Metatraits of the Big Five Differentially Predict Engagement and Restraint of Behavior

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ABSTRACT Although initially believed to contain orthogonal dimensions, the Big Five personality taxonomy appears to have a replicable higher-order structure, with the metatrait of Plasticity reflecting the shared variance between Extraversion and Openness/Intellect, and the metatrait of Stability reflecting the shared variance among Neuroticism, Agreeableness, and Conscientiousness. These higher order traits have been theorized to relate to individual differences in the functioning of the dopamine and serotonin systems, respectively. As dopamine is associated with exploration and incentive-related action, and serotonin with satiety and constraint, this neuropharmacological trait theory has behavioral implications, which we tested in 307 adults by examining the association of a large number of behavioral acts with multi-informant reports of the metatraits. The frequencies of acts were consistently positively correlated with Plasticity and negatively correlated with Stability. At the broadest level of description, variation in human personality appears to reflect engagement and restraint of behavior.

The Big Five taxonomy of personality traits has established itself as the model most consistently favored by personality psychologists over the last two decades (Costa & McCrae, 1992; Goldberg, 1993). Although initially conceptualized as containing orthogonal dimensions, factor analyses revealed the presence of two higher-order personality traits

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that account for much of the shared variance among the lower order dimensions (DeYoung, 2006; DeYoung, Peterson, & Higgins, 2002; Digman, 1997; Olson, 2005). These higher order traits appear reasonably constant across international samples, and their genetic basis has been provisionally established (Jang et al., 2006). The first metatrait, variously labeled Alpha, Stability, or Self-Control, is composed of the shared variance of Emotional Stability (Neuroticism reversed), Conscientiousness, and Agreeableness and is thought to relate to the need to maintain a stable organization of behavioral and psychological function (DeYoung, 2006). The second metatrait, labeled Beta, Plasticity, or Engagement, is composed of the shared variance of Extraversion and Openness/Intellect and has been hypothesized to relate to an individual's basic need to incorporate novel information from the environment. These two metatraits have been theoretically linked to the functioning of the serotonergic and dopaminergic neurotransmitter systems, respectively (DeYoung, 2006; DeYoung et al., 2002).

Serotonin is a broadly functioning neuromodulator with regulatory or inhibiting effects on mood, behavior, and cognition (Spoont, 1992). Gray and McNaughton (2000, p. 113) described serotonin as providing a signal of "avoidable danger," increasing vigilance while simultaneously suppressing hypothalamic and brain stem negative affective responses that might interfere with the self-regulation necessary to avoid the danger in question. Serotonergic circuitry originates in the raphe nuclei of the reticular formation, and its widespread projections act to limit negative affect and aggression while maintaining behavioral and motivational stability. Serotonin function has been directly linked to Conscientiousness, Agreeableness, and Emotional Stability, the traits constituting the metatrait of Stability (Jang et al., 2001; Manuck et al., 1998). Additionally, a review of research on serotonin and personality found the most consistent association to be between greater serotonin function and greater impulse control (Carver & Miller, 2006), which is consistent with the alternative label for this metatrait, "Self-Control" (Olson, 2005). Dopamine is also a broadly functioning neuromodulator, but with primarily activating effects on behavior and cognition. Dopaminergic circuitry originates in the ventral tegmental area and modulates approach behavior, incentive reward sensitivity, and breadth of thinking (Berridge & Robinson, 1998; Panksepp, 1998). Dopaminergic function has been related to both Extraversion, associated with incentive motivation, approach behavior, and positive affect (Depue & Collins, 1999), and Openness/Intellect, associated with broad thinking and cognitive flexibility (DeYoung, Peterson, & Higgins, 2005; Harris et al., 2005).

Given the breadth of function of these neurotransmitters in the brain, any influence they might have on human personality is likely to be similarly broad, making them plausible sources of the metatraits. Further, the metatraits should have very different behavioral expressions, given their hypothetical neurochemical underpinnings, with Plasticity relating more to activation or engagement of behavior and Stability relating more to the regulation or restraint of behavior. We examined this possibility in a multi-informant community sample, with 307 participants whose personalities were rated by themselves and three peers. Participants additionally rated the frequency with which they performed each of 400 behaviors. We hypothesized that Stability would be characterized by a disproportionately high number of negative correlations with the behavioral items, signifying its relation to restraint, whereas Plasticity would be characterized by a disproportionately high number of positive correlations with the behavioral items, signifying its relation to the activation and engagement of behavior. Further, we hypothesized that qualitative analysis of the results would indicate that the behaviors restrained by those high in Stability would be predominantly behaviors associated with strong disruptive impulses, whereas the behaviors engaged by those high in Plasticity would be predominantly behaviors associated with social or mental exploration.

Finally, we examined the Big Five personality traits in relation to the behavioral items in order to explore whether the dissociation between negative and positive correlations hypothesized at the metatrait level would also be observed at the Big Five level. If so, then Agreeableness, Conscientiousness, and Emotional Stability would be expected to have mostly negative behavioral correlates, whereas Extraversion and Openness would have mostly positive behavioral correlates.

METHOD

Participants and Design

Participants included 307 members of the Eugene-Springfield Community Sample (ESCS; 121 men, 186 women), ranging in age from 22 to 79 years ($M = 52.46$, $SD = 12.60$), who had Big Five Inventory (BFI) data from three peers. They were recruited by mail from lists of homeowners who agreed to complete questionnaires, delivered by mail, for pay, over a period of many years, beginning in 1994. The sample spanned all levels of educational attainment, with an average of 2 years of postsecondary schooling. Most participants identified themselves as White (97%). The remainder were Hispanic, Asian American, or Native American or did not report their ethnicity.

Materials

Behavioral frequencies were measured with a list of 400 behavioral acts administered to the ESCS in the fall of 1997. These behaviors were taken from a wide variety of domains and appear to reflect a reasonably broad and thorough sampling of activities. For each of these items, participants rated how often they had engaged in the activity using a 5-point scale: 1 = *never in my life*; 2 = *not in the past year*; 3 = *once or twice in the past year*; 4 = *three or more times in the past year, but not more than 15 times (such as once or twice a month)*; 5 = *more than 15 times in the past year*. In previous research, cluster analyses have been used to group these items into 60 behavioral clusters, each containing 2 to 15 items (Grucza & Goldberg, 2007; Roberts, Chernyshenko, Stark, & Goldberg, 2005). We employed scores for these clusters in addition to individual behaviors. Any behavioral items that did not reflect a clear and active behavior were removed from the analysis. These items primarily reflected health-related events (e.g., “Had a migraine headache,” “Had arthritis or joint pain”) that do not reflect behavior per se. Once such items were removed, the number of behavioral acts was reduced to 386.

The BFI contains 44 Likert-scale items, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*; John & Srivastava, 1999). During summer of 1998, it was administered to the ESCS participants and to peers who knew the participants well and were asked to rate them. Because analyses of multi-informant data indicate that the metatraits are substantively real but somewhat inflated by the biases of individual raters (DeYoung, 2006), use of multiple informants provides a more accurate assessment than self-ratings alone. Accordingly, we summed the self- and peer ratings for each Big Five dimension. The advantage of employing an arithmetic approach to combining self- and peer ratings, rather than a latent variable approach, is that the latter captures only the shared variance between the raters, but the former includes their unique variance as well. Including unique variance capitalizes on the fact that peer ratings contribute incremental predictive validity over and above self-ratings (Fiedler, Oltmanns, & Turkheimer, 2004; Mount, Barrick, & Strauss, 1994). In other words, different raters accurately assess different variance in participants’ personality.

RESULTS

Descriptive statistics for the multi-informant Big Five scores are presented in Table 1. To extract the metatraits, we conducted principal axis factoring (also known as common factor analysis) with direct oblimin rotation on the multi-informant domain scores. Table 1 reports the factor loadings of the summed domain scores, demonstrating the expected pattern of Stability and Plasticity metatraits.

Behavioral Correlates of the Metatraits

We next examined the relationship between the metatraits and the behavioral frequency data. Each behavior was correlated with the metatraits, controlling for gender and the other metatrait. We then ranked the behavioral items for each metatrait by the absolute magnitude of the correlations. To ensure that the behaviors were truly predicted primarily by the metatraits rather than by one of the Big Five domains within the metatraits, we placed each of the most strongly correlated behaviors one at a time into a structural equation model, which included both metatraits as latent variables with the summed multi-informant domain scores as markers (see Figure 1). Note that, whereas the arithmetic approach is appropriate to aggregate scores for different raters, a latent variable approach is appropriate for the metatraits because they comprise the shared variance among the Big Five domains. Behavioral items were then entered one at a time into the model, as criterion variables predicted by the metatraits, while controlling for gender. If freeing a path from any of the Big Five traits to the behavior significantly improved the fit of

Table 1
Descriptive Statistics, Reliabilities, and Factor Loadings for the Big Five Domains

	M	*SD*	Mean α	Interrater *r*	Stability	Plasticity
Extraversion	14.26	2.51	.86	.49	.008	**.593**
Agreeableness	16.49	1.96	.86	.31	**.633**	– .022
Conscientiousness	16.91	1.84	.85	.33	**.409**	.056
Neuroticism	10.26	2.52	.87	.38	– **.838**	.059
Openness	14.84	2.21	.85	.45	– .004	**.483**

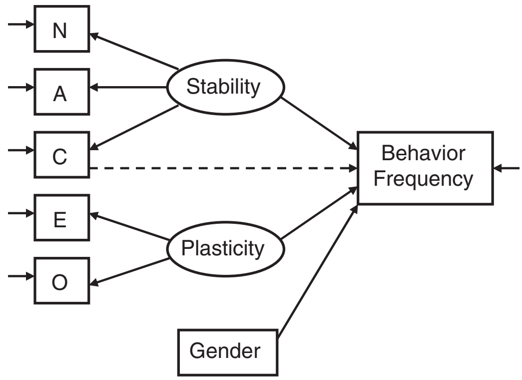

Figure 1
Structural equation modeling was used in determining whether each behavior was better predicted by the metatraits or the Big Five personality traits. Not shown in the diagram are correlations that were allowed between Plasticity and Stability and between gender and the personality variables. Paths from the Big Five to the behavior frequency variable were freed one at a time. For example, the figure depicts a model testing whether the metatraits predict a behavior over and above Conscientiousness.

the model and rendered the metatrait path insignificant, the behavior was considered to relate primarily to the Big Five trait level and was excluded from the final list of behaviors most strongly associated with each metatrait (Tables 2 and 3). The obtained results thus reflect behaviors correlated with the metatraits above and beyond any correlations that may exist at the five-factor level. The same procedure was repeated with the 60 behavioral clusters. The fit of the model prior to the inclusion of any behavioral frequency variable was almost perfect, $\chi^2 = 2.00$, $df = 9$, $p = .99$; CFI = 1.00; RMSEA = .000. Including the behavioral variables left the fit indices well above accepted thresholds for model fit.

Stability was significantly correlated with 91 of the 386 behaviors. Of these significant correlations, 90% (82/91) were negative correlations, instead of the 50% expected by chance. Plasticity was significantly correlated with 126 of the behaviors (for $p < .05$, $r > .12$). Of these significant correlations, 98% (124/126) were positive correlations, instead of the 50% expected by chance. The probability that this distribution of negative and positive correlations would occur randomly was $\chi^2(1, N = 91) = 58.56$, Cohen's $d = 2.69$, $p < .001$, for Stability and

Table 2
Strongest 20 Behavioral Correlates of Each Big Five Metatrait

Stability	Plasticity
1. Tried to stop using alcohol or other drugs. (– .29)	1. Was consulted for help or advice by someone with a personal problem. (.33)
2. Drank alcohol or used other drugs to make myself feel better. (– .29)	2. Planned a party. (.31)
3. Swore around other people. (– .27)	3. Attended a public lecture. (.30)
4. Hung up the phone on a friend or relative during an argument. (– .27)	4. Told a joke. (.28)
5. Lost my temper. (– .26)	5. Gave a prepared talk or public recital (vocal, instrumental, etc.). (.28)
6. Spent an hour at a time daydreaming. (– .26)	6. Spent an hour at a time daydreaming. (.26)
7. Yelled at a stranger. (– .25)	7. Wrote a thank you note. (.26)
8. Rode a motorcycle. (– .24)	8. Wrote a love letter. (.26)
9. Awakened in the middle of the night and was unable to get back to sleep (– .24)	9. Attended a city council meeting. (.25)
10. Became intoxicated. (– .23)	10. Entertained six or more people. (.24)
11. Had a nightmare. (– .23)	11. Volunteered for a club or organization. (.24)
12. Stayed up all night. (– .23)	12. Lounged around my house without any clothes on. (.24)
13. Took a sleeping pill. (– .22)	13. Decorated a room. (.23)
14. Ate breakfast in bed (not as a patient). (– .22)	14. Laughed out loud at something I thought of. (.22)
15. Drove faster than normal because I was angry. (– .22)	15. Went dancing. (.22)
16. Argued with someone. (– .22)	16. Asked questions in a meeting or lecture. (.22)
17. Took a hard drug (for example, cocaine, LSD, or heroin). (– .20)	17. Sang in a car or shower. (.22)
18. Paid bills. (– .19)	18. Wore formal clothing (evening gown, tuxedo, dinner jacket, etc.). (.21)
19. Drank four or more soft drinks a day. (– .19)	19. Renovated a room in a house. (.21)
20. Fed a stray dog or cat (– .19)	20. Made a new friend. (.21)

Note. For all correlations, $p < .001$.

Table 3
Strongest 10 Behavioral Cluster Correlates of Each Big Five Metatrait

Stability	Plasticity
Anger (– .32)	Interpersonal Warmth (.31)
Nervousness (– .28)	Parties (.30)
Overeating (– .24)	Laughter (.29)
Motorcycles/Hitchhikers (– .24)	Jokes (.28)
Irritation (– .24)	Sex (.27)
Sex (– .22)	Travel/Leisure (.26)
Laughter (– .20)	Dating (.23)
Disturbed Sleep (– .19)	Dieting (.22)
Jokes (– .17)	Politics (.20)
Overwork (– .15)	Motorcycles/Hitchhikers (.20)

For all correlations, $p < .001$.

$\chi^2(1, N = 126) = 118.13$, Cohen's $d = 7.75$, $p < .001$, for Plasticity. This pattern of results was retained (strengthened, in fact) when examining a smaller subset of significant behavioral correlates derived using a more conservative alpha level (for $p < .001$, $r > .21$). When using this criterion, 100% (16/16) of the correlations with Stability were negative, and 100% (20/20) of the correlations with Plasticity were positive. Chi-square analyses for these patterns of correlations were again significant for both Stability, $\chi^2(1, N = 16) = 16.00$, $p < .001$, and Plasticity, $\chi^2(1, N = 20) = 20.00$, $p < .001$. Table 2 presents the top 20 behavioral items for each metatrait.

A reasonable objection to these analyses is that because the list of 400 behavioral items is by no means exhaustive, it should not be assumed a priori that any positive and negative correlations would be evenly distributed across the metatraits. However, the obtained effects are of such a large magnitude that they remain significant even when adjusting the null hypothesis to reflect excessively large amounts of sampling bias in the choice of behavioral items. In the case of Stability, the effect remains significant even when assuming that 80% of the correlations would be in the obtained direction by chance alone, $\chi^2 = 5.81$, $p = .02$. For Plasticity, the effects remain significant even when assuming that 90% of the correlations would be in the obtained direction by chance alone, $\chi^2 = 9.91$, $p = .002$. The effects are so robust that they are not changed by the adoption of stringent null hypotheses to counter potential sampling biases.

A similar pattern was observed when looking at the relationship between the metatraits and behavioral clusters. Stability was significantly correlated with 25 clusters, all of which were negative correlations. Plasticity was significantly correlated with 29 of the clusters, all of which were positive correlations. The probability that this distribution of negative and positive correlations would occur randomly was $\chi^2(1,\ N = 25) = 25$, $p < .001$, for Stability and $\chi^2(1,\ N = 29) = 29$, $p < .001$, for Plasticity. Table 3 lists the top 10 behavioral clusters for each metatrait.

Behavioral Correlates of the Big Five

As an additional exploratory analysis, we examined the behavioral correlates at the five-factor level, by computing partial correlations between each of the multi-informant Big Five domains and the behavioral data while controlling for gender and the other four traits. Controlling for the other traits allowed us to examine the unique variance associated with each personality domain, resulting in less overlap among their behavioral correlates. We controlled for gender in order to reduce the confound of gender-specific behaviors as correlates of traits that showed significant gender differences (e.g., "had a mammogram" as a behavioral correlate of Agreeableness). Table 4 presents the top 10 behavioral correlates for each of the Big Five domains. What can be seen from this table is that, with the exception of Agreeableness, the divergent pattern of behavioral correlations is also evident at the five-factor level; the Plasticity-related traits positively predict behavior, whereas Emotional Stability and Conscientiousness negatively predict behavior. However, the pattern is considerably less pervasive at the Big Five level when one considers the full list of significant behavioral correlations: 48% (38/80) are negative for Agreeableness, 65% (72/111) are negative for Emotional Stability, 73% (56/77) are negative for Conscientiousness, 77% (111/144) are positive for Openness, and 86% (95/110) are positive for Extraversion.

DISCUSSION

As hypothesized, the metatrait of Stability was negatively correlated with the frequency of a wide variety of behaviors, whereas the meta-

Table 4
Strongest 10 Behavioral Predictors of Each Big Five Domain

Emotional stability	Extraversion
1. Took medication for depression. (– .43)	1. Told a dirty joke. (.28)
2. Took tranquilizing pills. (– .30)	2. Planned a party. (.26)
3. Visited a psychiatrist or psychologist. (– .29)	3. Entertained six or more people. (.24)
4. Took three or more different medications in the same day. (– .26)	4. Told a joke. (.24)
5. Shared a problem with a close friend or relative. (– .24)	5. Volunteered for a club or organization. (.24)
6. Misplaced something important. (– .23)	6. Tried to get a tan. (.23)
7. Participated in a self-help group. (– .23)	7. Attended a city council meeting. (.23)
8. Gave money to a panhandler. (– .23)	8. Colored my hair. (.23)
9. Took a sleeping pill. (– .22)	9. Went to a night club. (.23)
10. Tried to stop using alcohol or other drugs. (– .22)	10. Drank in a bar. (.22)
Agreeableness	**Openness**
1. Gave money to a panhandler. (.23)	1. Produced a work of art. (.51)
2. Drank in a bar. (– .22)	2. Read poetry. (.38)
3. Produced a work of art. (– .22)	3. Painted a picture. (.36)
4. Rode a horse. (– .22)	4. Wrote poetry. (.36)
5. Misplaced something important. (.21)	5. Bought a book. (.32)
6. Rode in a taxi. (– .21)	6. Read a book. (.30)
7. Used a thermometer to take my temperature. (.20)	7. Attended an art exhibition. (.29)
8. Drank beer. (– .19)	8. Made a gift for someone. (.29)
9. Participated in a self-help group. (.18)	9. Attended an opera or orchestra concert. (.28)
10. Took tranquilizing pills. (.18)	10. Attended a ballet performance. (.28)

(Continued)

Table 4 (Cont.)

Conscientiousness
1. Discussed sexual matters with a male friend. (−.23)
2. Lounged around my house without any clothes on. (−.22)
3. Picked up a hitch-hiker. (−.21)
4. Read a tabloid paper. (−.19)
5. Drove or rode in a car without a seatbelt. (−.19)
6. Swore around other people. (−.18)
7. Spent an hour at a time daydreaming. (−.18)
8. Shopped at a second-hand thrift store. (−.18)
9. Told a dirty joke. (−.18)
10. Listened to music (.18).

For all correlations, $p < .001$.

trait of Plasticity was positively correlated with many behaviors. Further, the associations of these behaviors with the metatraits could not be better explained by associations with individual Big Five traits. The consistency of the pattern of correlations was remarkable. At the broadest level of trait description, therefore, variability in human personality appears to reflect restraint and engagement. Stability appears to be associated with refraining from a variety of behaviors associated with disruptive impulses (such as drug use and reactive aggression), whereas Plasticity appears to be associated with engaging in a variety of behaviors associated with approach behavior and exploration (such as creative expression and attending social events). These results are consistent with the theory that the metatraits reflect serotonergically mediated self-regulation and constraint on the one hand and dopaminergically mediated exploration and engagement on the other (DeYoung, 2006; DeYoung et al., 2002).

The current findings have implications for models of the Big Five domains associated with Stability. In particular, some of the processes underlying these traits may best be understood in terms of the different systems that are being restrained or regulated in each case. Process models that are consistent with this view include those linking Agreeableness to the inhibition of interpersonal aggression (Meier, Robinson, & Wilkowski, 2006), Conscientiousness with the inhibition of distraction (Jensen-Campbell et al., 2002), and Emotional Stability with the inhibition of negative affect (Canli & Lesch, 2007).

In this context, it is important to differentiate the process we describe here as "restraint" from the behavioral inhibition system (BIS) proposed by Jeffrey Gray (Gray & McNaughton, 2000). Whereas Gray associated the BIS specifically with the potentiation of anxiety, Stability appears to reflect voluntary inhibition or regulation of negative emotion, aggression, and distraction. Sensitivity of the BIS is thought to be positively associated with Neuroticism (Gray & McNaughton, 2000), but Stability is negatively associated with Neuroticism. We should note that Gray's theory also encompassed a behavioral approach system (BAS), which he related to dopaminergic function and which appears reasonably similar to the process of activation that appears to characterize Plasticity.

Although Extraversion and Openness/Intellect may be usefully conceptualized in terms of their active properties (Depue & Collins, 1999; DeYoung et al., 2005) and the domains associated with Stability might benefit from being conceptualized in terms of voluntary inhibition or restraint, the diverging pattern of positive and negative correlations appears to be less pronounced at the five-factor level. Indeed, this is what would be expected if the functions of dopamine and serotonin are expressed primarily at the metatrait level. A more balanced pattern of results should obtain at the Big Five level because the phenotypic expression of these traits would be a function not only of their shared variance (arguably due to dopamine and serotonin), but also of their unique biological substrates. Thus, for instance, Agreeableness might be a function not only of restraint of aggression, but also of an active expression of social bonding systems. The idea that a phenotypic trait may emerge from multiple underlying systems is a common notion in personality psychology, most clearly expressed in circumplex models (Hofstee, De Raad, & Goldberg, 1992; Trapnell & Wiggins, 1990). Interestingly, interpreting Agreeableness as a combination of restrained aggression and prosocial motives is consistent with the interpersonal circumplex model, which characterizes this trait as a combination of low dominance and high warmth (McCrae & Costa, 1989).

Although the pattern of positive and negative correlations is interesting in itself, the content of those correlations is also of interest (Botwin & Buss, 1989; Buss & Craik, 1983; Funder & Sneed, 1993). Though any analysis of this sort is necessarily limited by the initial pool of behaviors, the current results do suggest qualitative behavioral profiles of the traits examined: Stability appears to be reflected most strongly in restraint from drug use and hostility and in the absence of disrupted sleep. The association of Stability with stable sleep is consistent with the finding that Stability is associated with circadian timing, such that people higher in Stability tend to be "morning people" with circadian rhythms more strongly entrained to the daily light–dark cycle (DeYoung, Hasher, Djikic, Criger, & Peterson, 2007). Plasticity is characterized primarily by social participation and self-expressive activities, behaviors consistent with an underlying exploratory drive. These profiles are consistent not only with our characterization of the metatraits as "Stability" and "Plasticity" but also with Digman's (1997) speculation that they might be related to socialization and personal growth, and with Olson's (2005) alternative labels, "Self-Control" and "Engagement." We see these various conceptions of the metatraits as complementary, converging on the same latent constructs from slightly different perspectives.

Lest anyone argue that the observed correlations are trivial in size, we point out that the magnitude of the trait–behavior correlations are similar to or greater than the average effect size found in social psychology of $r = .21$ (Hemphill, 2003; Richard, Bond, & Stokes-Zoota, 2003). Because the metatraits are high-bandwidth and low-fidelity constructs, it is appropriate that they are moderately correlated with a large number of behaviors rather than more strongly correlated with a smaller subset of behaviors (Cronbach & Gleser, 1965).

Looking at the behavioral correlates of the Big Five, Extraversion appears to be reflected primarily in social engagement; Openness is reflected in cultural and artistic pursuits; Emotional Stability is characterized by a lack of mental and physical problems; Conscientiousness appears to be marked by a lack of indiscreet and unproductive behaviors; Agreeableness, finally, appears the most difficult to define behaviorally, with correlates including generosity, health-related behaviors, and avoidance of alcohol. With the exception of Agreeableness, the behavioral content associated with each domain is congruent with what has been observed in previous research examining the behavioral expression of the Big Five both in laboratory settings (Funder & Furr, 2000; Funder & Sneed, 1993) and on self-report inventories of behavioral acts (Botwin & Buss, 1989). However, the range of behaviors examined here is broader than in most previous studies. Many of the behaviors were not likely to be observed in the laboratory (e.g., attending a city council meeting), and act-frequency inventories that list behaviors derived from prototypical associations of behaviors with traits (e.g., Botwin & Buss, 1989) are unlikely to assess many of those same behaviors. Our findings therefore broaden the available characterizations of behavior associated with the Big Five as well as the metatraits.

Some debate has occurred as to whether the metatraits reflect method artifacts rather than substantive constructs (e.g., Biesanz & West, 2004), but recent multimethod and genetic analyses suggest that both substantive and artifactual influences contribute to the higher-order factors (McCrae et al., 2008). Despite their finding that the metatraits were real and heritable, McCrae et al. (2008) concluded that the search for biological bases of personality could more profitably be conducted at the five-factor level. Although such investigations are undoubtedly producing valuable results, the current study suggests that investigating the neurobiological bases of the metatraits may also be fruitful. Not only were the metatraits able to predict behavioral outcomes above and beyond the Big Five, but the hypothesized pattern of negative and positive correlations was also more pronounced at the metatrait level. Use of multiple informants helped to ensure that our assessment minimized the amount of artifact in the metatraits and is recommended for all studies of the metatraits, if possible.

In conclusion, the current findings do not, in and of themselves, provide evidence that the metatraits of Stability and Plasticity emerge from individual variation in the function of serotonergic and dopaminergic systems. However, the results are in keeping with such a theory and demonstrate that a hypothesis based upon it successfully predicted the association between personality and behavior. Further research on this topic may advance our understanding of human personality, its role in behavior, and its relation to underlying neural and genetic processes. In future research, it would be desirable to base behavioral frequency assessments on observation or experience sampling to avoid the limitations of self-report.

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