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Bitter taste preference and psychopathy: A partial replication of

Sagioglou and Greitemeyer, 2016

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Abstract

In this study, we did a partial replication of Sagioglou and Greitemeyer's 2016 study concerning bitter taste preferences and malevolent personality traits. Undergraduate students ($n=40$, mean age=19.40, 75% females) completed a laboratory component consisting of 24 samples of 8 different solutions (sucrose, sodium chloride, quinine, and citric acid with a higher and lower concentration of each) for 3 iterations, as well as PTC testing and tongue staining in order to count fungiform papillae. This was followed by a survey component that utilized HEXACO (which assesses six major domains of personality) and the IPIP-NEO scale for psychopathy (measured with the factors of "fearless dominance" and "impulsive antisociality"). While this study failed to support the link between bitter taste preference and psychopathy, there was a significant positive correlation ($p<.01$) between psychopathy and extraversion as well as a significant negative correlation ($p<.01$) between psychopathy and honesty-humility. Taste and personality correlates included significant negative correlation ($p<.05$) existed between extraversion and the perceived intensity of sucrose, and also between agreeableness and perceived quinine intensity. While power and procedural issues warrant caution, the results we did achieve are promising and could have greater future applications as more studies are done to assess causal links between genetics and personality.

Bitter taste preference and psychopathy: A partial replication of Sagioglou and Greitemeyer, 2016

Taste, or gustation, is the sensation that results when molecules in the mouth activate receptors in the tongue and oral cavity. Psychology approaches this combination of physical stimuli and mental phenomena through the lens of psychophysics, a discipline that first made strides with taste in the 1930s. The field, by providing objective procedures for comparison, supported the notion that variation in oral sensory experience influences eating behavior (Bartoshuk, 2004). This study seeks to explore the links between personality and taste preference.

The human sense of taste develops over the lifespan, with preference and perception shifting and adapting based on social circumstances (such as availability and desirability of certain food items), biology (such as number of taste buds and their eventual atrophy), and personality (Higgs, 2015). Studies with both rats and humans have found certain proclivities for sweet and salty from birth, as well as early signs of bitter and sour taste aversion (Cowart, 1981; Eaton et al, 2012). Saliba, Wragg, and Richardson (2009) hypothesized and supported the possibility of taste preference as a function of personality using personality measures and preference for sweet white wines. Wine preference was assessed by giving the participants samples of sweet and dry wines while withholding which personality traits they sought to link to the sweet preference. The groups were separated based on preference and those in the sweet preference groups ranked wines based on sampling them. This preference for sweet white wine had significant correlations with higher impulsivity and lower openness to experience, assessed with the IVE Personality Questionnaire (Adult Impulsiveness, Venturesomeness, and Empathy

Scale) which includes questions like “Do you often buy things on impulse?” as well as the Big Five Inventory (which looks at conscientiousness, agreeableness, neuroticism, openness to new experience, and extraversion), respectively, which included statements like “I’m curious about many different things” that were scored on a five-point Likert scale from “disagree strongly” to “agree strongly.”

Elfhag and Erlanson-Albertsson (2006) utilized the Three Factor Eating Questionnaire for assessing psychological constructs of eating behavior and the Swedish Universities Scales of Personality to assess for personality traits in a population of obese individuals, including 44 women and 16 men. The Three Factor questionnaire, with 51 items, contains subscales for cognitive restraint (“I eat anything I want, anytime I want”), disinhibition (“I start dieting in the morning, but because of any number of things that happen during the day, by evening I have given up and eat what I want, promising myself to start dieting again tomorrow”), and hunger (“I am usually so hungry that I eat more than three times a day”). Each item was scored either as a 0 or a 1 (no or yes). The Swedish Universities Scales, consisting of 91 items, contains 13 different scales that ultimately cluster into three trait factors: neuroticism, aggression, and extraversion. The items were scored on a 4-point Likert scale. They found evidence of a link between strong sweet taste preference and neurotic personality traits, specifically a lack of assertiveness and embitterment. Strong fat taste preference, however, was linked with lower levels of cognitive restraint, specifically in how it relates to eating behaviours.

Sweet taste preferences were assessed in a structured interview where the researchers inquired about how important and preferred certain common sugary items were to each participant (such as ice cream, pastries, cookies, chocolate, soft drinks, etc). Participant answers

were ultimately placed into “strong sweet preference” and “no sweet preference.” Analogous to the measure for a sweet preference, fat preference was assessed in a structured interview with inquiries about importance and preference of fried foods, butter, cream, cheese, and processed meats like sausage; as with sweet preferences, answers were ultimately sorted into “strong fat preference” and “no fat preference.” Ashton and Pilkington (2014) were unable to find significant correlations between this same sweet taste preference and prosocial personality traits from the HEXACO factors (which looks at six primary factors of personality- honesty/humility, emotionality, agreeableness, extraversion, conscientiousness, and openness to new experience, the first three of which are considered the “prosocial” traits) in a sample of 300 people; essentially, those who preferred sweet tastes were not likely to have a “sweeter” personality. This suggested that, while the correlations are a possibility, the literature is not yet robust enough to support them consistently.

Elfhag and Erlanson-Albertsson’s study suggests a psychobiological stress model that is emulated through the work of Dess and Edelheit (1998), who found that exposure to stress increased the sensitivity of undergraduate students to the bitterness in saccharin. Eskine and colleagues (2011) looked closer at the effect of taste on perceived morality and found that bitter taste had a significant positive correlation with greater disgust later when rating moral transgressions. Participants made these moral judgments using Wheatley and Haidt’s (2005) six moral transgression vignettes, which included items like consensual incest between cousins, a congressman taking bribes, and shoplifting. Participants were either given fruit punch, water, or bitters and were then provided with the six vignettes which they rated by marking how “wrong” they were on a 14-cm line that constituted a spectrum from “not at all morally wrong” to

“extremely morally wrong.” These marks were then converted to scores ranging from 1 to 100, with increasing scores indicating increased opposition to the presented vignette. Participants were later asked to rate how sweet, neutral, or bitter their respective beverages were on 7-point Likert scales ranging from “not at all” to “very much.” While an overall well-supported explanation for the link between taste and personality has not been achieved for most of the primary tastes, promising theses have been proposed concerning the link between bitter taste preference and the more malevolent personality traits.

A generous portion of taste literature examines the relationship between the “supertaster gene” (TAS2R38) and a myriad of personality traits (Reed et al, 2006). The gene is most commonly tested for by making participants chew on PTC paper (phenylthiocarbamide) or PROP (propylthiouracil) strips to see if they perceive a strong bitterness. Those who possess the gene score higher when measuring their sensitivity to PTC and PROP and have increased sensitivity to bitterness in food, evidenced by stronger aversion to bitter foods (such as coffee and broccoli among many) (Duffy & Bartoshuk, 2000; Robino et al, 2016). As early as 1968, Very and Iacono began to piece together significant correlations between what would later be classified as “supertasters” by Bartoshuk and the MMPI subscale for hypomania (the most current version of this subscale looks primarily at impulsivity, irritability, and other qualities related to narcissism).

The primary inspiration for my research came from Sagioglou and Greitemeyer (2016) whose work suggested a link between bitter taste preference and malevolent personality traits, specifically “everyday sadism” and psychopathy. Given the relative novelty of this type of study in the last decade (the linking of taste and personality), the topic was certainly of interest for

further exploration. “Everyday sadism,” defined as those who enjoy inflicting at least moderate pain on others in everyday settings, was assessed with statements like “When making fun of someone, it is especially amusing if they realize what I’m doing” (verbal sadism), “I enjoy tormenting people” (physical sadism) or “I sometimes replay my favorite scenes from gory slasher films” (vicarious everyday sadism), which were scored from 1 to 5 on a Likert scale from “disagree strongly” to “agree strongly” (Buckels et al, 2013). Psychopathy—which describes those whose personalities are dominated by antisocial traits (pervasive and persistent disregard for morals, social norms, and the rights and feelings of others), lack remorse and guilt, and tend to exhibit high levels of impulsivity—was assessed with statements such as “I tend to be callous or insensitive” which were scored from 1 to 9 on a Likert scale from “disagree strongly” to “agree strongly” (Andrade, 2008).

Psychopathy is one of three components of the “Dark Triad,” which also includes Machiavellianism (individuals marked by cynicism, successful deception, impersonality, and manipulation in social situations) and narcissism (marked by an inflated, grandiose self-concept and a lack of intimacy in interpersonal relationships) (Geng et al, 2014; Campbell et al, 2007). These additional two components were assessed with statements like “I tend to manipulate other to get my way” and “I tend to want others to pay attention to me” respectively, each scored from 1 to 9 on a Likert scale from “disagree strongly” to “agree strongly.” In addition to the “Dark Triad” personality measure, the researchers also included the 12-item Buss-Perry Aggression Questionnaire, which assesses the four dimensions of aggression (verbal aggression, physical aggression, anger, and hostility). Items in the measure include statements like “I have threatened people I know” and “Given enough provocation, I may hit another person”; these items were

scored on 5-point Likert scales ranging from “very unlike me” to “very like me.” The lack of extensive research of this kind in the last decade (the linking of taste and personality) makes topic was certainly of interest for further exploration.

The measure in the original study that measured the “Dark Triad” contained only 12 items to examine three separate personality traits; a trait like narcissism cannot be accurately assessed with four items. In assessing only six major personality domains and the additional trait of psychopathy, the personality survey portion was kept to a reasonable 140 items total. In measuring taste preferences, Sagioglou and Greitemeyer assessed participant preference of the salty, sweet, sour, and bitter taste categories (spicy taste was excluded from this study) by providing 10 various food items for each of the taste categories for a total of 40 items, which were presented in a randomized order. Sweet preference was represented with items like candy and chocolate cake, sour with items like lemons and vinegar, salty with items like beef jerky or bacon, and bitter with items like coffee or radishes. These were presented in a randomized order and scored on a 6-item Likert scale from “dislike strongly” to “like strongly.” Participant responses were tallied and averaged for each category to create food-specific measures of taste preference. Using the same 6-point scale, participants then indicated how much they generally like sweet, sour, salty, and bitter foods, respectively. These four items constituted the general measure of taste preference.

While the original study encapsulated a larger population (n=953) and examined more variables, the method of determining taste preference and perception through questions concerning common food items was wanting in objectivity and prompted us to include a laboratory component with eight different solutions (two concentrations of each of the four taste

categories) and three iterations of each that serve as objective benchmarks. Even with the inclusion of each participant's general measure of taste preference, participants would not have all considered the bitterness of items like coffee or the sweetness of chocolate cake in the same way. My original research project utilizes more quantitative means of measuring participants' intensity and hedonic responses to each sample (Bartoshuk, 2004), which are measured to the closest millimeter and recorded as such instead of arbitrary adjectives that hold less meaning (Lim et al, 2009; Green et al, 1993).

“Everyday sadism” (which constitutes the fourth part of the “Dark Tetrad” when combined with the “Dark Triad”) and psychopathy were significantly correlated with bitter taste preference, but the only measure used in addition to HEXACO-PI-R (used to assess for the above-mentioned six major domains of personality) in this study is psychopathy, assessed with the IPIP-NEO scale (Witt et al, 2009). IPIP-NEO examines “fearless dominance” and “impulsive antisociality” as the two primary factors of psychopathy, each with 20 items; the former factor is assessed with statements like “I take charge” and “I feel comfortable around people” whereas the latter involves items like “I make rash decisions” and “I insult people.” These statements were then scored on a 5-point Likert scale ranging from “strongly disagree” to “strongly agree.” The purpose of our research was to determine if any of the correlations from Sagioglou and Greitemeyer's original study would hold up when tested with a more rigorously objective method component.

Method

Participants

Participants in the study ($n=40$, females = 72.5%, mean age = 19.40) were undergraduate students at a private liberal arts college in Florida. Most students were in courses that incorporated the laboratory portion of this study as a mandatory in-class project for a grade. Students who were also psychology majors were offered a research participation point, five of which are required for first year psychology students, as compensation for their completion of the survey portion.

Materials

Each participant was given a packet with an informed consent form explaining the general objectives of the study, 24 sets of scales (each sample matched with both a hedonic scale and an intensity scale) required for the initial tasting component as well as an additional intensity scale for the PTC testing. The packet also included a diagram of which portion of the tongue to isolate when staining took place to determine the number of fungiform papillae.

The tasting portion was done with clear 3.5 oz. polypropylene plastic cups (24 per student). Each cup was filled with 10mL of solution (3 iterations of each of the 8 solutions). The solutions were as follows: sucrose (0.15 M and 0.6 M), sodium chloride (0.15 M and 0.6 M), quinine (0.002 M and 0.0005 M), and citric acid (0.06 M and 0.015 M). The solutions were created with deionized water and dry chemical solvent from Sigma-Aldrich in St. Louis. In addition to the sample cups, participants were also provided with a 16 oz. Solo cup filled with distilled drinking water, an additional cup of the same size for spitting into when done swishing with water, and a PTC strip for the second step of the lab portion. The tongue staining portion required an additional 3.5 oz. cups with three drops of McCormick blue food coloring as well as

a Q-Tip cotton swab. The window with which to isolate the tongue was created from off-white cardstock one inch in length on which a 0.25-inch hole punch was used to create the window.

Measures

The secondary portion of the lab consisted of a survey, comprised of the HEXACO (which looked at six major personality domains) and the IPIP-NEO psychopathy scales (which looked at the trait through the factors of fearless dominance and impulsive antisociality). HEXACO, a 100-item scale, utilizes a 5-point Likert scale from “strongly disagree” to “strongly agree.” Questions included in this personality inventory were items like “I clean my office or home quite frequently” and “I feel reasonably satisfied with myself overall.” This revised version of the personality inventory was chosen for its low intercorrelations and because it was free.

The IPIP-NEO psychopathy scales, comprised of 40 total items (20 each for “fearless dominance” and “impulsive antisociality”) were developed by Witt, Donnellan, and Blonigen (2009) from three other scales: IPIP-NEO (the original 300-item self-report personality inventory intended to examine the Big Five for personality factors), the Revised NEO Personality Inventory (NEO-PI-R, a 240-item self-report inventory, also designed to primarily examine the Big Five), and the Psychopathic Personality Inventory-Revised (a 160-item self-report inventory comprised of two factors, “fearless dominance” and “self-centered impulsivity”). The resulting 40-item IPIP-NEO psychopathy inventory held up in terms of both reliability and consistency in initial studies conducted by Witt and colleagues and was the most economical option as it was also free to use.

Design and Procedure

The first portion of the study was a laboratory component with three sections. Participants initially tasted the 24 samples and rated each on both a hedonic scale and an intensity scale. The mark they placed on the line was later measured to the nearest millimeter. Solutions were swished in the mouth, not swallowed, for several seconds and then spit back into cups. They were then instructed to wait one minute between each sample at which time they could also swish with plain drinking water.

For the PTC screening portion of the lab, participants chewed on (but did not swallow) a PTC strip for 10 seconds and then marked their response on the separate intensity scale. The final step, that of staining the tongue, required students to use the cotton swab to dip into the food coloring and paint the front half of their tongue. They then took the guide with the hole punched out and placed the opening over the region indicated by the diagram on their worksheets (the front of the tongue between the center line and front left edge with the intention of isolating a spot dense with fungiform papillae). Upon concluding the lab portion of the study, students were informed as to what they had tasted in class and were then asked not to share this information with other potential participants.

Students had the option to follow up the laboratory portion by participating in a survey emailed to them. Their willingness to participate in this portion was indicated on the consent form for the laboratory portion. For one course students were encouraged to participate in this portion while in class; in all other instances, participants were able to do this on their own time in the environment of their choosing. Several students were sent follow-up emails to encourage them to participate. Data was initially stored and sorted in Microsoft Excel. SPSS was used to calculate correlations and create scatter plots.

Results

Of the 44 participants who completed the laboratory portion and were eligible to do the next phase, 40 participants additionally did the survey and were included in the final round of data analytics. Bivariate correlations for all personality and taste factors are shown in Table 1. There was a significant positive correlation ($p < .01$) (Figure 1) between psychopathy as a total variable and extraversion as well as a significant negative correlation ($p < .01$) (Figure 2) between psychopathy and honesty-humility. A significant negative correlation ($p < .01$) (Figure 3) also existed between the “impulsive antisociality” factor of psychopathy and conscientiousness. In addition, a significant negative correlation ($p < .05$) occurred between the “fearless dominance” factor of psychopathy and emotionality. PTC values significantly correlated ($p < .05$) with openness.

In terms of taste and personality correlates, a significant negative correlation ($p < .05$) existed between the factor of “fearless dominance” and perceived intensity of citric acid, as well as between extraversion and the perceived intensity of sucrose, and also between agreeableness and perceived quinine intensity. A significant positive correlation ($p < .05$) occurred between emotionality and likeability (hedonic measurement) of sucrose. An independent samples t-test found a statistically significant difference ($p < .0005$) between the taster and non-taster populations with a cutoff of 10 (out of 100) on the intensity scale provided when looking specifically at openness to new experience. There was a significant negative correlation ($p < .01$) between tasters and the trait of openness, as shown in Table 2.

Cronbach’s alphas for each of the scales showed high internal consistency across the board. The psychopathy scales, “fearless dominance” and “impulsive antisociality,” had alphas

of 0.859 and 0.901, respectively. The breakdown for the subscales within HEXACO were as follows: honesty humility, 0.767; emotionality, 0.808; extraversion, 0.800; agreeableness, 0.766; conscientiousness, 0.834; and openness to experience, 0.813.

Discussion

Support for the link between bitter taste preference and psychopathy from the original 2016 study was not achieved in this research. In fact, the anticipated results for sodium chloride and sucrose did not pan out; while they were the more positively rated solutions in the group, the expected consistency of those results did not occur (according to previous taste literature, sucrose and sodium chloride should be rated favorably across participant groups consistently). Despite the improvements to overall objectivity by establishing non-naturalistic means of comparing tastes, our sample population (n=40) was unlikely to yield results with high internal validity given the size of the original study (n=953). In addition to the disadvantage faced with a much smaller participant population, the laboratory portion of the experiment itself also left great room for improvement.

One of the most frequent complaints while administering the experiment was that the potent taste of both quinine and citric acid stayed in the mouth even after swishing with water and the mandatory one-minute waiting period. Some participants, even though instructed to carefully observe the waiting period, did not obey the instructions and tasted the next sample before a full minute had passed. Participants were also instructed to vary the order in which they chose their samples. Each set of eight samples was repeated three times and participants were able to randomize within a row of eight as they wanted. Close to a third, however, went ordinarily, rating samples from left to right in the exact order in which they were presented. The

fungiform papillae count was not included in the final results because we were unable to establish a uniform method for participants to place the window on their stained tongues so as to capture the same region for each person; the inconsistency among the sample was too great.

This experiment was conducted multiple times with several different classes. The worksheet packets that the participants used during the experiment changed twice in the early iterations of the experiment because I was unable to make the scales exactly 100mm the first two times. While this did not ultimately affect the data, the change required more direct handling of the data to turn into a more standard format and therefore presented more chance for errors to be made. The three iterations of each of the eight samples were averaged following the conclusion of data collection, and the high and low concentrations were later averaged together in order to be more economical because of the lack of statistically significant difference between the high and low concentrations of each.

As stated above, links were indeed supported between personality and taste preference within this study, but they were neither the personality traits nor the taste preferences originally hypothesized. Extraversion had a significant negative correlation with psychopathy in the original study, unlike our findings which boasted a significant positive correlation. Links between hedonic sucrose ratings and emotionality, sucrose intensity ratings and extraversion, hedonic citric acids ratings and agreeableness, and quinine intensity and agreeableness, could suggest links between taste groups and personality traits not previously explored in psychological literature that provide greater material for future studies on taste perception and preference and their correlations with personality traits. The significance of the results concerning taste and personality that did manifest justify further pursuit of this field of research

as they continue to suggest a link between personality and genetics related to the gustatory system.

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Table 1

Bivariate correlations between all personality and taste factors

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1. Psy - Fearless Dominance	–																		
2. Psy - Impulsive Antisociality	0.18	–																	
3. Quinine - Hedonic	0.20	-0.06	–																
4. Quinine - Intensity	-0.22	0.22	-.825**	–															
5. Citric Acid - Hedonic	0.21	0.17	-0.06	0.18	–														
6. Citric Acid - Intensity	-.312*	0.02	-.491**	.596**	-0.25	–													
7. Sodium Chloride - Hedonic	-0.06	0.19	0.08	-0.02	.490**	-0.26	–												
8. Sodium Chloride - Intensity	-0.19	0.18	-.487**	.632**	-0.06	.725**	-0.22	–											
9. Sucrose - Hedonic	-0.28	0.03	-0.23	0.26	0.14	0.02	-0.09	-0.08	–										
10. Sucrose - Intensity	-0.30	0.30	-.526**	.631**	0.08	.484**	0.17	.592**	0.10	–									
11. Honesty-Humility	-.322*	-.489**	0.28	-0.30	-0.23	0.03	-0.14	-0.16	0.04	-0.14	–								
12. Emotionality	-.340*	-0.12	-0.22	0.30	-0.05	0.31	-0.15	0.25	.315*	0.11	-0.11	–							
13. Extraversion	.771**	0.17	0.21	-0.17	0.05	-0.17	-0.10	-0.23	-0.17	-.358*	-0.25	-0.03	–						
14. Agreeableness	-0.09	-0.18	0.14	-.337*	-.323*	-0.06	0.28	-0.19	-0.17	0.00	0.27	-.342*	-0.08	–					
15. Conscientiousness	0.17	-.593**	0.03	-0.10	0.03	-0.12	-0.17	-0.19	0.06	-0.28	0.21	0.22	0.18	-0.05	–				
16. Openness	0.01	-0.22	0.04	-0.08	-0.21	0.30	-0.23	-0.11	-0.06	-0.10	0.31	0.13	0.21	0.22	0.18	–			
17. PTC	-0.04	0.07	-0.08	0.08	0.09	-0.13	-0.11	0.11	0.05	0.17	-0.08	-0.15	-0.28	-0.22	-0.04	-.340*	–		
18. Psychopathy Total	.751**	.783**	0.08	0.01	0.25	-0.19	0.09	0.00	-0.16	0.01	-.532**	-0.30	.603**	-0.18	-0.29	-0.15	0.02	–	

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 2

Bivariate correlations between all personality factors and the taster/nontaster group

Variable	1	2	3	4	5	6	7	8
1. Honesty-Humility	—							
2. Emotionality	-0.109	—						
3. Extraversion	-0.253	-0.029	—					
4. Agreeableness	0.269	-.342*	-0.076	—				
5. Conscientiousness	0.207	0.223	0.182	-0.055	—			
6. Openness	0.311	0.129	0.213	0.219	0.178	—		
7. PsychopathyTotal	-.532**	-0.296	.603**	-0.178	-0.292	-0.145	—	
8. Taster/Nontaster	-0.188	-0.048	-0.214	-0.286	-0.099	-.435**	0.144	—

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

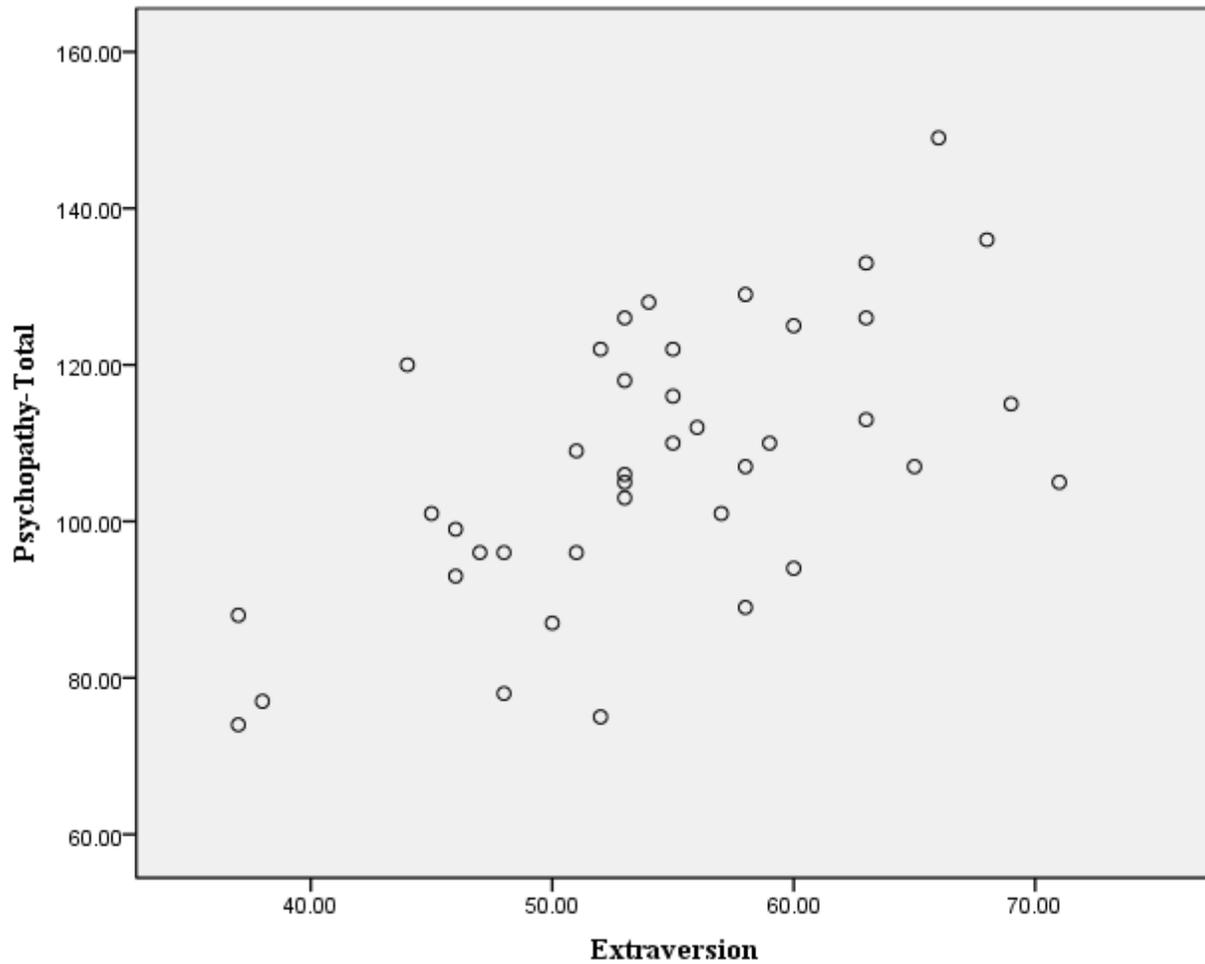


Figure 1. Significant positive correlations ($p < .01$) found between psychopathy as a total variable (the sum of the “fearless dominance” and “impulsive antisociality” factors) and the HEXACO variable of extraversion. A significant positive correlation ($p < .01$) was also revealed between “fearless dominance” and extraversion, but not between “impulsive antisociality.”

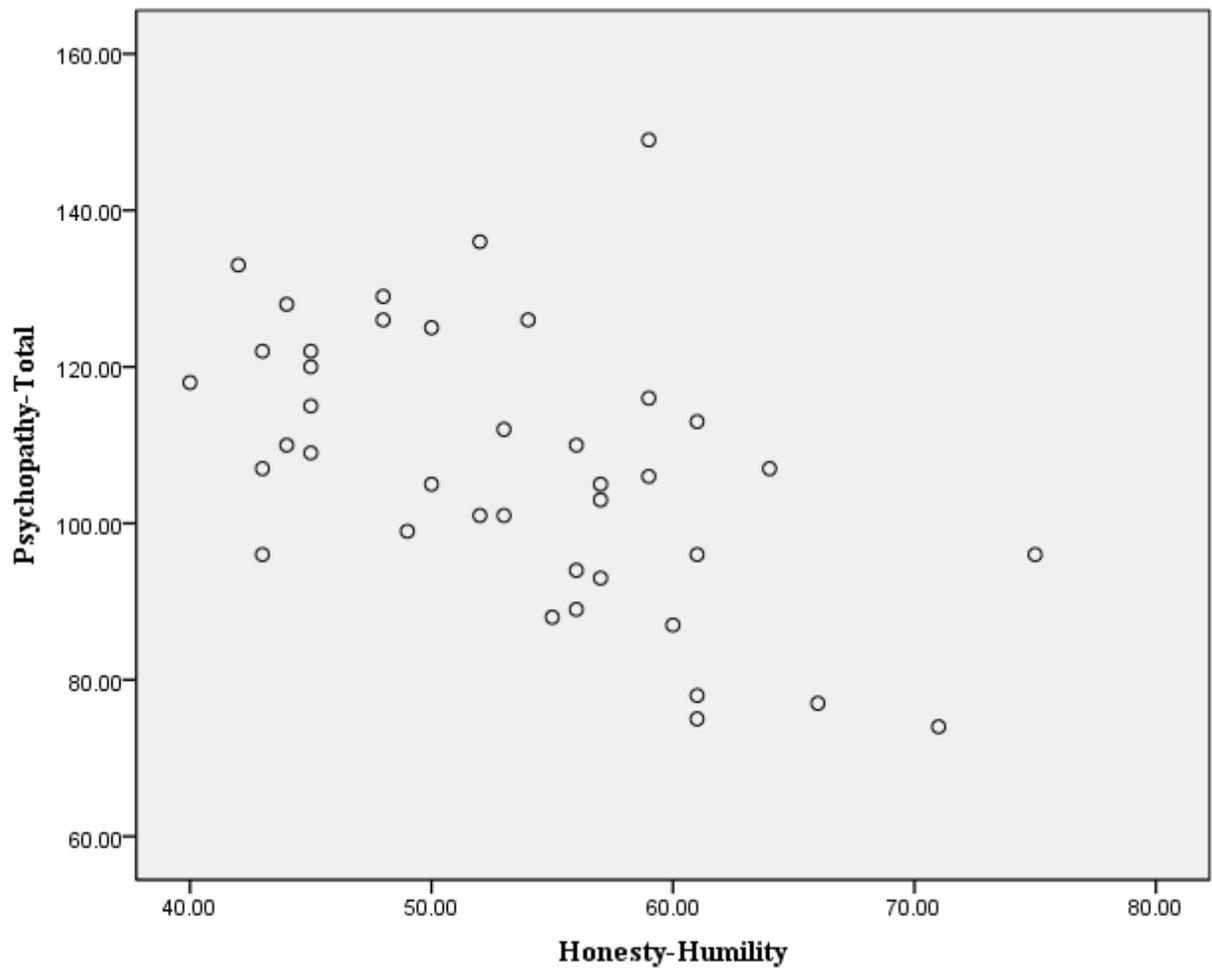


Figure 2. Significant negative correlations ($p < .01$) found between psychopathy as a total variable (the sum of the “fearless dominance” and “impulsive antisociality” factors) and the HEXACO variable of honesty-humility.

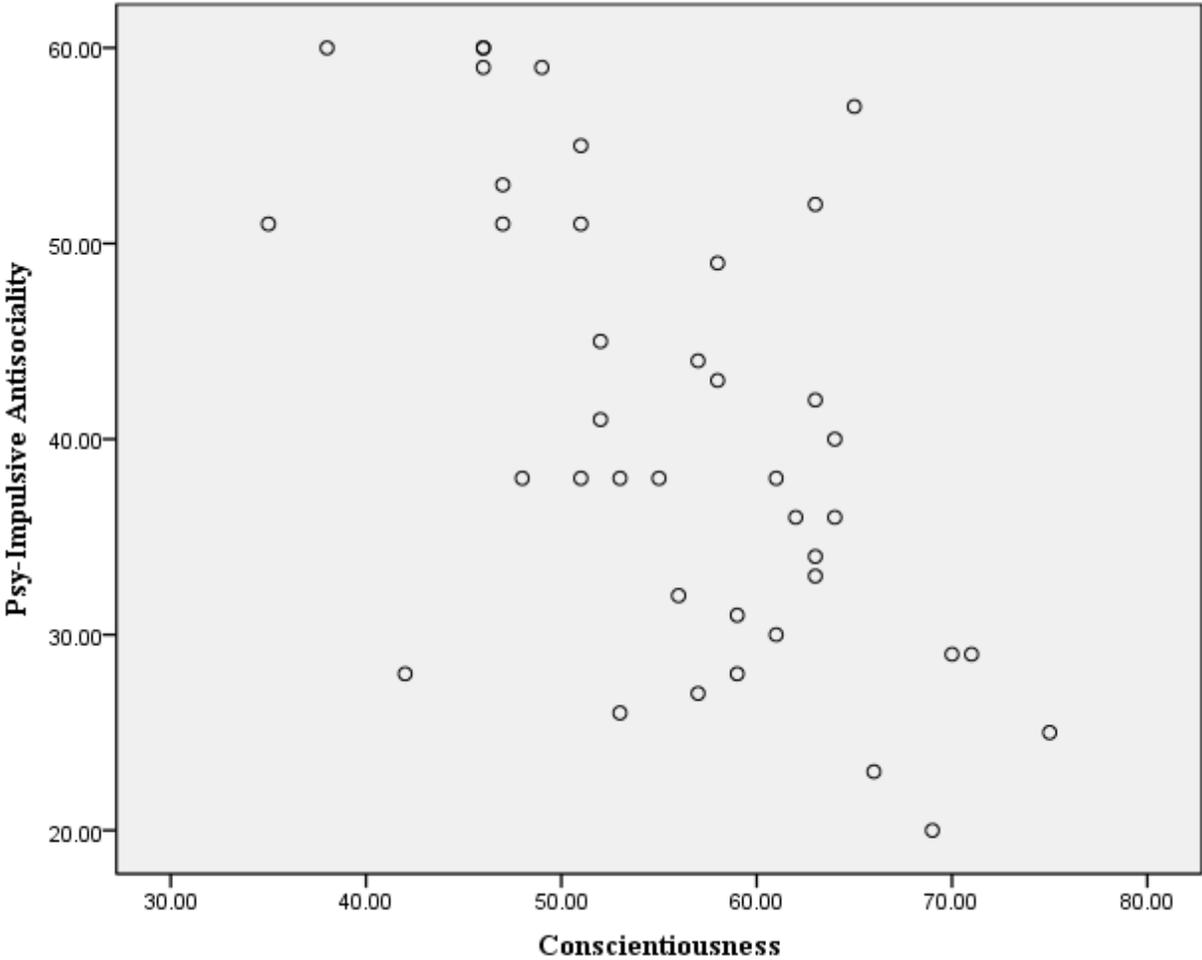


Figure 3. Significant negative correlations ($p < .01$) found between the “impulsive antisociality” factor of the psychopathy scale and the HEXACO variable of conscientiousness.

Appendix

Sample set of scales used to mark intensity (left) and hedonic (right) scores

SOLUTION NUMBER:

DO NOT MARK IN THIS SPACE

Intensity:

Hedonic:

strongest imaginable

most liked sensation imaginable

Neutral

barely detectable

most disliked sensation imaginable