DOES INDIVIDUAL PERSONALITY TYPE INFLUENCE DIETARY TASTE PREFERENCE AMONG SOUTH DAKOTA STATE UNIVERSITY (SDSU) STUDENTS?

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ABSTRACT

People who exhibit prosocial (i.e., extraverted) behavior are often characterized as being “sweet,” while those exhibiting more introverted behaviors are sometimes labeled as “bitter,” “sour,” etc. Such social personifications, apart from their value as practical communication, may actually intimate complex personality traits. Positive correlations between hedonic response to taste sensation and personality type have been reported in the published literature and have been advanced as potentially predictive indicators of dietary habits and even diet-related disease susceptibility (e.g. obesity, diabetes, heart disease, cancers, etc.). Such reports inspired us to hypothesize that individual hedonic response to sweet tastes would predict prosociality within a South Dakota State University (SDSU) student demographic. To explore this hypothesis, we modified standardized personality type and taste preference survey instruments and systematically administered them to students randomly selected from two distinct SDSU student sub-populations ($N = 31$). Surveys were modified to score only personality type (i.e., introvert vs. extravert) and taste preference (i.e., salty vs. sweetness). In contrast to some previously published studies, we detected no statistically significant positive correlation between personality type and taste preference response scores (one-tailed Pearson product-moment correlation analysis ($\alpha = 0.025$; $r = 0.203$; $P = 0.274$). Because our study suffered from reduced statistical power (relative to previously published studies) and because subjects reported some confusion in understanding personality type survey instructions (in post-study interviews), we conclude that these two factors likely contributed experimental artifact sufficient to account for our contradictory results.

Keywords
taste preference, personality type, correlation
INTRODUCTION

Human taste preference arises from hedonic (i.e., pleasurable) response to gustation (i.e., food tasting) and mounting evidence suggests that prosocial (i.e., extraverted) individuals may actually possess an innate preference for sweet foods (Mattes 1994, 1997; Meier et al. 2012; Stone and Pangborn 1990; Summar et al. 2009). Indeed, food taste sensations themselves may also influence behavior. For example, Meier et al. (2012) reported that tasting sweet foods resulted in induced prosocial behavior in human subjects, while Eskine (2013) reported a diminution of prosocial behavior in subjects exposed to organically prepared foods. In the latter study, subjects were also significantly more likely to render harsher judgments in response to perceived moral transgressions. Similarly, Eskine et al. (2011) found that subjects exposed to “disgusting” taste sensations were also significantly more likely to render harsher moral judgments. Eskine et al. (2012) also reported that subjects asked to read about moral transgression and moral virtue reported gustatory disgust and delight, respectively. These studies intimate a compelling interdependency between taste sensation and human behavior.

Such findings, apart from their pure intrigue, also appear to provide some insight into the common usage of embodied metaphors (e.g., “sweet,” “bitter”) used by humans to describe other human personalities and behaviors. For example, the term “sweet” is often used to describe pleasant, selfless and affectionate personalities and behaviors, while the terms “sour” and “bitter” are used to describe unpleasant, distasteful and selfish behaviors (Meier et al. 2012; Stone and Pangborn 1990). Though underlying causation remains speculative, one possibility is that prosocial individuals, because they are more outgoing and thus generally more engaged in energetic life activities and emotions, may simply have evolved metabolic requirements for increased carbohydrate intake to sustain elevated mental and physical engagement. Some evidence in support of this was reported in a recent study of rats bred for dietary selectivity (Eaton et al. 2012). There, rats ingesting low levels of saccharin were significantly more subordinate to rats ingesting higher amounts of the chemical. These findings, in addition to corroborating human studies noted above, suggest that taste preference-personality trait relationships are not unique to humans. Regardless, such taste preferences, whether arising from environmental, socialization, or even genetic processes (Tepper 2008), are increasingly hypothesized to be potentially useful indicators of human personality type (Meier et al. 2012; Stone and Pangborn 1990; Summar et al. 2009). A number of studies have thus attempted to correlate taste preference and personality type metrics in an effort to establish their utility for predicting dietary habits and even disease susceptibility (e.g., diabetes, obesity, seasonal affective disorder, alcoholism, opiate addition, anorexia, bulimia) (Drewnowski 1995; Arbisi et al. 1996; Sandstrom et al. 2003; Summar et al. 2009; Meier et al. 2012).

Taste preference has been historically defined as the quantitative (or rated) likeliness that an individual will prefer the taste of a particular food substance to another. Substance taste characteristics are now standardized in the Dietary Frequency Questionnaire (DFQ) established by the National Health and Nutrition
Examination Study (NHANES; National Cancer Institute; NHANES, 1991). Standardized taste preference metrics (especially those based upon sweetness gustation) have been utilized in previous taste preference-personality type studies and appear to be gaining momentum as predictive or at the very least semi-predictive parameters. For example, significant positive correlations have been reported between sweet taste preference and the following conditions: neuroticism (Elfhag and Erlanson-Albertsson 2006; Kikuchi and Watanabe 2000; Saliba et al. 2009), obesity (Elfhag and Erlanson-Albertsson 2006), induced stress (Grunberg and Straub 1992; Summar et al. 2009), impulsiveness, openness and agreeableness (Saliba et al. 2009; Meier et al. 2012), helping behavior (Meier et al. 2012) and, as earlier noted, dominance behavior in rats (Eaton 2012).

Because college students are generally regarded as having “unusual” dietary habits, much of what is known about taste preference-personality type relationships has been derived from studies of this unique social demographic (Stone and Pangborn 1990; Kikuchi and Watanabe 2000; Meier et al. 2012). Of these, the classic study by Stone and Pangborn (1990) is considered one of the seminal investigations of the utility of taste preference and personality type correlations in identifying prosociality. In their study, a university student population ($N = 100$) was examined in an effort to correlate personality type and taste preference for salty and sweet food items. They reported that individuals who scored high in prosocial (extraverted) behavior also reported consistent hedonic response to sweet tastes. They used five standardized personality assessment instruments to score personality type and participant dietary history, and habits were assessed using the NHANES DFQ. There, hedonic response to the taste of a sodium-enriched beef broth and a sugar-enriched lemonade solution was scored using a Likert-type scale of like or dislike (i.e., 1 = extreme dislike and 5 = extreme like).

Inspired principally by the Stone and Pangborn (1990) study, as part of a highly focused undergraduate capstone research project, we sought to emulate their study by using a substantially more tailored experimental design approach for evaluating the “directional” relationship between taste preference (i.e. salty $\rightarrow$ sweet) and personality type (i.e. introvert $\rightarrow$ extravert) within two South Dakota State University (SDSU) student sub-populations. We hypothesized that prosocial (extraverted) individuals would have a significantly higher taste preference for sweetness than for saltiness.

METHODS

Nine male and 22 female SDSU students were selected from two distinct student sub-populations at SDSU. Subjects were drawn from the SDSU Introductory Psychology and ROTC course sections via single in-class announcements (by course instructors) requesting volunteers for participation in a controlled psychological study. In the announcements, students were instructed to indicate their commitment to study participation by sending an email via the SDSU course management system to a predetermined email address established specifically for participant identification and registration. Upon receipt of all emails from interested students, all student names were entered into Microsoft (MS)
Excel© (Redmond, WA) and numerically coded. Students were then sent a reply email in which they were provided assigned experimental code numbers, as well as the date, time and location of the experiment. Students were further instructed to arrive at the testing facility with their experimental code numbers. Participant code numbers were then randomized using the RAND function in MS Excel©. Upon their arrival at the SDSU Psychology Department computer lab (at which both surveys were administered), students were instructed to sit at randomly numbered computer terminals according to their assigned experimental code numbers. Participating students were provided extra credit points (as agreed upon by their course instructors) in return for their participation.

Participants ranged in age from 18-25 years of age (with 87.1% of subjects in the range 18-21 years of age and 12.9% in the range 22-25 years of age). Consistent with the Stone and Panghorn (1990) study, a combination self-reporting survey and taste-testing survey approach was used to assess subject personality type and taste preference for sweet and salty tastes. Personality type was assessed using a modified version of the standardized Big Five Inventory (BFI) (John et al. 1991; John et al. 2008) that presented participants only those questions relevant to evaluating prosocial personality type. The BFI is a standardized 44-item psychometrically comprehensive survey instrument designed to quantify an extensive suite of personality characteristics, including extraversion, agreeableness, conscientiousness, emotional stability and openness based upon a Likert response scale (i.e., 1 (strongly disagree) to 5 (strongly agree)) (John et al. 1991; John and Srivastava 1999; John et al. 2008). The BFI is considered to be a psychometrically superior self-reporting instrument and is widely used (and cited) within diverse experimental and clinical settings (John et al. 1991; John and Srivastava 1999; John et al. 2008). However, as our study was confined to a relatively simpler assessment of prosocial personality type, we excerpted and used only those BFI questions relevant to this aim. Such modifications of standardized instruments in pursuit of increased accuracy in quantifying specific behavioral characteristics (especially where assessment time and resource constraints prevail) have been previously reported and are gaining wide acceptance in regards to equivalent rigor, reliability and validity, etc. (Stone and Pangborn 1990; Gosling et al. 2003 and references therein; Rammstedt and John 2007 and references therein; Donnellan and Lucas 2008). Indeed, considerable debate has emerged within the self-reporting personality assessment literature regarding the relative efficacy of longer (so-called “psychometrically superior”) instruments, with increasing numbers of published studies reporting comparable and even superior results using more tailored (so-called “psychometrically inferior”) instruments (Gosling et al. 2003 and references therein).

BFI extraversion personality scores are scaled from 8 to 40, with lower scores indicating introversion and higher scores indicating greater extraversion (John et al. 1991; John and Srivastava 1999; Rammstedt and John 2007; John et al. 2008). Self-response questions were also extracted from the NHANES DFQ in order to quantify subject’s daily intake of sweet foods. The NHANES instrument is a 139-item psychometrically comprehensive questionnaire designed to quantify individual taste preference and daily dietary intakes, with a portion of the questionnaire focused on evaluating preference for the major taste sensations
(i.e., salty, sweet, sour, bitter and umami) (NHANES 1991). Consistent with previous investigations (e.g. Stone and Pangborn 1990; Rammstedt and John 2007 and references therein), in modifying these standardized assessment instruments, we sought to confine our investigation to the relationship between sweet taste preference and prosocial behavior within these SDSU sub-populations. Prior to commencement of the study, subjects were verbally instructed that they were participating in a randomized controlled study designed to assess taste preference and personality type and how to properly respond to survey questions. Subjects were then asked to provide signed consent before participating.

Subjects were assembled in a designated computer lab within the SDSU Psychology Department and presented with a spectrum of prosocial personality and behavior characteristics via individual online portals and were asked to self-report on the extent to which those characteristics accurately described (or failed to describe) their personalities. Subjects were instructed to rank their responses using a Likert-type scale (e.g., 1 (strongly disagree) to 5 (strongly agree)). Upon completion of the online personality assessment, subjects were then provided samples of salt and sugar (50 mg each) and were instructed to taste each one (in no specified order) and then indicate their perceived level of taste pleasurability in response to each sample using a 7-point Likert scale (i.e., 1 (highly enjoyed the salt) to 7 (highly enjoyed the sugar)). Summary statistics were computed for raw response scores and normality of the sample distributions was assessed using the Kolmogorov-Smirnov normality test ($\alpha = 0.05$). Response score relationships were evaluated using a one-tailed Pearson product-moment correlation analysis ($\alpha = 0.025$). Statistical analysis was performed using StatPlus:Mac© software (AnalystSoft Inc., Vancouver, BC). One-tailed analysis was used as our study was focused on determining a “directional” effect in illuminating the extent to which extravert (as opposed to introvert) behavior might (or might not) be a reliable predictor of sweet (as opposed to salty) taste preference (see Ruxton and Neuhäuser 2010 for a critical review of one-tailed statistical testing).

RESULTS

Though a general positive trend was observed between self-reported personality type scaling (i.e. introvert $\rightarrow$ extravert) and taste preference scaling (i.e. salty $\rightarrow$ sweet) survey response scores, Pearson product-moment correlation analysis ($\alpha = 0.025$, one-tailed) revealed that response scores were not significantly positively correlated ($N = 31$, $r = 0.203$, $p = 0.274$) (Figure 1). The median taste preference response score was 6.00 (median absolute deviation (MAD) = 1.00) and the median personality type response score was 25.0 (MAD = 4.00). Both response score data sets were normally distributed (Kolmogorov-Smirnov testing; $p > 0.05$), although it is interesting to note that the taste preference response sample distribution was considerably more skewed relative to the personality type response sample distribution (skewness = -0.5004 and -0.004480 for taste response and personality type response scores, respectively) (Figures 2 and 3). As the taste preference response scores of 1 and 7 appeared extreme relative to the median value (6.00), modified Z-scores were computed for these data using
Figure 1. Results of one-tailed Pearson product-moment correlation analysis ($\alpha = 0.25$) of taste preference and personality type survey response scores ($N = 31$). Statistical and fitted regression line parameters are presented in the upper right box insert. Data points suspected of being statistical outliers are identified in the red ellipses.

$r = 0.203; \rho = 0.247 \quad y = 0.0885x + 2.52$

Figure 2. Response frequency histogram for the taste preference survey response scores ($N = 31$). The dashed line represents the fitted normal probability distribution curve.
the method of Iglewicz and Hoaglin (1993) to determine whether these data points should be considered statistical outliers. To calculate modified Z-scores, the absolute spread of the data around the sample medians was normalized to the MAD and a derived normalization coefficient (0.6745). Modified Z-scores approaching ±3.5 are considered legitimate statistical outliers (Iglewicz and Hoaglin 1993). Modified Z-scores for the taste preference response score = 1 and 7 data were ±3.38 and ±0.675, respectively. Thus, though the taste preference score response = 1 data were borderline, we did not treat these data points as outliers.

**DISCUSSION**

Diet-related disease (especially obesity) has reached global scale epidemic proportions, with some social demographics (e.g., teens, inner city residents, African Americans and Hispanics) disproportionately afflicted (Centers for Disease Control and Prevention (CDC) 2013; World Health Organization (WHO) 2013). As obesity significantly increases the risks for other pathologies (e.g., diabetes, cardiovascular disease and cancers), obesity research efforts have intensified. Though etiologies remain speculative (and controversial), such alarming trends have highlighted the need for effective (and preferably simple)
cognitive (and other) assessment tools capable of accurately predicting human dietary propensities.

As human dietary habits are manifestations of innate behavior (Stone and Pangborn 1990; Kikuchi and Watanabe 2000), quantitative correlations of personality type (e.g. introvert vs. extravert) and taste preference (e.g. salty vs. sweet) metrics are emerging as promising indicators of human dietary habits. Indeed, such correlations may even possess diagnostic utility in determining disease susceptibility within some social demographics (Arbisi et al. 1996; Elfhag and Erlanson-Albertsson 2006; Saliba et al. 2009; Sandstrom et al. 2003; Stone and Pangborn 1990 and references therein). In what is considered one of the seminal studies of the relationship between taste preference and personality traits, Stone and Pangborn (1990) examined prosocial behavior and hedonic taste response to salty and sweet tasting foods within a population of college students. As noted above, they detected a significant sweet taste preference among individuals identified as extraverts. Their revelations have inspired several follow-up studies of this unique social demographic (e.g. Kikuchi and Watanabe 2000; Meier et al. 2012 and references therein), including our own, designed to assess the applicability of their findings to diverse taste sensations and personality traits and demographics.

As this was an undergraduate capstone research effort, our study was quite constrained by assessment time and resources. As such, we were able to obtain only a relatively limited sampling of these student sub-populations (N = 31). That sample was then subjected to modified (i.e., “directional”) self-reporting personality type and binary taste-testing assessments. Our analysis failed to detect a statistically significant positive relationship between prosocial personality type and sweet taste preference scores (r = 0.203, p = 0.274) (Figure 1). We must therefore reject our hypothesis that individual taste preference is significantly correlated with prosocial personality type within these distinct SDSU student sub-populations. Interestingly, our findings contradict those of several other prominent published studies (e.g. Kikuchi and Watanabe 2000; Stone and Pangborn 1990; Summar et al. 2009; Meier et al. 2012). We were thus initially inclined towards some doubt regarding the broader utility of these metrics to identify personality-dependent dietary habits within this demographic. Given the relatively limited scope (and statistical robustness) of our study, however, our confounding results are more likely attributable to experimental artifact arising largely from small sample size and thus decreased statistical power. Previous studies in which significant positive correlations were detected between taste preference and personality type survey response metrics reported more extensive (and stratified) sampling of college student populations (e.g., Stone and Pangborn 1990, N = 100; Kikuchi and Watanabe 2000, N = 470; Sandstrom et al. 2003, N = 112; Summar et al. 2009, N = 40; Meier et al. 2012, N = 84).

Though statistical robustness is perhaps the most immediately intuitive explanation for our confounding results, we must also consider potentially influential cognitive factors as well. For example, during post-experiment interviews, we found that some subjects reported confusion in understanding how to properly indicate their responses to the modified BFI survey. Their confusion appeared to be related primarily to the differences in response scaling between our modified
BFI personality and taste preference surveys. This is quite interesting, as both surveys provided subjects with similar Likert-type response options. However, the BFI survey response scale ranged from 1 to 5, while the taste preference response scale ranged from 1 to 7. Initially, we attributed this to a relatively inconsequential issue related to differential perception among some subjects in processing and interpreting the disparate response scales. However, as we eventually obtained some consensus corroboration of the perceived problem, we are forced to conclude that this confusion likely exerted non-trivial confounding influence on response data.

Perhaps exacerbating subject confusion, despite subjects receiving a thorough initial verbal indoctrination to study design and objectives and detailed survey completion instructions, for efficiency of administration and data collection (and management), the modified BFI survey was administered via a computer terminal (online portal) that provided subjects with a brief set of additional written instructions for completing the survey in that format. Thus, though these additional written instructions should have reinforced the verbal instructions provided prior to commencing the surveys, the modified BFI survey (or perhaps its completion instructions) appeared to be perceived by subjects as “more complicated” in comparison to the taste preference survey. In contrast, the taste preference survey was explained entirely verbally and subjects appeared to perceive it as relatively “simpler.” Because both verbal and written survey completion instructions were duplicative, we must again conclude that differential cognitive factors likely exerted substantive confounding influence on response scores.

As subjects tended to characterize the surveys as “more complicated” or “simpler,” our results may be further explained in part by satisficing arising from the differential cognitive demands of each of the survey instruction sets (or their mode of delivery). Such satisficing may have caused those subjects who perceived the survey instructions (or their mode of delivery) to be “more complicated” to provide more socially acceptable responses (or responses requiring less introspection effort). Satisficing has been previously invoked to account for a variety of confounding trends in self-reporting assessment data (Lam 2003; Heerwegh et al. 2005). Moreover, because the additional written survey instructions were provided via computer terminal, some subjects may have perceived the computer delivery format as depersonalizing the survey experience, thereby further influencing them towards satisficing responses (Heerwegh et al. 2005). Properly controlling for such cognitive bias in self-reporting assessment studies is difficult but essential for obtaining results that facilitate accurate interpretation. Indeed, the potential for differential cognition to impact self-reporting assessment data is widely regarded as a perennial challenge for the behavioral sciences (see Stone et al. 2000 and Podsakoff et al. 2003 for comprehensive reviews). Future self-reporting assessments of this demographic should (to the extent possible within experimental constraints) identify and control for such potentially confounding cognitive factors as prescribed by multiple authors in Stone et al. (2000).

Though certainly illuminating at some level, the post-experiment participant feedback is at the same time further confounding when one considers the response score frequency histograms presented in Figures 2 and 3. As noted, the
“simpler” taste preference survey response score sample distribution is skewed considerably (skewness = -0.5004), while the more “complicated” BFI personality response score sample distribution is nearly ideally normally distributed (skewness = -0.004480). This is intriguing, as one might expect the opposite to be true based solely upon an analysis of the sample distribution histograms. Nonetheless, such apparent confounding results appear to be a common artifact of self-reporting psychological experimentation, especially where personality assessments are integral to experimental design (see Schwarz 1999 and references therein). Indeed, a number of studies have shown that individuals instructed to self-report on perceived personality attributes are influenced by environmental and situational factors that must be carefully considered when analyzing and interpreting resultant response data (see Schwarz 1999 and references therein). We are thus again forced to consider that cognitive factors of this type contributed experimental artifact sufficient to impact the response data.

Though we failed to detect a significant positive correlation between taste preference and personality type response scores, the overall positive trend in the data is consistent with the significant positive correlational findings reported in previously published studies. More robust sampling of these student sub-populations is needed to obtain more definitive insight into the utility of personality type metrics for predicting dietary preference (and ultimately diet-related disease susceptibility) within this unique demographic. Future studies should ensure greater uniformity in self-reporting survey response scaling and more rigorously evaluate the impacts of verbal versus written instruction on survey response results. Such work should, in addition to controlling for influential cognitive factors (such as those hypothesized above), also employ stratified experimental designs aimed at detecting age-, gender-, ethnicity-, and even geography-dependent effects. While a number of compelling age-, gender- and ethnicity-dependent taste preference trends have been reported (e.g. Stone and Pangborn 1990; Grunberg and Straub 1992; Drewnowski et al. 1997; 1999 and references therein; Goldberg and Strycker 2002; Wansink et al. 2003; Kampov-Polevoy et al. 2004; Elfhag and Erlanson-Albertsson 2006; Summar et al. 2009), numerous studies have also reported contradictory findings (e.g. Goldberg and Strycker 2002; Corbin 2006; Richardson and Saliba 2011 and references therein). This is perhaps an inevitable consequence of the vast complexity of human behavior and thus such findings may simply be as good as it gets. Regardless, it remains unclear to what extent (if any) such factors influence taste preference in relation to personality type correlations and whether personality type metrics can reliably predict dietary habits (and, by extension, diet-related disease susceptibility). What is abundantly clear, however, is that we have only just begun to scratch the surface of our understanding of the relationship(s) between human personality traits and taste preferences (Saliba et al. 2009 and references therein) and that considerable work remains to be done in order to illuminate the true nature of these relationships (and any predictive utility they may afford). Accordingly, this should continue to be an exciting and fertile area of psychological inquiry well into the future.
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