

# Explaining to Students How Personality Differences Can Be Maintained in the Face of Directional Selection through Trait Covariation

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## ABSTRACT

Those of us who teach both personality psychology and evolutionary psychology must help students understand how individual differences in personality are maintained in the face of directive selection. A new study is offered to help explain the maintenance of personality variability over evolutionary time. Analysis of scores on the five major personality factors in two large data sets ( $N_s = 307,313$  and  $619,150$ ) confirmed a prediction from socioanalytic theory that the most common two-score profiles occur within superfactors  $\alpha$  and  $\beta$ , which affect coalition formation and status achievement, respectively (Hogan & Blicke, 2017). A parallel analysis of 1,718 representative English trait terms indicated that most trait terms fall at the intersection of two positive or two negative poles of the five factors, with five notable exceptions. The co-occurrence of negative and positive personality traits may help to explain how variability in personality is maintained over evolutionary time and is a good object lesson for students on how we are the result of blind evolution rather than intelligent design.

## KEYWORDS

Big Five, Blind Evolution, Human Nature, Individual Differences, Directional Selection, Personality, Trait Covariation

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Personality psychology and evolutionary psychology are similar in that both concern the study of the "whole person." That is to say, in contrast to subdisciplines of psychology that focus on one subsystem of psychological functioning (e.g., perception, memory, emotion, motivation, learning, social behavior), personality psychology seeks to understand how all of these psychological subsystems are organized within individuals into a complex, unified system (Mayer, 2007). Similarly, evolutionary psychology has suggested that perception, memory, emotion, and so forth are organized around adaptive problems such as finding food, escaping predators, and procuring a mate.

The "whole-person approach" of both personality psychology and

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evolutionary psychology suggests a natural compatibility between these two disciplines. However, there are also some deep differences between the worldviews typically presented in personality psychology and evolutionary psychology. Although personality psychology addresses both human universals and individual differences (Kluckhohn & Murray, 1953), the emphasis is clearly on the latter. This lies in stark contrast to evolutionary psychology's emphasis on the species-typical behavior that results from directional selection (Nichols, Sheldon, & Sheldon, 2008). Furthermore, personality psychology emphasizes behavioral consistency and stable traits<sup>1</sup>, while evolutionary psychology describes how psychological mechanisms encourage adaptive responses to changing threats and opportunities in the environment. These tensions have led two founders of evolutionary psychology to regard individual differences in personality as random fluctuations or "evolutionary noise" (Tooby & Cosmides, 1990).

Those of us tasked with teaching personality as something real and substantial and not just noise need to address Tooby and Cosmides' skepticism about personality. And for those of us who teach both personality and evolutionary psychology (often to the same group of students), it is incumbent upon us to explain to our students the similarities and differences between the two disciplines and to provide potential solutions to the tensions between individual differences and species-typical behavior. As a case-in-point, I describe some new research on the puzzle of covariation among traits in the Big-Five model of personality. The puzzle of covariation among the Big-Five personality traits can be summarized as follows.

Each of the Big Five traits is defined by opposite poles (e.g., Introversion-Extraversion), where one pole is generally considered to be more desirable and to be evolutionarily adaptive. An important question is how individual differences in these five traits are maintained in the face of directional selection, which would push all members of the species toward the more adaptive pole. Standard answers to this question include selective neutrality, mutation-selection balance, maladaptive extremes, trade-offs, niche-picking, and person-role fit. Students should be taught these standard answers. However, even though each of these standard answers may partially explain the maintenance of individual differences in the course of evolution, they do not address the fact that some combinations of Big-Five traits occur more often than others.

To anticipate the conclusion of the research described in detail below, an analysis of these combinations shows that, while positive traits tend to cooccur with other positive traits (and negative traits with other negative traits), some combinations of positive and negative traits occur more frequently than expected by chance, perhaps through genetic linkages. For these combinations, the negative trait within the pair might limit the adaptive consequences of the positive trait, while the positive trait within the pair could protect the individual from the detrimental consequences of the negative trait. If true, these less-than-optimal trait combinations can not only help explain the maintenance of individual differences in the Big Five; they can also serve to demonstrate to students how the blindness of evolution produces organisms that are kludges rather than intelligently-designed, optimally-adapted systems.

## An Empirical Study and Evolutionary Interpretation of Covariation among the Big Five Personality Traits

The Big-Five Model embodies the view that the universe of personality trait description (roughly 18,000 trait adjectives in the English language) is well-captured by five personality dimensions sometimes labeled Extraversion vs. Introversion, Agreeableness vs. Antagonism, Conscientiousness vs. Unconscientiousness, Emotional Stability vs. Neuroticism, and Creativity vs. Closed-Mindedness (Goldberg, 1993). The five major personality factors have been identified in the lexicons of 30 languages studied to date (de Raad, Barelds, Timmerman, de Roover, Mlačić, & Church, 2014). The pervasiveness of the five dimensions of personality has been explained by *the lexical hypothesis*, namely, "that the most important individual differences in human transactions will come to be encoded as single terms in some or all of the world's languages" (Goldberg, 1993, p. 26).

Goldberg (1981, p. 161) proposed that the Big Five embody five questions with universal importance to social transactions over our evolutionary history: "(1) Is X active and dominant or passive and submissive (Can I bully X or will X try to bully me)? (2) Is X agreeable (warm and pleasant) or disagreeable (cold and distant)? (3) Can I count on X (Is X responsible and conscientious or undependable and negligent)? (4) Is X crazy (unpredictable) or sane (stable)? (5) Is X smart or dumb (How easy will it be for me to teach X)?" The current paper proposes that Goldberg was on the right track, but that it might be more useful to consider the impact of combinations of the Big Five on social transactions than individual Big-Five dimensions. For example, as we will see in the current study, bullying is not a function of pure Extraversion, but a combination of Extraversion and Antagonism.

Historically, the Big Five were identified initially by a varimax rotation of five factors found in factor analyses of personality ratings based on large sets of personality trait adjectives from ordinary language such as *talkative*, *cooperative*, *responsible*, *calm*, and *imaginative* (e.g., Norman, 1963). A varimax rotation guarantees that the five factors will be statistically independent from one another. The statistical independence of the Big Five therefore provided a clear conceptual framework for developing new questionnaires and inventories to measure personality. Authors of these new personality inventories attempted to create scales for the five factors that were statistically independent, just like the varimax-rotated factor analyses of trait adjectives.

Yet, despite the best efforts of the most talented scale authors, scales for the five factors have been found to be only somewhat independent of each other. For example, the NEO PI-R, which has been called the "gold standard" for measuring the five factors (Muck, Hell, & Gosling, 2007), shows correlations as high as .40 between scales for the first and fifth factors and -.53 between scales for the third and fourth factors (Costa & McCrae, 1992, Appendix F; their fourth factor is scored in the direction of Neuroticism). Comparable scales from the Hogan Personality Inventory correlate .39 and .58 (Hogan & Hogan, 1992, Table 2.4). For the Big Five Inventory, those correlations are .21 and -.34 (Soto & John, 2017, Table 2; they also score the fourth factor in the direction of Neuroticism). Barrett and Rolland (2009), reviewing a number of meta-analyses and studies with large sample sizes, found that all five factors tend to intercorrelate positively when the fourth factor is scored in

the direction of Emotional Stability, often at the same magnitude of different scales that allegedly measure the same factor.

While Nettle (2011) has offered some evolutionary speculation on the covariance of narrower traits that make up each one of the five major personality factors, only a little has been written about the evolutionary significance of covariation among the five factors themselves. Covariation among Agreeableness, Conscientiousness, and Emotional Stability has been called superfactor  $\alpha$  and the covariation between Extraversion and Openness to Experience, superfactor  $\beta$  (Digman, 1997). Hogan and Blicke (2017) theorize that these two superfactors affect two evolutionary tasks they call "getting along" (forming friendships and coalitions) and "getting ahead" (achieving dominance and status). Mustek (2007) observed that  $\alpha$  and  $\beta$  also covary at a higher level that he called the General Personality Factor (GPF), similar to the  $g$  factor in intelligence testing. Hofstee (2003), who used the label  $p$  for the GPF, pointed out that the Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Creativity tend to be evaluated positively while Introversion, Antagonism, Unconscientiousness, Neuroticism, and Closed-Mindedness tend to be evaluated negatively. Although some psychologists have suggested that the intercorrelations among the five factors reflect an artifact or bias toward describing one's self in a socially desirable way, Hofstee maintains that the positive and negative evaluations of the five dimensions indicate an objective assessment of the desirability of the traits. In general, it appears that the positively-evaluated poles of the Big Five enhance evolutionary fitness, while the negative poles detract from fitness.

However, the observation that one pole of each of the Big Five generally enhances fitness while the other detracts from fitness raises a fundamental question about personality and evolution: How have individual differences persisted through evolutionary time if natural selection has been favoring one pole of each Big Five dimension over the other (Hawley & Buss, 2011)? To date, at least six theories have been advanced to explain the persistence of individual differences in personality over evolutionary time.

**Selective Neutrality** (Tooby & Cosmides, 1990). Selective Neutrality essentially denies that individual differences in personality have anything to do with natural selection and evolution. Although it might appear that personality differences give rise to differences in reproductive success, Tooby and Cosmides hold that, in the absence of strong evidence for that appearance, a more conservative view is that personality reflects random fluctuations or "evolutionary noise"—differences that are neither favored or opposed by natural selection. Hawley and Buss (2011) list a number of reasons why selective neutrality is unlikely, including the fact that the major personality factors are stable over time, situations, and cultures, that continuities between the Big Five and personality in other species have been noted, that Big-Five traits predict objectively-measured behavior, that all five dimensions have moderate heritability, and that the Big Five have been linked to components of fitness such as survival, mating success, the achievement of status, offspring production, and parenting.

**Mutation-Selection Balance** (Keller & Miller, 2006). A common assumption in evolutionary thinking is that most mutations, which give rise to genetic variability in a population, are harmful and therefore removed by natural selection. However, in

some cases selection pressure is not strong enough to remove all instances of mutation as they arise. If the mutation rate for new variations is equal to the rate of removal by natural selection, then individual differences will persist.

**Maladaptive Extremes** (MacDonald, 1995). A relatively recent conception of personality disorders is that they represent extreme versions of the normal Big-Five dimensions. MacDonald hypothesizes that personality variation around the mean for any Big-Five dimension represents viable strategies for solving evolutionary problems, but that extremes on the Big Five are deleterious. Thus, personality is subject to balancing selection, which allows variation not far from the mean but removes variants that are too far from the mean.

**Trade-Offs** (Nettle, 2006). Nettle's analysis noted that each pole of each of the Big-Five dimensions provides both advantages and disadvantages toward survival and reproduction. He concludes that the advantages and disadvantages are about equal, providing neither pole of any Big-Five dimension with greater reproductive success. Hence, all personality variants remain in the population.

**Niche-Picking** (Penke & Jokela, 2016). Penke and Jokela stress the proactive nature human beings. Rather than moving about randomly and becoming targets for selective forces, people are predisposed to seek out and create environments to which they are best adapted. Because different environmental niches favor each pole of each Big-Five dimension, people with different personalities have found or created unique environments favorable to their survival, which maintains personality variation in the human species.

**Person-Role Fit** (Johnson, 1983). Johnson proposed that, while Agreeableness, Conscientiousness, and Emotional Stability increase fitness, the other two Big-Five dimensions predispose individuals toward different, necessary roles in human groups. These roles can be considered as micro-niches in which individuals with unique personality configurations can thrive. Because these roles are all essential for effective group functioning, variation in personality differences is preserved.

### **HYPOTHESES ABOUT AN ADDITIONAL MECHANISM FOR PRESERVING INDIVIDUAL DIFFERENCES**

Except for selective neutrality, there is merit to existing theories about the maintenance of personality differences over evolutionary time. Without denying these previous theories, the current research considers how covariation between different personality traits could help maintain individual differences in personality. This article has already cited research documenting the tendency of Agreeableness, Conscientiousness, and Emotional Stability to co-vary into superfactor  $\alpha$  and Extraversion and Creativity to co-vary into superfactor  $\beta$ , as well as the tendency of  $\alpha$  and  $\beta$  to co-vary as the general personality factor  $p$ . If this pattern of covariation was absolute (i.e., that personality dispositions were always either toward the five positive poles or five negative poles of the Big Five), then it would seem that directional selection might eventually erase the negative dispositions. But the tendency of the Big Five to co-vary toward  $\alpha$ ,  $\beta$ , and  $p$  is just slight. A positive

standing on one of the Big Five traits does not guarantee a positive standing on the other four. In fact, combinations of positive and negative Big-Five traits do exist in the population, in some cases due to chance, but perhaps in other cases due to genetic linkages. When positive-negative trait combinations occur, the fitness-detracting nature of the negative trait and the fitness-enhancing nature of the positive trait could balance each other, maintaining trait variability. The notion that the fitness impact of a personality trait can be affected by the presence of a co-occurring personality trait is called *correlational selection* (Réale & Dingemanse, 2011).

The slight tendency of the Big Five to co-vary into  $\alpha$ ,  $\beta$ , and  $p$  (which allows for at least some combinations of positively- and negatively-evaluated traits) led to four specific hypotheses.

The first hypothesis was that profiles of individuals' two most extreme scores would most often consist of two positively-evaluated Big-Five poles or two negatively-evaluated Big-Five poles. This is statistically required, given the typical pattern of positive intercorrelations among the Big Five dimensions. Pairs of the most extreme scores were expected to be found primarily among Agreeableness, Conscientiousness, and Emotional Stability or Antagonism, Unconscientiousness, and Neuroticism (the  $\alpha$  superfactor markers) and between Extraversion and Creativity or Introversion and Closed-Mindedness (the  $\beta$  superfactor markers).

The second hypothesis derives from a discovery by Hofstee, de Raad, and Goldberg (1992), that most personality trait adjectives are related to two Big-Five factors rather a single dimension of the Big Five. The second hypothesis was that in a large, representative set of personality trait adjectives more traits would be related to two positive or two negative poles of the five factors than to one positive and one negative pole. This prediction about personality trait-descriptive adjectives mirrors the prediction about the frequency of persons' two-most-extreme-scores from the first hypothesis. Also, paralleling predictions from the first hypothesis, the most common pairs of Big-Five dimensions for defining trait adjectives were expected to come from either the three  $\alpha$  superfactor markers or two  $\beta$  superfactor markers. The idea that the frequencies of trait words defined by various pairs of Big-Five dimensions is similar to the frequencies of persons with extreme scores on those same pairs of Big-Five dimensions follows from the general lexical hypothesis about language reflecting important observations about persons. "The degree of representation of an attribute in language has some correspondence with the general importance of an attribute" (Saucier & Goldberg, 2001, p. 849). To the degree that the lexical hypothesis is true, there will be more personality trait words for describing the more common Big-Five combinations.

The third hypothesis was that the two most extreme scores for a significant minority of persons would come from the positive pole of one Big-Five factor and the negative pole of another factor. This hypothesis is based on the idea that if positive traits were always accompanied by other positive traits (and negative traits by other negative traits), directional selection would move everyone toward the positive poles, eliminating individual differences. But if some trait clusters were defined by the positive pole of one Big-Five dimension and the negative pole of another Big-Five dimension, then the positive pole of a trait might enhance fitness of the negative pole of another trait to which it is linked, or the negative pole might reduce

the fitness of the positive trait to which it is linked. Either way, linkages of positive and negative Big-Five traits could contribute to the maintenance of personality variability over evolutionary time.

Finally, paralleling the prediction from the third hypothesis, the fourth hypothesis was that a few combinations of one positive and one negative Big-Five dimension would define an appreciable number of personality trait adjectives. It was predicted that the combinations of one positive and one negative Big-Five traits that define the most adjectives would tend to be the same as the most common profiles of one extreme positive and one extreme negative Big-Five scores.

## METHOD

In a previous study, Johnson (2014) collected data from 307,313 persons who completed a 300-item inventory of the Big Five personality traits called the IPIP-NEO-300 and from 619,150 persons who completed a 120-item version of the inventory called the IPIP-NEO-120. He has made these data publicly available in an Open Science Framework repository at <https://osf.io/tbmh5/>. For each of these two archival data sets, scores were transformed to normalized z-scores, and each person's two most extreme scores were identified. Frequencies were computed for the 40 possible profiles in the two samples. The average frequencies of persons with two positive extreme traits or two negative extreme traits were compared to the average frequency of persons with one extreme positive and one extreme negative trait. Results from the two samples were compared.

Goldberg (1982) assembled a set 1,718 personality trait terms representative of the nearly 18,000 trait terms in the English language and asked a sample to rate themselves with these terms over a number of sessions to minimize fatigue. That archival data set was reanalyzed with an algorithm similar to the algorithm used by Hofstee, de Raad, and Goldberg's (1992) to see how many terms were defined by all combinations of the positive and negative poles of the Big Five. The difference was that Hofstee et al. divided the circumplexes defined by Big-Five factors as the x and y axes into twelve 30° segments and considered the two 60° segments between the x and y axes as blends of the Big Five. The algorithm in the current study, following Wiggins and Broughton (1991), divided the circumplexes into eight 45° segments, with adjectives falling within the 45° segment between the axes as blends of the Big Five<sup>2</sup>.

Among the 1,718 personality traits adjectives, there were 366 adjectives that Hofstee, de Raad, and Goldberg (1992) would describe as "pure factor markers," that is, best represented by a single Big Five factor rather than a pair of factors. To make the analysis of adjectives similar to the analysis of two-factor personality profiles, these terms were discarded, leaving 1,352 trait adjectives that were defined by combinations of the Big Five. The frequencies trait adjectives within each of the 40 combinations of Big-Five traits were compared to the frequencies of persons for each of the 40 combinations of extreme pairs of Big-Five traits.

Because the combinations of positive and negative Big-Five traits were of special interest, the content of each of the largest sets of trait adjectives defined by

a positive and negative Big-Five pole was examined to assess the psychological significance of these Big-Five combinations. Although I expected that positive-negative configurations with the largest number of adjectives would mirror the most frequent positive-negative extreme profiles from the two samples, I was ready to interpret in evolutionary terms any relatively large positive-negative trait adjective sets that did not parallel common personality profiles.

## RESULTS

**All two-factor frequencies.** There are 40 possible profiles defined by the two most extreme scores on the Big-Five personality domains.<sup>3</sup> The expected frequency of each profile if all two-score profiles are equally likely is therefore 1/40 or 2.5%. Study of observed frequencies (see Table 1) shows that these frequencies vary considerably from 2.5%, indicating that the 40 profiles are not all equally likely.<sup>4</sup> Table 1 also shows the frequencies of trait adjectives in each of the 40 two-Big-Five-factor configurations. The correlation of frequencies for the 40 profiles across the two samples of persons was  $r = .97$ , indicating extreme consistency across the two samples. The frequencies in the first sample correlated  $r = .28$  ( $p < .05$ , one-tailed) with the frequencies of trait adjectives in the comparable two-factor cells, while the frequencies in the second sample correlated  $r = .21$  (n.s.) with the frequencies of trait adjectives. Thus there was weak support for the general lexical hypothesis, that there are more trait adjectives in the lexicon for more frequent two-factor personality profiles of actual persons. However, when these correlations were recomputed after removing a small subset of adjectives that Lewis R. Goldberg (personal communication) considered to be psychometrically inferior (because they contained unfamiliar amplifications, e.g. *overfiery* and negations, e.g., *undevious*) the correlations increased to  $r = .45$  and  $r = .40$  (both  $ps < .01$ , two-tailed test). So, perhaps the data do provide good support to the lexical hypothesis when high-quality data from familiar adjectives are used.

**Positive-positive and negative-negative versus positive-negative combinations.** As predicted, more persons and more adjectives were defined by either two positive or two negative poles of the Big Five than by one positive and one negative pole. For sample one, the average frequency for positive-positive pairings was 3.32%, for negative-negative pairings, 3.13%, and positive-negative pairings, 1.78%. Comparable frequencies for sample two were 3.38%, 3.14%, and 1.74%. The average frequencies of those three categories for personality trait adjectives were 3.03%, 2.80%, and 2.09%.

**Frequencies of personality profiles within and across superfactors  $\alpha$  and  $\beta$ .** Looking within the positive-positive categories, the highest frequencies tended to fall within combinations of the markers for the  $\alpha$  and  $\beta$  superfactors. Frequencies above the mean are as follows (first value is for sample one and the second value, for sample two). Among all frequencies, two of the highest were found for the  $\alpha$  markers Agreeableness + Conscientiousness (4.2%, 4.2%) and Conscientiousness + Emotional Stability (4.4%, 4.5%). However, the frequency for Agreeableness + Emotional Stability was slightly below the mean (2.7%, 2.9%). Also above the mean frequency was the pairing of  $\beta$  markers Extraversion +

Openness to Experience (4.1%, 3.5%). Additionally and unexpectedly, above-average frequencies were found across the two superfactors, Extraversion + Emotional Stability (4.4%, 4.5%) and Agreeableness + Creativity (3.4%, 3.6%). (All of these frequencies were similar in the negative-negative Big-Five pairings).

**Frequencies of adjectives within and across superfactors  $\alpha$  and  $\beta$ .**

Among combinations of two positive poles, frequencies of trait adjectives above the average of 3.03% were found for  $\alpha$  markers Agreeableness + Conscientiousness (4.3%), Conscientiousness + Emotional Stability (4.4%), and Agreeableness + Emotional Stability (3.8%). However, the frequency for  $\beta$  markers Extraversion + Creativity, while substantial, was below-average (2.9%). Also, one above-average frequency was found across the superfactor markers, for Extraversion + Agreeableness (3.6%). The pattern of highest frequencies was therefore similar, but not identical, to the highest frequencies of two-factor personality profiles, partially confirming the lexical hypothesis.

Among the negative-negative combinations with frequencies above the average of 2.80% were the  $\alpha$  markers Antagonistic-Neurotic (5.0%) and Unconscientious-Neurotic (5.0%). The frequency of Antagonistic + Unconscientious, however, was slightly below average (2.8%). The frequency of the  $\alpha$  markers Introversion + Closed-Minded was above average (3.0%). But there were also three combinations across the superfactors that were above average in frequency, Introverted + Antagonistic (3.1%), Introverted + Closed-Minded (3.0%), and Unconscientious + Closed-Minded (3.0). Again, these patterns were similar to the patterns found in the two-factor personality profiles.

**More-frequent-than-average positive-negative personality profiles.**

Frequencies of personality profiles defined by one positive and one negative pole from the Big Five generally did not deviate much from the low means (1.78%, 1.74%) for that category. Exceptions might be the combinations Conscientious + Closed-Minded (2.9%, 3.3%) and Creative + Unconscientious (2.8%, 3.0%).

**More-frequent-than-average positive-negative adjectives.**

A similar examination of personality traits defined by one positive and one negative pole of the Big Five did not find the Conscientious + Closed-Minded or Creative + Conscientious combinations to be relatively frequent. This disconfirmed the prediction that frequent positive-negative personality profiles would be marked by a relatively high number of personality trait adjectives. Instead, it would seem that relatively high adjective combinations mark personality syndromes that are of interest rather than personality syndromes associated with high fitness.

Two combinations of positive-negative traits associated with adjectives frequencies that were even higher than the positive-positive combination mean of 3.03% were Extraverted + Antagonism (5.2%) and Emotional Stability + Antagonism (4.8%). There were also three positive-negative combinations whose frequencies were higher than the positive-negative average of 2.09%: Extraverted-Neurotic (3.0%), Agreeable-Neurotic (2.4%), and Agreeable + Closed-Minded (2.7%). These relatively high-frequency positive-negative combinations appear in Table 2 with complete lists of the trait adjectives defined by each combination. The possible evolutionary significance of these combinations is considered in the Discussion section.

## DISCUSSION

A majority of persons and personality traits can be understood in terms of either two positive or two negative poles from the Big Five. Those combinations define syndromes that promote or detract from evolutionary fitness, particularly in the themes of getting along or getting ahead. Yet a substantial number of persons and traits can be understood in terms of one positive and one negative pole from the Big Five. Of particular interest might be five syndromes of special concern because of the way they impact on fitness. My experience in teaching personality courses tells me that students are very receptive to understanding human behavior in terms of personality syndromes (coherent constellations of personality traits) and therefore should relate easily to the syndromes catalogued in Table 2.

The positive-negative combination with the most adjectives was Extraversion + Antagonism (5.2%). There were 70 traits that were classified by this combination, including *bullying*, *domineering*, *forceful*, and *overbearing*. The content of the trait adjective list suggested the label *Aggressive Intimidation*. Today, aggressive intimidation is not generally a positively-evaluated form of social interaction, but over the course of human history, aggressive intimidation probably increased fitness under certain circumstances. The behavior was probably even valued when directed toward members of the out-group. Apparently, this behavioral style has been important enough to generate many words to describe it. Trapnell and Paulhus (2012) found that the Extraversion + Antagonism conjunction also subsumes the "Dark Triad" traits of narcissism, Machiavellianism, and psychopathy. This particular syndrome provides an excellent example to students on how certain behaviors may not be ideal in a modern world where we struggle to avoid annihilating ourselves with weapons of mass destruction, yet natural selection has not yet weeded out such behaviors.

The positive-negative combination Emotional Stability + Antagonism had the second-greatest frequency of adjectives (4.8%). There were 65 traits defined by this combination, including *compassionless*, *heartless*, *masculine*, *murderous*, and *tough-minded*, and *virile*. This set of traits suggests the label *Callous Hypermasculinity*. The *Callous Hypermasculinity* syndrome bears a resemblance to the previous personality style, *Aggressive Intimidation*, but seems to refer specifically to unfeeling males. Some of the speculations about the adaptiveness of intimidation may therefore also apply to this personality style.

There were three additional combinations that defined more than the average number of traits for a positive-negative combination: Extraversion + Neuroticism (40 traits indicating *Over-Talkativeness* such as *big-mouthed*, *gabby*, *loose-tongued*, *nosey*, and *meddlesome*); Agreeableness + Neuroticism (33 traits indicating *Effeminacy* such as *dainty*, *feminine*, *sensitive*, *thin-skinned*, and *unmasculine*); and High Agreeableness + Closed-Mindedness (36 traits indicating *Submissiveness* such as *acquiescent*, *ingratiating*, *servile*, and *tame*).

Whereas the *Aggressive Intimidation* and *Callous Hypermasculinity* styles might be seen as adaptively self-enhancing at the expense of others, it is more difficult to see how *Over-Talkativeness*, *Effeminacy*, and *Submissiveness* could enhance an individual's fitness. To the contrary, people tend to be wary of the over-talkative gossip, who might be a valued source of information about others but also

an intrusive, nosy snoop. The *Effeminate* personality looks in some ways like the opposite of the *Callous Hypermasculine* type, and the *Submissiveness* syndrome looks like the opposite of *Aggressive Intimidation*. Individuals exhibiting these two personality syndromes look like targets for manipulation by others, and therefore at risk for lowered fitness. However, some have argued that gossiping does have adaptive benefits (Davis, Dufort, Desrochers, Vaillancourt, & Arnocky, 2017), and it is possible that submissive individuals are employing a sneaky strategy to get what they want from others. These sorts of puzzles about whether apparently maladaptive syndromes have hidden benefits can be excellent topics for classroom discussions about determining whether behaviors have fitness-enhancing benefits.

The questionable adaptiveness of *Over-Talkativeness* and the downright vulnerability to exploitation of *Effeminacy* and *Submissiveness* might provide insight into the role of combination of personality traits in maintaining personality variance over evolutionary time. Perhaps a generally negative trait such as Neuroticism is not protected from natural selection when it is paired with generally positive traits such as Extraversion and Agreeableness. Rather, when Neuroticism is paired with Extraversion or Agreeableness, these normally positive traits will be selected against, which would favor Introversion and Antagonism. By this reasoning, to stay in the population, Neuroticism could be indirectly favored when the positive end of that dimension, Emotional Stability, is paired with a negative trait such as Antagonism. We saw this combination in the Callous Hypermasculinity syndrome. While exploitative styles such as *Callous Hypermasculinity* and *Aggressive Intimidation* may have enhanced fitness under certain conditions, these exploitative behavioral strategies risk push-back from coalitions of individuals who do not want to be bullied and exploited. Recognition of potentially problematic group members who are too aggressive, callous, or gossipy is a first step in managing them. Language facilitates the labeling of problematic personality syndromes, which can be identified by statistical analyses of the personality lexicon such as the one in the current study.

The maintenance of variability in traits by the pairing of negative traits with other, positive traits may play a role outside of personality. Who knows to what extent biological variability is maintained because a generally fitness-enhancing morph tends to co-occur with another trait that detracts from fitness, but is held in the population because its alternative, positive form is linked to yet another trait that detracts from fitness? Organisms were not designed by a sighted watchmaker who created optimal, interlinking traits (Dawkins, 1986/2015). Rather, evolution is blind, which means that we are, to some extent, kludges: amalgams of well-functioning components and not-so-well-functioning components. While Richard Dawkins' book, *The Blind Watchmaker*, is an excellent source of examples of imperfect design, students might be more receptive to a funny, more recent book, *Not So Intelligent Design* (Ingman & Ingman, 2018). One of the greatest challenges to teaching evolutionary psychology, according to Liddle and Shackelford (2011, p. 130) is that "students must understand and accept as true the theory of evolution by natural selection," but that the students' religious beliefs about intelligent design interfere with that acceptance. There are many routes to handling beliefs about intelligent design, but one effective route is to provide examples imperfect design that are difficult to explain if one assumes an intelligent designer. Students tend to be put off

by Dawkins' demeanor, but may be less threatened by the Ingmans' humorous book.

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## FOOTNOTES

<sup>1</sup>There are alternative models of personality that emphasize dynamic processes over stable traits. The origin of many of these dynamic process models can be found in the writings of Walter Mischel, often regarded as the most important critic of stable personality traits. However, while dynamic processes certainly occur in the brain, such processes are only possible because the brain possess some stable structures, and even Mischel has proposed stable personality structures that seem to be little more than a relabeling of traditional personality trait concepts (Johnson, 1999). Johnson (1997, 2009) has drawn an analogy between the stable properties of elements described by chemistry and traits of persons described by personality psychology. "Traits seem to be required for science of personality, because any science involves detecting and explaining consistent patterns (Hanson, 1958). Imagine trying to construct a science of chemistry if elements and compounds did not possess stable properties—if sodium chloride were only sometimes water soluble. If people had no stable properties (i.e., traits), they could not be studied scientifically" (Johnson, 1997, p. 74).

The three publications by Johnson also explain why the proposal, offered by some of Mischel's followers, that situations are sometimes more powerful than traits is untenable. The essential problem with the proposal that traits and situations are separate forces whose magnitudes can be compared is that they are not separate forces. Rather, traits are descriptions of behaviors that are likely to occur in a particular type of relevant situation. Just as the properties of chemical substances such as the solubility of sodium chloride in water or the magnetizability of iron in electrical fields refer to dispositions toward a behavior in a particular kind of situation, properties of persons (*viz.*, personality traits) also refer to dispositions toward a behavior in a particular kind of situation (not cross-situational consistency, as critics have claimed). For example, the trait *cooperative* refers to compliance with reasonable requests, not indiscriminate compliance with others' wishes in every situation (Alston, 1975; Johnson, 1997). Just as one cannot logically compare the relative power of salt versus the relative power of water in dissolving behavior, one cannot logically compare the relative power of personality traits versus the relative power of situations in the determination of behavior. Traits and situations are not competing forces any more than genes and environments are competing forces; rather, they are equally necessary contributions toward the production of behavior.

<sup>2</sup>The Hofstee et al. (1992) procedure of dividing circumplexes into 30° duodecants would have produced results that were more fine-grained than necessary. For example, their procedure distinguishes *combative*, *rough*, *crude*, and *gruff*, all of which are designated II-I+ (primarily antagonistic and secondarily, extraverted), from *opinionated*, *domineering*, *boastful*, and *forceful*, all of which are designated I+II- (primarily extraverted and secondarily, antagonistic). For the purposes of the present study, it was sufficient to simply designate all of these traits as representing the positive pole of Extraversion and the negative pole of Agreeableness.

<sup>3</sup>There are ten possibilities for the most extreme score: either extremely high or extremely low on each of the Big Five. Once the most extreme score is identified, there are eight possibilities for the second most extreme score because it cannot be

the same as the most extreme score nor can it be the opposite. For example, if the most extreme score is high Extraversion, the second most extreme score cannot be high Extraversion or high Introversion. When frequencies of the most two extreme scores profiles were calculated, no distinction was made between the which of the two scores was more extreme. So, for example, individuals whose most extreme score was high Extraversion and second most extreme score was high Agreeableness were combined with persons whose most extreme score was high Agreeableness and second most extreme score was high Extraversion.

<sup>4</sup>A traditional chi-square test of the crosstabulation table is not appropriate because of a dependency of the second most extreme score on the first and a zero expected frequency for impossible cells (e.g., high Extraversion with high Introversion).

Maintenance of Personality Differences Through Trait Covariation

APPENDIX A

Table 1

Frequencies of Each of 40 Possible Two-Most-Extreme-Score Profiles and Trait Rating in Two-Factor Blends

	Agreeable	Conscientious	Emotionally Stable	Creative	Introverted	Antagonistic	Unconscientious	Neurotic	Closed-Minded
Extraverted	2.3%	2.5%	4.4%	4.1%		2.4%	2.2%	1.1%	1.7%
	2.3%	2.8%	4.5%	3.5%		2.4%	1.9%	0.9%	2.0%
	3.6%	2.4%	2.2%	2.9%		5.2%	2.1%	3.0%	0.7%
Agreeable		4.2%	2.7%	3.4%	2.2%		1.1%	1.8%	1.9%
		4.2%	2.9%	3.6%	2.0%		1.1%	1.5%	1.8%
		4.2%	3.8%	1.3%	2.5%		1.4%	2.4%	2.7%
Conscientious			5.5%	1.8%	1.6%	1.3%		0.9%	2.9%
			5.5%	1.9%	1.5%	1.2%		1.0%	3.3%
			4.4%	2.7%	1.5%	1.2%		1.6%	0.6%
Emotionally Stable				2.3%	0.9%	1.7%	0.8%		2.6%
				2.6%	0.8%	1.5%	0.9%		2.6%
				2.7%	3.2%	4.8%	1.6%		1.6%
Creative					1.6%	1.7%	2.8%	2.3%	
					1.8%	1.5%	3.0%	2.1%	
					1.0%	2.0%	1.1%	1.7%	
Introverted						2.1%	2.3%	4.8%	3.9%
						2.0%	2.6%	5.2%	3.2%
						3.1%	2.4%	2.7%	3.0%
Antagonistic							3.5%	2.3%	3.4%
							3.9%	2.4%	3.8%
							2.5%	5.0%	1.3%

## Maintenance of Personality Differences Through Trait Covariation

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Unconscientious		4.5%	2.3%
		4.3%	1.8%
		3.3%	3.0%
Neurotic			2.2%
			2.1%
			1.5%

Note. First row, N=307,313 persons; second row, 619,150 persons; third row, N=1,352 Trait Adjectives

	IPIP-300	IPIP-120	Adjectives
Positive-Positive pairings, average frequency =	3.32%	3.38%	3.03%
Negative-Negative pairings, average frequency =	3.10%	3.14%	2.80%
Positive-Negative pairings, average frequency =	1.78%	1.74%	2.09%

APPENDIX B

Table 2

Five Relatively Frequent Combinations of Positive and Negative Big-Five Traits

Extraversion + Antagonism = Aggressive Intimidation	Emotional Stability + Antagonism = Callous Hypermasculinity
1. ABRASIVE	1. BOYISH
2. ANTAGONISTIC	2. COMPASSIONLESS
3. ARGUMENTATIVE	3. CONSCIENCELESS
4. BIGHEADED	4. DAUNTLESS
5. BLUSTERY	5. EMOTIONLESS
6. BOASTFUL	6. FATIGUELESS
7. BOISTEROUS	7. FEELINGLESS
8. BRASH	8. HARD-HEARTED
9. BRAWLSOME	9. HEARTLESS
10. BRAZEN	10. IMMOVABLE
11. BRUSQUE	11. INDEFATIGABLE
12. BRUTAL	12. INDELICATE
13. BULLISH	13. INEXCITABLE
14. BULLYING	14. INEXHAUSTIBLE
15. CAUSTIC	15. INSENSITIVE
16. COCKY	16. INTEMPERATE
17. COMBATIVE	17. IRON-HEARTED
18. COMPETITORY	18. LARCENOUS
19. CUNNING	19. LECHEROUS
20. DEVILISH	20. MANLY
21. DEVIL-MAY-CARE	21. MASCULINE
22. DOMINEERING	22. MURDEROUS
23. EXPLOITATIVE	23. PITILESS
24. EXPLOSIVE	24. REMORSELESS
25. FIERCE	25. RUGGED
26. FORCEFUL	26. THICK-SKINNED
27. HARD-HEADED	27. TIRELESS
28. INCONTROLLABLE	28. TOUGH
29. INDOCILE	29. TOUGH-MINDED
30. INQUISITORIAL	30. UNAFFECTIONATE
31. INSUPPRESSIBLE	31. UNAIDING
32. INTOLERANT	32. UNASSISTING
33. KNOW-IT-ALL	33. UNBENDING
34. LEWD	34. UNBENEVOLENT
35. MANIPULATIVE	35. UNBLUSHING
36. MILITANT	36. UNCHANGING
37. MISCHIEVOUS	37. UNCOMPASSIONATE
38. OBTRUSIVE	38. UNCONSTRAINABLE
39. OVERBEARING	39. UNCOURTLY

40. OVERBOLD	40. UNDEVOUT
41. OVERCUNNING	41. UNEARNEST
42. OVERCURIOUS	42. UNEMOTIONAL
43. OVERDARING	43. UNEXCITABLE
44. OVERFIERCE	44. UNFAITHFUL
45. OVERLUSTY	45. UNFEARING
46. RASCALLY	46. UNFEELING
47. REPROACHFUL	47. UNFEMININE
48. RETORTIVE	48. UNFLINCHING
49. RISQUE	49. UNGRACIOUS
50. ROGUISH	50. UNKIND
51. ROUGH	51. UNKINDLY
52. ROWDY	52. UNLADYLIKE
53. RUDE	53. UNMAIDENLY
54. SADISTIC	54. UNMOVABLE
55. SELF-IMPORTANT	55. UNPERSUADABLE
56. SLY	56. UNPITYING
57. SURLY	57. UNPLIABLE
58. TREACHEROUS	58. UNPOLITE
59. TYRANNICAL	59. UNRELENTING
60. UNCONTROLLED	60. UNSENTIMENTAL
61. UNCURBABLE	61. UNSHAKABLE
62. UNHEEDFUL	62. UNSUBDUABLE
63. UNMILD	63. UNSYMPATHETIC
64. UNREASONABLE	64. VIRILE
65. UNRESTING	65. WARMTHLESS
66. UNSUBMISSIVE	
67. VIOLENT	
68. WEARILESS	
69. WILD	
70. WILY	

<p>Extraversion + Neuroticism = Over-Talkativeness</p> <ol style="list-style-type: none"> <li>1. BIG-MOUTHED</li> <li>2. BIGOTED</li> <li>3. BOSSY</li> <li>4. CATTY</li> <li>5. COMPLAINING</li> <li>6. EXAGGERATIVE</li> <li>7. EXCESSIVE</li> <li>8. EXHAUSTIVE</li> <li>9. FACETIOUS</li> <li>10. FLAUNTY</li> <li>11. FLUTTERY</li> <li>12. GABBY</li> <li>13. HEADSTRONG</li> <li>14. HIGH-HANDED</li> <li>15. HOT-BLOODED</li> <li>16. INTRUSIVE</li> <li>17. LAVISH</li> <li>18. LOOSE-TONGUED</li> <li>19. LOUD</li> <li>20. LOUD-MOUTHED</li> <li>21. MEDDLESOME</li> <li>22. MUSHY</li> <li>23. NOISY</li> <li>24. NOSEY</li> <li>25. OSTENTATIOUS</li> <li>26. OVEREMPHATIC</li> <li>27. OVEREXCITABLE</li> <li>28. OVERLOUD</li> <li>29. OVERPASSIONATE</li> <li>30. OVERTALKATIVE</li> <li>31. OVERZEALOUS</li> <li>32. PREACHY</li> <li>33. PRESUMPTUOUS</li> <li>34. PROVOCABLE</li> <li>35. QUARRELSOME</li> <li>36. SNOOPY</li> <li>37. SUBJECTIVE</li> <li>38. SWELLHEADED</li> <li>39. VAIN</li> <li>40. VOLATILE</li> </ol>	<p>Agreeableness + Neuroticism = Effeminacy</p> <ol style="list-style-type: none"> <li>1. ALARMABLE</li> <li>2. AMOROUS</li> <li>3. COMPLIMENTARY</li> <li>4. CONSOLATORY</li> <li>5. DEPENDENT</li> <li>6. EFFEMINATE</li> <li>7. EMOTIONAL</li> <li>8. EXCITABLE</li> <li>9. EXHAUSTIBLE</li> <li>10. FEELINGFUL</li> <li>11. FEMININE</li> <li>12. FLATTERABLE</li> <li>13. FRIGHTENABLE</li> <li>14. GIRLISH</li> <li>15. INGRATIATORY</li> <li>16. LADYLIKE</li> <li>17. MANIPULABLE</li> <li>18. MATERNAL</li> <li>19. OVERWOMANLY</li> <li>20. PERSUADABLE</li> <li>21. SENSITIVE</li> <li>22. SENTIMENTAL</li> <li>23. SOFT-SHELLED</li> <li>24. SQUEMISH</li> <li>25. THIN-SKINNED</li> <li>26. ULTRASENTIMENT</li> <li>27. UNGENTLEMANLY</li> <li>28. UNHARDY</li> <li>29. UNMANLY</li> <li>30. UNMASCULINE</li> <li>31. WARM</li> <li>32. WEEPY</li> <li>33. WOMANLY</li> </ol>
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Agreeableness + Closed-Mindedness = Submissiveness

1. ACCOMMODATING
2. ACQUIESCENT
3. BOUNTIFUL
4. CENSORIAL
5. COMPLAISANT
6. CONCEITLESS
7. COUNSELABLE
8. DAPPER
9. DISGUISELESS
10. GUSHY
11. HOMESPUN
12. INCURIOUS
13. INGRATIATING
14. MILD-HEARTED
15. MODERATE
16. MOLDABLE
17. OBLIGING
18. OVERSCRUPULOUS
19. PRAYERFUL
20. RESTRAINABLE
21. SERVILE
22. SLOW-WITTED
23. SUBMISSIVE
24. SUGARY
25. TAME
26. TRANSPARENT
27. TRUSTFUL
28. UNBOOKISH
29. UNCURIOUS
30. UNDERWITTED
31. UNDISCERNING
32. UNDISCRIMINATING
33. UNINVESTIGATIVE
34. UNQUESTIONING
35. UNSCEPTICAL
36. UNWARY