Pilot Analysis of Genetic Effects on Personality Test Scores with AI: ABO Blood Type in Japan

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Abstract

It is estimated that genetic factors are responsible for approximately 30-60% of an individual's personality. However, statistical analyses have yet to demonstrate a significant and consistent relationship between personality tests and genetic factors. Conversely, a significant portion of individuals in Japan, South Korea, and Taiwan believe that there is a linkage between ABO blood type, which is determined genetically, and personality. This pilot study analyzed data from a large-scale survey (N=2,887) using a combination of traditional statistical methods and AI to examine this relationship. The results indicated the relationship between ABO blood type and self-reported personality traits on several single-question items, in accordance with expected outcomes. These findings suggest that this relationship may extend beyond ABO blood type and personality to encompass other inherited characteristics. The influence of the level of interest on personality was also discussed.
Keywords: gene, personality, ABO, blood type, AI

1. Introduction

1.1 Influence of Heredity Based on Twin Studies

The estimated percentage of heredity's impact on personality ranges from 30-60% according to twin studies and other investigations [1-4]. There exist two distinct types of twins: identical and fraternal. Identical twins are formed from a fertilized egg that splits during multiplication, resulting in both individuals having identical DNA. Conversely, fraternal twins are formed from the fertilization of two separate eggs by different sperm, resulting in them having distinct DNA profiles. In reality, it is observed that identical twins often have the same facial features, hair color, and eye color, while fraternal twins do not typically exhibit such similarities.

In light of these findings, the influence of heredity on psychological and physical characteristics has been evaluated through statistical analysis of the differences between identical and fraternal twins. To date, a plethora of twin pairs have been studied through the use of personality tests such as the Big Five. The outcomes of these studies indicated that differences between identical twins were minimal in comparison to the differences between fraternal twins, suggesting that psychological and constitutional traits are partially determined by DNA. These twin studies have been conducted globally with comparable results,

and the data generated is highly reproducible. However, it should be noted that these surveys primarily focused on standard families in developed countries, and therefore did not encompass the more severe conditions, such as malnutrition during times of war.

In the 1950s, it was discovered that heredity is regulated by a biomolecule with a double helical structure known as DNA (deoxyribonucleic acid). DNA encodes genetic information through the sequence of 4 base classes, comprising billions of bases in humans. Due to the recent rapid advancements in the life sciences, the International Human Genome Sequencing Consortium announced in 2003 that the complete DNA sequence, or whole genome, had been decoded. The subsequent 1000 Genomes Project, initiated in 2008, was the first among many genome sequencing projects that have been launched globally, yielding a plethora of solid results. These developments have enabled the direct analysis of the relationship between genomes and personality and abilities through mathematical methods, which was not possible using traditional methods.

1.2 Genome-wide Association Analysis Studies

A prevalent methodology employed in genetics research is GWAS (genome-wide association analysis studies), which aims to identify genetic variations associated with specific diseases or characteristics of an individual's constitution. This is accomplished by collecting and comprehensively analyzing the genomic information of a large population to identify small variations in genetic information known as SNPs (single nucleotide polymorphisms). Each analysis examines hundreds to thousands of SNPs simultaneously and compares the differences in genetic information found between populations that possess a specific trait and those that do not, in order to identify the SNPs that appear more frequently in relation to that trait.

However, even when SNPs are identified through GWAS, the genetic contribution derived from them is typically significantly smaller than that estimated through twin studies. This phenomenon, known as missing or hidden heritability, has garnered significant attention as GWAS is increasingly utilized.

A notable example of this is provided by Lo et al [5]. In this study, the researchers sought to correlate data on all SNPs in the human genome of over 260,000 individuals with the Big Five personality test, the most widely used personality test in current psychology. As a result, 6 genes were identified as being associated with personality, however, the coefficient of determination R^2, which indicates the degree of influence, was less than 0.4% for all of them, an extremely small value that would typically be considered an error. This value is much smaller than the 30-60% values obtained in twin studies.

There are several potential explanations for such extremely small heritability estimates, including 1) interactions between genes (nonlinear interactions), 2) genetic and environmental interactions, and 3) the challenge of detecting and analyzing SNPs with current molecular genetics techniques. This is also important in approaching an essential understanding of genetic phenomena. Recent studies have shown that over 1,200 genes are involved in height [6] and 124 genes in hair color [7].

1.3 Blood Type Personality Studies

Conversely, some studies have arrived at the opposite conclusion from the aforementioned explanation, that the effects of individual genes are minuscule. This is exemplified by studies on the correlation between

blood type and personality. A significant number of studies on this topic have been published in East Asia, particularly in Japan.

Approximately half or more of the population in Japan, South Korea, and Taiwan contend that the relationship between genetically determined ABO blood type and personality is credible [9-13]. However, there is still a lack of scientific consensus on the relationship between blood type and personality. What past research findings have in common is that the Big Five personality tests, which aggregate multiple questions from 5 to several hundred into 5 factors, have shown little or no consistent differences [12-15]. In contrast, many studies have found statistically consistent and significant differences when analyzing each single question item that is considered to be a "blood type trait." This can be successfully explained by considering that blood type affects only a very limited number of question items that comprise the personality factors, which would explain the previously inconsistent results. This is because each personality factor is a statistical integration of many question items, and the differences in the few question items that differed by blood type are expected to be reduced to negligible levels. This is similar to the previously mentioned mechanism by which genes that affect height and hair work [6-7].

Since the year 2000, several studies have been published to explore the relationship based on genetic factors such as linkage disequilibrium [16-17], and another report found a relationship between genotype and the TCI Personality Test, as predicted by blood type [18]. In 2022, several studies on ABO blood type and intestinal and intestinal microflora were published [19-21]. According to these reports, differences in the abundance of bacteria have been shown to have a causal relationship with depression and mental health.

1.4 Strategy of This Study

As previously stated, hundreds and thousands of genes are involved in macroscopic data such as height and hair color [6-7]. If one assumes that the properties of the 5 Big Five factors are similar to those of height, it is at least theoretically possible to assume that these two mechanisms are identical. As previously noted, the Big Five personality test ultimately narrows the thousands of potential question items down to no more than a few hundred. This is because question items with relatively small differences are omitted. If genes act on each item separately and each effect is small, then many question items that differ by blood type would be omitted. Accordingly, the final version of the personality test resulted in little or small differences in personality factors. This aligns with the fact that previous studies have not yielded consistent differences, and is very similar to the behavior of a number of genes that influence height and hair.

While testing this hypothesis would require a very large amount of personality and genomic data, "blood type" would improve the situation, as more than 90% of Japanese people know their blood type. If 100% accuracy is not required, an Internet survey is sufficient to complete the task. As for the Big Five personality tests, the Big Five Scales (BFS), standardized in Japan, includes blood type traits in some of the 60 items that make up the 5 personality factors [22].

In recent years, there has been a proliferation of scales that aim to measure psychological constructs with a minimal number of items, such as scales to measure subjective well-being [23] and self-esteem [24] with a single item. These scales have been widely adopted in various studies. Similarly, in the realm of the

Big Five personality test, brief measures such as 5-item and 10-item inventories have been developed. For instance, Gosling, Rentfrow, and Swann created the Ten Item Personality Inventory (TIPI), which measures the 5 factors of the Big Five in 10 items, using a 7-point scale [25]. Furthermore, Oshio, Abe, and Cutrone developed a Japanese version of the Ten Item Personality Inventory (TIPI-J) [26].

If personality tests are capable of measuring differences in personality based on blood type, certain question items within the test should exhibit variations based on blood type. Thus, the following methodology will be employed in this study. In the Big Five personality test, the number of question items varies from 5 to several hundred. Therefore, utilizing data obtained from the "same sample," we will compare the results of the aforementioned 10-item test [26] with those of a test comprising a larger number of items. If the differences of blood type traits are small, then many of them are omitted, a test with more items should be able to detect blood type differences more effectively. Blood type traits are typically described by adjectives, such as "nervous." Thus, a Big Five personality test whose question items are adjectives and which includes blood type traits should be employed for comparison. One such Japanese-language personality test that satisfies this condition is the aforementioned BFS; this test includes 3 blood type traits in all 60 question items [22]. Therefore, we will investigate whether blood type differences appear not only in these three question items, but also in the personality factors that include these items.

1.5 Analysis Using AI

Although personality is known to interact with a complex interplay of genetic factors such as gender and age, previous findings have shown that the interaction between these factors is not always linear [27-29]. Most previous psychological studies have assumed that the influence of blood type is constant, regardless of age, gender, and other factors [9-15]. Statistical methods used in designing personality tests using questionnaire methods, such as principal component analysis and correlation analysis, fundamentally assume linear relationships. Therefore, there is no theoretical guarantee that they can accurately analyze data that are not always linear in reality.

These issues may be addressed through the use of artificial intelligence (AI or machine learning). This is because AI can theoretically handle such nonlinear models. Therefore, in this study, we decided to pilot the use of AI to predict blood types from the results obtained from the question items, as well as traditional ANOVA. Since this prediction is typical of "supervised learning," there is no need to prepare a special mathematical model; current AI cloud systems can handle this task. Assuming the aforementioned mechanism, i.e., that genes act on each question item separately and that the effect is small and omitted for personality tests with fewer items, the prediction of participants' blood type using blood type traits is more accurate than the prediction using the 5 factors of the Big Five personality test.

2. Methods

2.1 Participants and Question Items

Given that the implementation of AI necessitates a substantial amount of data, we elected to utilize

crowdsourcing as a means of data collection for this study. A sample size of 3,200 individuals was selected for the year 2022, and participants were administered two commonly utilized personality tests, the BFS and the TIPI-J. The sample was stratified by age, with each decade represented, and evenly distributed between males and females. Participants were asked to rate each question item on a scale of 1 to 7, with greater numbers indicating a stronger agreement with the statement. Additionally, participants were asked to rate their belief and knowledge of blood type personality traits on a score of 1 to 4, with greater numbers indicating a greater belief or knowledge. Self-reported blood type was utilized, as a majority of Japanese individuals are aware of their blood type. Out of 3,200 participants, 161, or 5% of the total, were unaware of their blood type. Of the remaining 3,039 participants, 2,887 were used in the final analysis, after excluding any apparently inappropriate samples, such as those who provided identical responses to the first 20 sequential questions of the personality test. Lastly, an additional item was included to assess participants' interest in both their own and others' personalities, and participants were asked to rate their interest on a scale of 1 to 7, with greater numbers indicating a greater interest.

In order to circumvent ethical concerns, the blood type trait question items were extracted from previously published literature and academic studies [9-10]. As previously stated, the BFS includes 3 items related to blood type traits, an additional 5 items were added, resulting in a total of 8 items; 2 items for each of the 4 blood types. These 5 question items were subsequently reviewed by a Japanese crowdsourcing company that holds the Japan's Privacy Mark (JIS Q15001) certification, and were confirmed to not present any ethical issues. This company provides anonymous data to its clients and informed consent was obtained from participants in advance. This study also obtained prior approval from the institutional Ethics Review Committee. The statistical software used for ANOVA was jamovi 2.3.18, and the significance level was set at 0.05. The blood type distribution was 1,091 type As, 632 type Bs, 862 type Os, and 302 type ABs, which were consistent with the Japanese population average [30]. Effect sizes were also calculated [31]. For multiple comparisons, the Holm's method was utilized.

2.2 Analytical Strategy

We tried to follow those methods of psychological personality testing, and deliberately selected the most suitable traits (Table 1) that would certainly produce the differences: images of traits were consistent to the preceding academic studies, they showed large differences in the academic studies and their means were close to 50%, they did not show extreme values, and they were consistent to the preceding surveys of other studies.

Table 1. Blood Types and Its Major Personality Traits

Blood Type	Personality
A	Meticulous* (BFS: Conscientiousness), Nervous* (BFS: Neuroticism)
B	Self-paced, Self-centered* (BFS: Openness)
O	Big-hearted, Laid back
AB	Hard to be understood, Dual personality

* Three items included in the BFS.

We utilized traditional ANOVA, and the Microsoft Azure Machine Learning, a cloud AI system. All question items, including gender and age, were used as training data for prediction targeting for the blood type. All data was divided into training and predicting. This was done automatically by the system. In these cases, since the sample sizes of the AI training data were relatively small (this means that the prediction errors might become larger if we used the raw data of 1-year increment of age), a dummy variable of 10-year increments was used [20s = 2, 30s = 3, 40s = 4, 50s = 5].

AUC was used to evaluate the predictions; AUC is a metric used to evaluate binary classification. It has a value of 0.5 if machine learning does not work (the prediction is the same as a random result), and a value of 1 for a perfectly correct prediction. For multiple classifications with 4 values, such as blood type, the weighted AUC is used instead of the standard AUC. Similarly, the value of the weighted AUC is 0.5 if the prediction is the same as the random result and 1 if it is a perfect prediction.

3. Results

3.1 Analysis 1: ANOVA for the Big Five Personality Factors and Blood Type Traits

As for the BFS, only one factor, Conscientiousness, was statistically significant at $p < 0.05$, and after the Holm's correction. The magnitude of η^2 was at most 0.010, and thus the effect size was small (Table 2). As for the TIPI-J, no factor was significant (Table 3).

Table 2. ANOVA for the Big Five Personality Factors of BFS and Blood Type

Factors	Average Scores by Blood Type				*F*	η^2	*p*
	A (N=1091)	B (N=632)	O (N=862)	AB (N=302)			
Neuroticism	4.298	4.308	4.311	4.273	0.372	0.000	0.773
Extraversion	3.870	3.822	3.846	3.871	0.395	0.000	0.756
Openness	3.759	3.755	3.789	3.744	0.179	0.000	0.910
Agreeableness	4.321	4.262	4.279	4.237	1.128	0.001	0.278
Conscientiousness	3.689	3.876	3.873	3.819	10.141	0.010	**< .001***

Note. $p < 0.05$ are highlighted in bold. * $p < 0.05$ after the Holm's correction.

Table 3. ANOVA for the Big Five Personality Factors of TIPI-J and Blood Type

Factors	Average Scores by Blood Type				*F*	η^2	*p*
	A (N=1091)	B (N=632)	O (N=862)	AB (N=302)			
Neuroticism	4.159	4.186	4.148	4.113	0.283	0.000	0.838
Extraversion	3.544	3.514	3.544	3.599	0.338	0.000	0.798
Openness	3.726	3.765	3.680	3.831	1.478	0.002	0.218
Agreeableness	4.689	4.646	4.586	4.680	1.460	0.002	0.224
Conscientiousness	3.946	3.911	3.867	3.871	0.771	0.001	0.510

As for the blood type traits, all items were statistically significant at $p < 0.05$, and after the Holm's

correction. The magnitude of η^2 was at most 0.026, and thus the effect size was small (Table 4). In 7 of the 8 items, with the exception of the item "self-centered," the blood type with the highest score matched the respondent's blood type traits.

Table 4. ANOVA for the Blood Type Traits

Traits (Blood Type, BFS)	Scores by Blood Type				F	η^2	p
	A (N=1091)	B (N=632)	O (N=862)	AB (N=302)			
Nervous (A, N)	**4.271**	4.079	4.200	4.017	3.880	0.004	**0 .009***
Meticulous (A, C)	**4.335**	4.006	4.044	4.060	11.240	0.012	**< .001***
Self-centered (B, A)	3.681	3.938	3.823	3.967	6.630	0.007	**< .001***
Hard to be understood (AB, N/A)	3.897	4.112	4.085	**4.182**	5.880	0.006	**< .001***
Self-paced (B, N/A)	4.487	**4.812**	4.587	4.546	8.021	0.008	**< .001***
Dual personality (AB, N/A)	2.929	3.082	3.060	**3.772**	25.186	0.026	**< .001***
Big-hearted (O, N/A)	4.097	4.103	**4.289**	4.007	5.621	0.006	**< .001***
Laid back (O, N/A)	3.899	4.084	**4.462**	4.053	25.510	0.026	**< .001***

Note. Highest scores that match with blood type traits and $p < 0.05$ are highlighted in bold. * $p < 0.05$ after the Holm's correction.

On the question item "Do you think blood type and personality are related?", 9.0% of the respondents answered "related a lot," 47.9% answered "related somewhat," 25.8% answered "not related," and 17.3% answered "I don't know." On question item "Do you know the traits and compatibilities of blood types?", 4.5% answered "I know a lot," 44.0% answered "I know some," 35.9% answered "I know a little," and15.6% answered "I don't know at all."

3.2 Analysis 2: Blood Type Predictions Using AI

AUCs which indicate the accuracy of predictions were, in descending order, 0.593 for blood type traits (8 items), 0.529 for the BFS (60-item Big Five personality test), and 0.501 for the TIPI-J (10-item Big Five personality test). In a comparison of the Big Five personality tests, the BFS, which has a larger number of items, was more accurate.

Table 5. Results of Blood Type Predictions Using AI

Data	Weighted AUC	N	Algorhythm
BFS (5 factors with 60 items)	0.529	2887	Voting Ensemble
TIPI-J (5 factors with 10 items)	0.501	2887	Voting Ensemble
Blood type traits (8 items)	0.593	2887	Voting Ensemble

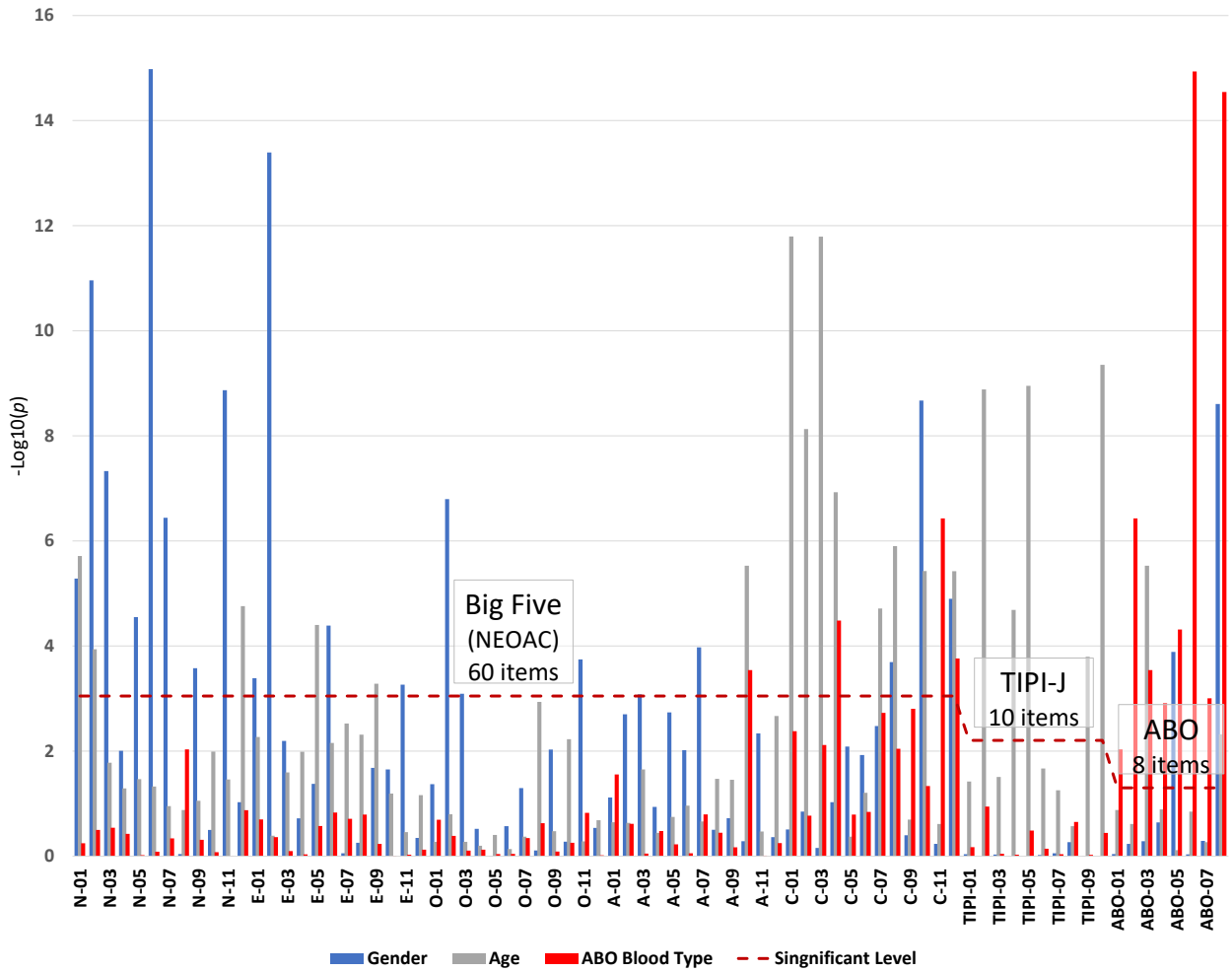
4. Discussions

4.1 Consistency with Previous Studies

As for differences in relation to blood type, none of the TIPI-J's personality factors and only one BFS

factor were statistically significant (Tables 2-3). Conversely, all 8 blood type questions were significant (Table 4). Furthermore, the majority of differences based on gender or age were more pronounced than those based on blood type (Figure 1). In the 8 blood trait items, the scores for each blood type were highest for the corresponding blood type, except for "self-centered"; Type AB scored 3.967, slightly greater than type B's 3.938. However, this difference was not statistically significant. Therefore, it can be stated that virtually all of the blood type traits in this study confirmed each score of the corresponding blood type was the highest. This evidently illustrates the correlation between blood type and personality. These results suggest that, as anticipated, question items with smaller differences were eliminated, and that tests with more items were more likely to detect differences in blood type.

Figure 1. *p* Values of Individual Items by Gender, Age and ABO Blood Type



It is generally acknowledged that the influence of blood type on personality is less pronounced than that of gender or age. Many prior studies have assumed that the effects of blood type are more significant than those of gender or age, leading to inadequate control of extraneous variables. It is likely that the effects of gender or age typically outweigh those of blood type, resulting in inconsistent results from the Big Five personality tests. In the future, more rigorous control of sample characteristics will be required. It seems that there exists a certain structure within studies utilizing the Big Five personality tests that makes it

challenging to discern differences in blood type traits. As Lo et al. have demonstrated [5], it would be unsurprising for the coefficient of determination R^2 between a single gene and the Big Five personality test to be less than 0.4%, even analyzing over 260,000 individuals in total. These findings provide a potential explanation for the perplexing phenomena observed in previous studies, such as inconsistent differences and minuscule differences even with large sample sizes.

It is worth noting that some researchers contend that differences in personality by blood type are not genuine, but rather pseudo-correlations resulting from the "self-fulfillment phenomenon." However, these researchers have conducted limited studies that directly examine data and demonstrate the self-fulfillment phenomenon. Conversely, studies that have directly investigated this have found differences as blood type traits, even in "groups with no knowledge of blood type traits" [32]. Therefore, the validity of the claim that all differences in personality stemming from blood type are caused by the "self-fulfilling phenomenon" is somewhat questionable.

4.2 Personality Sensitivity

The TIPI-J utilized in this investigation comprises a mere 10 question items for the 5 Big Five personality factors. To ensure the precision of the examination with a relatively limited number of items, all of which are paired with opposite meaning items; it is assumed that the scores on each pair items for each factor are essentially negatively correlated. The results obtained from the sample of 2,887 utilized in this study were as follows, with all pairs displaying negative correlations (Table 6).

Table 6. Correlation Coefficients between TIPI-J's Each Paired Items

Factors	Item Nos.	*r*	*p*
Neuroticism	4, 9	-0.319	**< .001***
Extraversion	1, 6	-0.239	**< .001***
Openness	5, 10	-0.361	**< .001***
Agreeableness	2, 7	-0.306	**< .001***
Conscientiousness	3, 8	-0.294	**< .001***

Note. $p < 0.05$ are highlighted in bold. * $p < 0.05$ after the Holm's correction.

However, certain prior studies [32] have revealed an anomalous phenomenon in which a correlation exists between greater levels of personality sensitivity and correspondingly greater scores. In other words, a "positive correlation" exists for certain question items that comprise these pairs. If this is not exceptional, it would significantly undermine the reliability of this particular personality test. To investigate this phenomenon, correlation coefficients were calculated between scores on the 10 TIPI-J question items and levels of personality sensitivity, utilizing a sample of 2,887 individuals. The results are illustrated in Table 7. Scores for personality sensitivity were determined by responses to the question "I am interested in both my own and others' personality" on a scale of 1 to 7 (with greater numbers indicating a greater interest).

Of the 5 pairs of question items, Neuroticism and Agreeableness were "positively correlated" with questions affirming personality sensitivity. Therefore, there were indeed pairs of question items that were

essentially "opposite" in meaning, yet displayed much "the same" scores. The interpretation that appears most plausible is that, regardless of the specific questions asked, respondents with greater levels of personality sensitivity felt that they were more "matched" than others. This suggests that, even if scores on the Big Five personality test are the same, the personalities of the individuals in question may not necessarily be equivalent. This is close to the example of sensitivity testing mentioned above, in which there are individual differences in human perceptions and subjective and objective evaluations do not necessarily match.

Table 7. Correlation Coefficients between TIPI-J Each Paired Items and Personality Sensitivity

Factors	Item Nos.	*r*	*p*
Neuroticism	4	**0.069**	**< .001***
	9	**0.121**	**< .001***
Extraversion	1	0.279	**< .001***
	6	0.005	0.768
Openness	5	0.282	**< .001***
	10	-0.087	**< .001***
Agreeableness	2	**0.063**	**< .001***
	7	**0.266**	**< .001***
Conscientiousness	3	0.253	**< .001***
	8	-0.018	0.337

Note. Both paired items' $r > 0$ and $p < 0.05$ are highlighted in bold. * $p < 0.05$ after the Holm's correction.

By utilizing the same methodology as in Analysis 2, and utilizing data from only the 978 respondents who were deemed to possess high levels of personality sensitivity; those who affirmed both the "relationship between blood type and personality" (respondents answered that they "know a lot" or "know some" with regards to blood type personality traits) and "sufficient understanding" (blood type and personality were "related a lot" or "related somewhat"), AUC increased from 0.593 to 0.628 (Table 8). This further supports the existence of an effect of personality sensitivity.

Table 8. Result of Blood Type Predictions Using AI

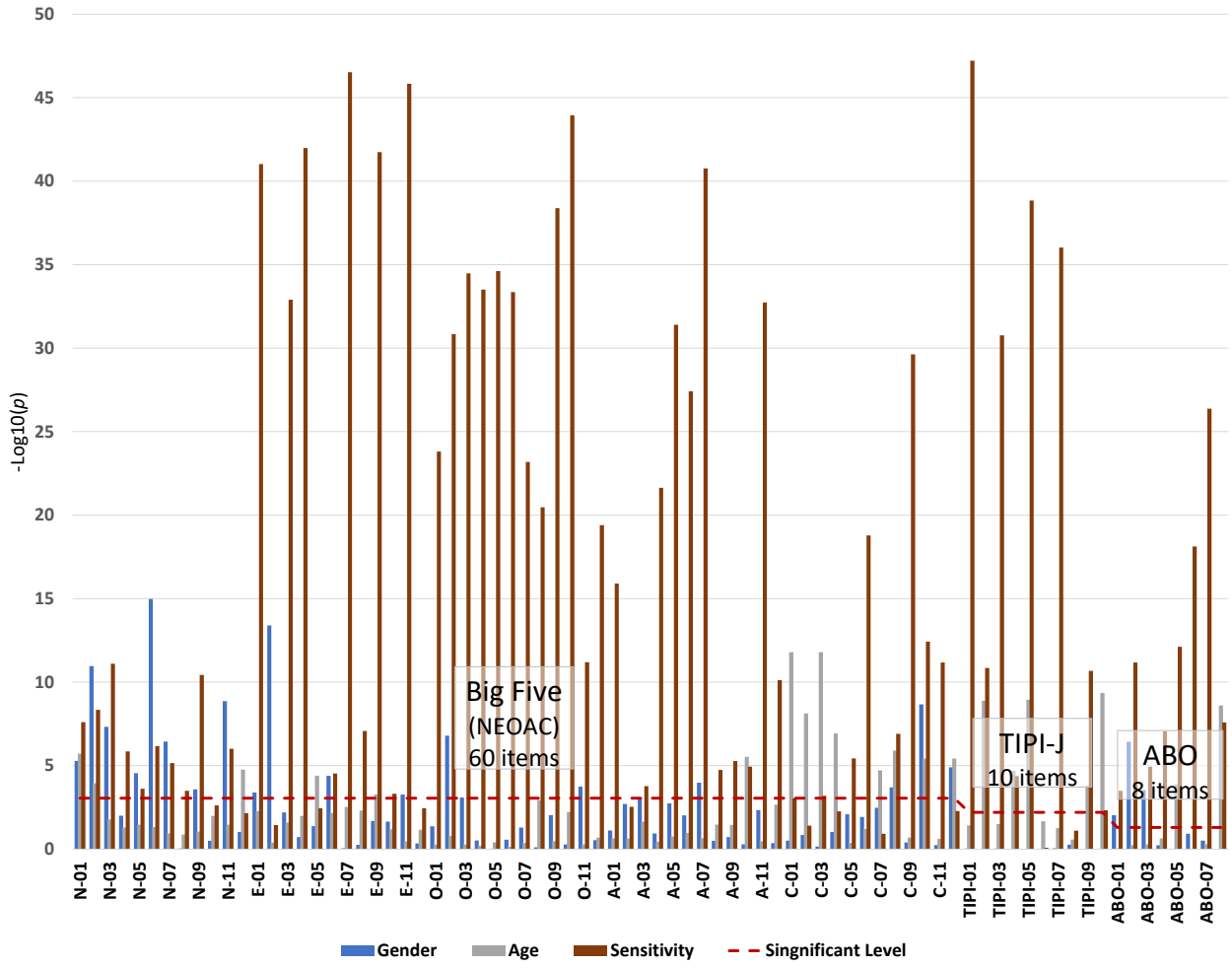
Data	Weighted AUC	N	Algorhythm
BFS (5 factors)	0.529	2887	Voting Ensemble
TIPI-J (5 factors)	0.501	2887	Voting Ensemble
Blood type traits (8 items)	0.593	2887	Voting Ensemble
Blood type traits (8 items, well-knowledge) *	0.628	978	Voting Ensemble

* Participants who answered both "they knew a lot (some) of blood type traits" and "blood type and personality were related a lot (somewhat)."

Additionally, the impact of personality sensitivity on scores for each item suggests that the influence of personality sensitivity was more pronounced than that of gender or age (Figure 2). These may offer valuable

insights regarding the interpretation of personality test scores, including the potential for Simpson's paradox to be present. However, research on personality sensitivity remains limited [33-34]. Further studies in this area are eagerly anticipated.

Figure 2. *p* Values of Individual Items by Gender, Age and Personality Sensitivity



4.3 Interpretation of Contradictory Phenomena

Assuming that the prior elucidations are adequate, it would be feasible to explicate the data on "blood type and personality," which are commonly believed to be inconsistent, in a nearly unified manner.

For example:

1. In a study predicated on a comprehensive survey analyzing data from Japan and the United States on a population of over 10,000, virtually no differences by blood type were discovered. This is because the survey employed question items only pertaining to life and finances and did not comprise question items regarding personality [35].
2. Blood type traits have tended to remain static over the years, according to a periodic large-scale opinion survey (several thousand respondents annually) that comprises question items on personality traits [36-38].

3. The Big Five personality tests yielded equivocal outcomes or no differences due to the varying gender and age groups, which have a more pronounced impact on personality than blood type.

Some researchers have also cast doubt on whether the ABO blood type gene, a single gene, truly has a substantial impact on personality. However, recent studies have revealed that a single gene influences hundreds of other genes. For example, the gene BAZ1B, which is believed to be associated with human "self-domestication," was found to affect the activity of 448 other genes [39]. This gene, BAZ1B, is crucial for neural crest and facial development and may be involved in self-domestication. Thus, there may be no particular quandary in assuming that ABO blood type genes influence personality.

5. Conclusion

The expression of traits by a singular gene is significantly limited. Nevertheless, a discernible correlation was observed between blood type and self-reported personality traits in various individual question items, which corresponded to traits that had previously been cited. Traditional personality tests, such as the Big Five test, usually employ a personality factor comprised of multiple items. Blood type does not exert a unique influence on an individual's personality. On the contrary, various factors, such as gender and age, have a complex and notable impact. This precludes the attainment of consistent results without accounting for these nonlinear interactions. Traditional personality tests, such as the Big Five test, usually employ a personality factor comprised of multiple items. In this case, the effect of blood type is variable, which can lead to inconsistent results unless the gender, age, or other conditions of the sample are properly controlled. The above explanation is closely aligned with the theory of personality psychology as well as other genetic effects phenomena. Our findings provide a novel, albeit hypothetical, framework for how genes impact human traits.

Meanwhile, the sample in this study was confined to Japanese populations only, the AI training data was of a small sample size, its use was experimental, and the interaction between gender and age is still unknown. Further research utilizing a larger, more global dataset is required to fully grasp the implications and to enhance methodologies.

Conflict of Interest

The author declares no conflict of interest.

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