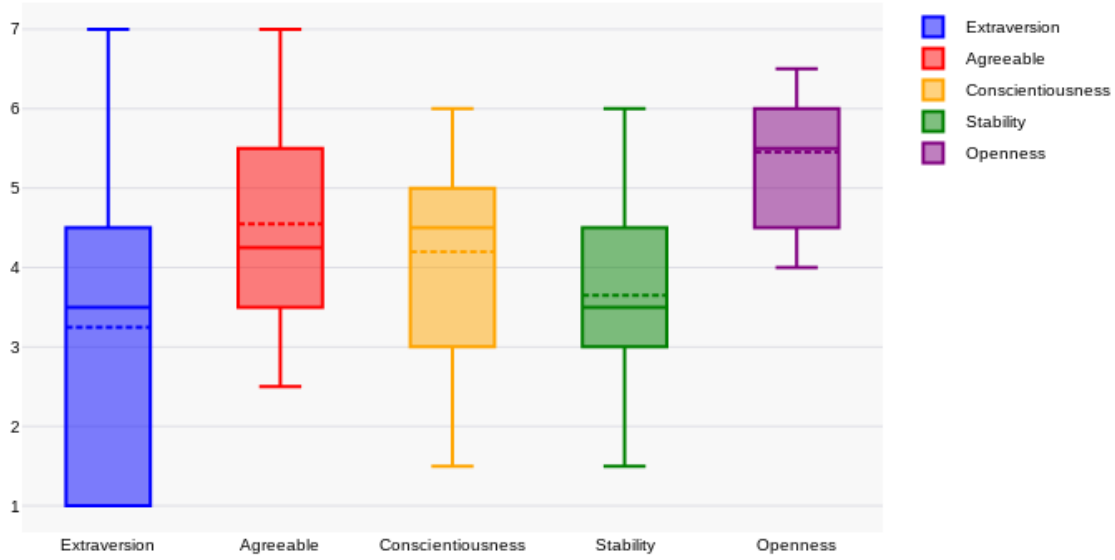

Figure 2. Distribution of personality traits (Full line = Median, Dotted Line = Mean)

Free graphing software was used to determine the correlation between these two variables. The correlation coefficients varied wildly for each trait, with r ranging from -.36 (extraversion) to .32 (conscientiousness), and a similar pattern for each regression lines' slopes. One way significance tests for means, It was found that these correlations were not significant at alpha level .05. For the full inferential statistics and regression formulas for the data, see table 2 below.

Table 2. Regressions and Inferential Statistics (df = 8, one sided t-test for b<0)

Trait	Created Regression line (a+bx)	r value	t value	p value
Extraversion	5.17467 - 0.469432x	-.36	-1.10	.153

Agreeableness	4.29039 + 0.0633188x	.07	0.18	.571
Conscientiousness	3.07205 + 0.275109x	.33	0.97	.819
Emotional Stability	3.6179 - 0.00436681x	>-0.01	-0.01	.495
Openness to Experience	6.15721 - 0.172489x	-0.32	-0.95	.185

Discussion

From the data above, it can be seen that the general hypothesis is not supported, as the Null hypothesis failed to be rejected. There were a few signs that the data could likely follow past work on the subject, specifically with extraversion, openness to experience, and emotional stability. On the contrary, the data from agreeableness and conscientiousness showed inverse predicted correlations from the general hypothesis. Along with this, the data from this study is not significant. This was due to the fact that when completing significance tests, none of the observed data was significant at alpha level .05. This effect may be worsened by the sampling method which, though predicted to be low, likely had a response bias.

Conclusion

Overall, the intersection between personality and autism expression is slowly becoming more understood. Research has shown that personality can show signs of a universal, cognitive factor behind autism expression, which can progress the field into uncharted territory. Though this study may have not reached a firm conclusion of this topic at the high school level, it is believed it can be used by others to hopefully improve the field in numerous ways. Hopefully, this research will help give a broader perspective on what it means to be Autistic.

Limitations

Because of these issues, improvements for replication using this model are needed. The most glaring of these issues include sample size and test engineering. Since the sample size was so low, the tests likely had too small of a test power to detect such correlations between personality and AQ. This can be improved by increasing the sample size using more rigorous methods than the ones used in this study. Test engineering could also be improved by including a truely random matched pairs design, while also conforming to scientific standards using simple random sampling.

Future Studies

For future research using this questionnaire, many potential paths can be explored. For one, further studies can explore how these trends are maintained for thoses with different levels of autism. Currently, the questionaires used make the assumption that subjects who complete the survey are of average intelligence and cognitive abilities. However, people with certain expressions of autism diagnosed with ASD may be cormorbidly have an intellectual disability, due to neurological based impairments on one's executive cognition (Al-Mazidi, 2023). Using self report methods for people with intellectual disabilities have been shown to have questionable validity in this regard (Finlay & Lyons, 2001). At the same time, as shown in Schriber (2013), third person

alternatives for personality assessments may not accurately reflect one's true personality. Another path for future research involves changing questionnaire bases. In studies of broad autistic trait expression, for example, more recent tests such as the BAPQ (Sasson et al., 2013b) and the BAP-IT (Godoy-Giménez, 2024) are very recent and unique alternatives to the AQ when examining Autism Trait Expression in a broader sense.

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Endnotes

1. Most studies use the term "Neuroticism" instead, which has the opposite definition of Emotional stability. For later hypothesis testing purposes, "Emotional Stability" was used instead, as was in

Lodi-Smith (2019), with the scores reversed when citing a paper using "Neuroticism" instead of "Emotional Stability."

2. The rubric and questions can be found on the "Autism Research Centre" website. https://docs.autismresearchcentre.com/tests/AQ10.pdf
3. The entire TIPI and its rubric, including various translations and other useful information, can be found on Gosling's website free of charge. https://gosling.psy.utexas.edu/
4. The term "pseudo" is used since a true matched pairs design would be completely randomized. Google forms can't implement such technology, and so an innocuous survey question about the participants favorite pet (dogs or cats) was improvised to direct the order of the questionnaire.