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<http://doi.org/10.1007/s12144-020-01310-1>

<http://hdl.handle.net/11067/6366>

#### **Metadados**

##### **Data de Publicação**

2021

##### **Resumo**

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##### **Editor**

Springer

##### **Palavras Chave**

Reactance, Personality, Person-centered approach, Communication, Adolescents

##### **Tipo**

article

##### **Revisão de Pares**

yes

##### **Coleções**

[ILID-CIPD] Artigos

Esta página foi gerada automaticamente em 2024-09-21T10:19:02Z com informação proveniente do Repositório

## **Reactance and personality: Assessing psychological reactance using a biopsychosocial and person-centered approach**

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### **Author Note**

Support for this research comes from national funds from the Fundação para a Ciência e Tecnologia I.P. (FCT) [*Portuguese Foundation for Science and Technology*], under the Projects CIPD-BI-UID/PSI/04375/2019 and PTDC/MHC-CED/2224/2014.

All procedures performed in studies involving human participants were following the ethical standards of the institutional ethics committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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### Abstract

Reactance is a critical concept for understanding adolescents' noncompliance and resistance to behavioral change. Traditionally, reactance has been conceptualized as a state comprising negative emotions and cognitions. However, research indicates that one's proneness to reactance can be considered a personality trait. The present study aimed to develop a current understanding of individual differences in trait reactance from a biopsychosocial perspective. Adolescents ( $n = 1,837$ ) completed Cloninger's Junior Temperament and Character Inventory and two validated measures of trait reactance. A person-centered analytical approach was used to assess how clusters of adolescents with distinct temperament profiles, character profiles (Latent Profile Analysis), and integrated temperament-character personality networks (Latent Class Analysis) differed in reactance. High reactance was characteristic of adolescents with temperament profiles involving high novelty seeking and low harm avoidance. High behavioral reactance was characteristic of adolescents with immature character profiles. Finally, high reactance was characteristic of adolescents with integrated personality networks reflecting emotional instability, immature intentionality, and low self-awareness. This study expands current knowledge by showing how individual differences in trait reactance correspond to structural differences in personality. Specifically, our findings indicate that high trait reactance in adolescents is an expression of maladaptive organizations of biopsychosocial processes. This more nuanced understanding of trait reactance can aid the development of contexts (e.g. clinical, educational, society, communication) for promoting positive outcomes in adolescents will all types of personality.

*Keywords:* reactance, personality, person-centered approach, communication, adolescents

## **Reactance and personality: Assessing psychological reactance using a biopsychosocial and person-centered approach**

Psychological Reactance Theory (PRT; Brehm, 1966; Brehm & Brehm, 1981) posits that people value their ability to enact free behaviors at will, in the present or future, and find it aversive when they perceive this ability is restricted (for a recent review article, see Rosenberg & Siegel, 2018). The aversive nature of this perceived restriction then motivates individuals to restore their lost freedom via cognitive and/or behavioral efforts. This motivational state, *state reactance*, comprises a combination of negative emotions and negative cognitions (Dillard & Shen, 2005; Quick & Stephenson, 2007a; Rains & Turner, 2007). State reactance is an important construct because it can lead individuals to increase their engagement in an undesirable behavior (e.g. smoking) in response to efforts to reduce it (e.g. in the context of therapy or health communications; Brehm, 1966).

PRT is particularly relevant for understanding adolescent functioning. From a developmental perspective, adolescents are more likely to experience state reactance because of the developmental task of identity formation in this period (Erikson, 1968). Consistent with this, prior studies indicate that younger individuals, and particularly older adolescents, typically display the highest trait reactance (Hong, Giannakopoulos, Laing, & Williams, 1994). According to Erikson, the pursuit of independence and individuality requires divergence from societal and parental expectations, meaning that adolescents are likely to be sensitive to any imposed rules, regulations, responsibilities, or life transitions that can be perceived as threats to the establishment of self-determination. Such threats can be seen to block adolescents' basic psychological needs for adaptive social development (Deci & Ryan, 2008), particularly the needs for autonomy and competence (Grolnick, Deci, & Ryan, 1997), and lead to state reactance and non-compliance. For example, research has shown that controlling parenting frustrates autonomy satisfaction and enhances reactance proneness (Van Petegem,

Soenens, Vansteenkiste, & Beyers, 2015) and that psychological control leads to increased emotional and behavioral problems in adolescents via reactance (Laird & Frazer, 2020). Moreover, the development of an 'optimal level of reactance' in childhood (autonomous sense of self without reactively cutting off from others) is theorized to result from experiences of parenting (Dowd & Seibel, 1990), and indeed processes linked to differentiation of the self significantly predict reactance (Johnson & Buboltz, 2000).

The natural development and complexification of personality over the course of adolescence may also explain why adolescents are more prone to reactance. Several longitudinal studies focused on changes in the dimensions of the Five-Factor Model (FFM; Costa & McCrae, 1992) suggest that openness, conscientiousness, and extraversion decrease from early adolescence before recovering in later adolescence (Göllner et al., 2017; Van den Akker, Deković, Asscher, & Prinzie, 2014); that is, personality becomes less mature before improving. A more recent longitudinal study demonstrated that parents rated their adolescents as more impulsive and rebellious between 12 and 14, and that early adolescents do not yet have the fully developed capacity to self-regulate emotional impulses (Zohar, Zvir, Wang, Cloninger, & Anokhin, 2018). The finding that adolescence is a period of elevated impulsivity and emotional instability is further supported by cross-sectional studies comparing older and younger adolescents (Moreira et al., 2015, 2012). Such findings imply that reactance is a particularly evident personality characteristic of adolescents. However, as we shall argue, it remains unclear how individual differences in this trait relate to structural differences in personality. Hence, the general purpose of this study was to address the following research question: what types of personality (and thus what types of adolescents) are most likely to display reactance?

### **Reactance as a Personality Trait**

Although not originally posited by PRT, it is acknowledged that individual-differences play a role in determining one's proneness to perceiving situations as threats and experiencing state reactance (Brehm, 1966; Dowd, Milne, & Wise, 1991; Shoham, Trost, & Rohrbaugh, 2004). This tendency for reactance, or reactance proneness, is described as *trait reactance*. Individuals high in trait reactance are theoretically expected to experience state reactance and its component negative emotions and cognitions more often, and indeed some studies have directly demonstrated that trait reactance is predictive of state reactance (Dillard & Shen, 2005; Quick & Stephenson, 2007b).

The concept of trait reactance has been used widely in the field of clinical psychology where it is considered a key moderator of therapeutic success (Rosenberg & Siegel, 2018). Therapists and clinicians are authority figures who can, during treatment, be perceived to restrict certain freedoms. This can include explicit restrictions of certain activities, such as smoking, but any recommendations to engage in alternative behaviors or adopt other attitudes can be seen as threats (Seibel & Dowd, 1999). Studies have shown that patients with higher trait reactance are less compliant with therapy (Seibel & Dowd, 1999) and are at risk of worse prognoses (Beutler, Moleiro, & Talebi, 2002). Trait reactance has also been linked to antivaccination attitudes and beliefs (Finkelstein et al., 2020; Hornsey, Harris, & Fielding, 2018). Therefore, this construct has been important for informing therapists and clinicians how to tailor their treatments to serve different types of patient, particularly those at risk of noncompliance (Karno, Longabaugh, & Herbeck, 2010). For example, a recent meta-analysis has shown that high reactance individuals have better psychotherapy outcomes when therapists are less directive (Beutler, Edwards, & Someah, 2018).

Given the relevance of this construct, a sizeable body of research has involved the development and validation of scales to measure trait reactance, including the

Hong Psychological Reactance Scale (HPRS; Brown, Finney, & France, 2011; Hong & Faedda, 1996; Hong & Page, 1989; Moreira, Cunha, & Inman, 2020; Thomas, Donnell, & Buboltz, 2001; Waris et al., 2020; Yost & Finney, 2018) and Therapeutic Reactance Scale (TRS; Buboltz, Thomas, & Donnell, 2002; Dowd et al., 1991; Inman, Sousa, Cunha, & Moreira, 2019). Studies of the HPRS have identified various underlying structures, but there is now robust evidence that it captures a unidimensional construct, despite some multidimensionality in the items (e.g. Brown et al., 2011). Studies testing the factor structure of the TRS are less abundant, but nonetheless also present several candidate multidimensional structures. Originally, however, the scale was found to be divided into two subscales reflecting verbal and behavioral styles of reactance. These dimensions were only moderately correlated ( $r = .37$ ) and had differing patterns of association with external variables (e.g. internal locus of control; Dowd et al., 1991), implying they are distinct dimensions. Moreover, these two styles of reactance are associated with different personality characteristics (Seibel & Dowd, 2001).

Despite the wide application of trait reactance in clinical psychology, some authors have argued that more research is needed to establish whether reactance should be conceptualized and measured as a trait (Miron & Brehm, 2006; Shoham et al., 2004). We add that while multiple studies in the field of clinical psychology have assumed that reactance is a component of personality, there has yet to be a definitive demonstration that individual-variations in reactance reflect structural differences in personality. Thus far, most research testing the construct validity of trait reactance has sought to define a nomological network by describing the associations between measures of trait reactance and measures of other theoretically related personality variables. Studies have shown that measures of trait reactance are associated with a range of variables including independence, aggression, dominance, and low tolerance (Dowd & Wallbrown, 1993; Dowd, Wallbrown, Sanders, & Yesenosky, 1994). In a study of psychotherapy clients, individuals with obsessive-compulsive or borderline

personality disorders reported the highest trait reactance (Seibel & Dowd, 2001). Thus, personalities characterized by a need for autonomy, interpersonal distrust, and oppositionalism appeared to be the most reactive. In another study comparing Myers-Briggs personality types, “thinkers” (who make a judgement based on objective methods) were found to be more reactive than “feelers” (those who make judgments based on values and subjective notions) (Buboltz et al., 2003). Researchers have also explored the associations between trait reactance and the personality dimensions of the Five-Factor Model (FFM; Costa & McCrae, 1992). Specifically, trait reactance was negatively correlated with agreeableness ( $r = -.47$ ), and positively, albeit weakly, correlated with neuroticism ( $r = .14$ ) and openness to experience ( $r = .19$ ; Seemann, Buboltz, Thomas, Soper, & Wilkinson, 2005; Yost & Finney, 2018). Seemann et al. further examined the independent contributions of the facets of each Big 5 personality dimension, and found that trait reactance was associated with low straightforwardness and compliance (agreeableness), high openness to ideas (openness to experience), high assertiveness and excitement-seeking (extraversion), and fewer positive emotions (extraversion).

There are several limitations with this body of evidence. Firstly, many of these studies relied on outdated personality typologies (Myers-Briggs personality types) or measures (e.g. the California Psychological Inventory; Gough, 1987). Moreover, researchers have argued the FFM offers an incomplete description of personality (Ashton & Lee, 2007; Cloninger, Svrakic, & Przybeck, 1993) because it relies on linear factor analysis to derive personality factors from lexical terms (Veselka, Schermer, & Vernon, 2012). Personality dimensions derived from linear factor analyses are predictive of many outcomes but are problematic for describing the causal structure of personality because they do not integrate genetic, physiological, psychological, and social/environmental influences (Cloninger et al., 1993). In many cases, lexical personality dimensions incorporate multiple distinct biopsychosocial processes and are



not etiologically independent (Cervone, 2005; Cloninger, 2008; De Fruyt, Van De Wiele, & Van Heeringen, 2000). Because theories based on evidence from behavioral genetics, neurobiology, and psychology allow for a more comprehensive understanding of the structure of personality (Munafò & Flint, 2011; Veselka et al., 2012) there is a need to use them to deepen the current understanding of psychological trait constructs.

A second limitation is that these studies used variable-centered approaches, meaning they examined the linear (one-to-one) relationships between variables. Recent evidence has given heavy support to a conceptualization of personality as the expression of complex, dynamic, and non-linear interactions between multiple biopsychosocial systems that regulate learning processes (Zwir et al., 2018a, 2018b, 2019a). Because these studies focused on examining relationships between independent personality correlates, rather than personality as an integrated and interacting set of biopsychosocial systems, they do not provide a clear picture of the dispositional dimensions involved in the development of reactance via individual-context interactions.

### **The Biopsychosocial Model of Personality**

According to the biopsychosocial model, the structure of personality corresponds to the expression of three interacting biopsychosocial systems of learning and memory (Cloninger, 2004). These three systems, which regulate processes for associative conditioning, intentionality, and self-awareness respectively, are captured by an integration of two distinct personality domains labelled *temperament* and *character* (Cloninger et al., 1993). The temperament dimensions of this model reflect organizations of psychobiological process that shape how a person automatically and unconsciously learns to behave, react emotionally, and form attachments via associative conditioning (Cloninger, Cloninger, Zwir, & Keltikangas-Järvinen, 2019). Character dimensions, on the other hand, reflect organizations of higher-order cognitive processes that shape what people intentionally make of themselves

(Cloninger, 2004). This involves two biopsychosocial systems. The first regulates intentional self-control based on personal goals, values, and facts (what am I going to do?). The second regulates evaluations and appraisals of one's intentions and values in context via self-awareness (addressing the questions why, where, and when?) (Zwir et al., 2019a).

According to the biopsychosocial model, human personality can be organized and described at several levels of complexity from (1) individual temperament and character dimensions, (2) genetically independent multi-trait temperament and character profiles, and (3) joint networks of temperament and character profiles reflecting different integrated expressions of the three major systems of learning and memory (Zwir et al., 2019). We shall consider each in turn:

### ***Temperament and Character Dimensions***

The psychobiological model defines four temperament dimensions and three character dimensions. These four temperament dimensions are *novelty-seeking* (responsible for activation of behavior in response to novelty: impulsive vs. deliberate), *harm avoidance* (related to tendency to inhibit behavior in presence of aversive stimuli: fearful vs. risk-taking), *reward dependence* (sensitivity to reward; sentimental vs. detached), and *persistence* (resistance to behavioral extinction; determined vs. easily discouraged). The three character dimensions are *self-directedness* (systems of concepts, principles, and values about the self that informs intentional behavior; purposeful vs. aimless), *cooperativeness* (representations of being a member of a group or community; helpful vs. self-centered), and *self-transcendence* (awareness of being part of a wider reality that transcends the individual; altruistic vs. individualistic).

### ***Multi-Trait Temperament and Character Profiles***

Evidence indicates that the heritability of personality is determined by sets of genes that code for specific multi-trait temperament and character profiles, and not

individual dimensions (Cloninger & Zvir, 2018; Zvir et al., 2018a, 2018b, 2019b).

Because this implies that two people can have the same features of a single trait (e.g. high novelty seeking) as a result of different molecular and biological processes, it follows that multi-trait profiles should be used to assess human temperament and character (Cloninger & Zvir, 2018). Past studies have identified several common temperament profiles across samples, including the contrasting 'reliable' (defined most prominently by lower novelty seeking and higher reward dependence and persistence) and 'unreliable' profiles<sup>1</sup> (defined most prominently by higher novelty seeking and lower reward dependence and persistence), and shown that people with a reliable temperament have more adaptive functioning (Moreira, Inman, & Cloninger, 2020; Moreira, Inman, Cloninger, & Cloninger, 2020; Moreira, Inman, Rosa, et al., 2020; Rettew, Althoff, Dumenci, Ayer, & Hudziak, 2008; Thomas, Chess, & Birch, 1968; Zvir et al., 2018b). Distinct character profiles have also been identified in several studies. Recently, Zvir et al. (2018a) identified five genetically distinct profiles; three reflecting healthy personalities ('creative', 'organized', and 'resourceful'), and two reflecting unhealthy personalities ('apathetic' and 'dependent'). The healthiest profile, the 'creative' profile, is characterized by high values for all three character dimensions. The most unhealthy, the 'apathetic' profile, has low values for all dimensions. Research demonstrates that healthy characters, and most notably the creative profile, are linked to elevated health, well-being, and adaptive functioning (Cloninger & Zohar, 2011; Moreira et al., 2015; Moreira, Inman, Cloninger, et al., 2020; Zvir et al., 2018a). In turn, unhealthy characters are linked to increased risk of personality disorders (Svrakic, Whitehead, Przybeck, & Cloninger, 1993).

### ***Joint Temperament-Character Networks***

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<sup>1</sup> Note that profiles with these features have been assigned different labels across studies. To summarize the quality of these profiles, we refer to terminology used by Zvir et al. (2019).

An important recent discovery was that peoples' genetically distinct temperament and character profiles are integrated via genetic-environment interactions (Zwir et al., 2019). Specifically, Zwir et al. identified three joint temperament-character networks that represented groups of individuals with distinct integrated expressions of the three major systems of learning and memory: the *Emotional-Unreliable* network (people with an unreliable temperament paired with low intentionality and self-awareness, leading to emotional reactivity), the *Organized-Reliable* network (people with a reliable temperament paired with high intentionality but low self-awareness), and the *Creative-Reliable* network (people with a reliable temperament paired with high intentionality and self-awareness). Crucially, people with a creative-reliable personality profile, and thus the prototypical features of the biopsychosocial system for self-awareness, were shown to be the healthiest in terms of wellbeing. In contrast, people with an emotional-unreliable personality profile, and thus the prototypical features of the biopsychosocial system for associative conditioning, were the least adaptive. Several recent studies have identified similar networks using latent class analysis and shown similar differences in terms of functioning (Moreira, Inman, & Cloninger, 2020; Moreira, Inman, Cloninger, et al., 2020). Overall, these results demonstrate that adaptive human functioning is dependent on a healthy integration of the biopsychosocial processes underlying temperament and character, leading to a coherent personality (Cloninger, 2003).

### **The Present Study: Aims and Hypotheses**

The overarching objective of the present study was to describe how differences in personality relate to trait reactance. More specifically, we hoped to provide insights into how trait reactance can be conceptualized as an expression of interacting biopsychosocial systems. Considering the complex and hierarchical structure of personality (Zwir et al., 2019), we aimed to (1) identify groups of adolescents with distinct multi-trait temperament and character profiles, and then (2) use these profile

memberships to identify clusters of adolescents occupying joint temperament-character networks. For both profiles and networks, we explored differences in trait reactance as a function of personality. Because past research suggests behavioral and verbal expressions of reactance may be relatively distinct constructs (Dowd et al., 1991), we explored how adolescents with distinct personalities varied in both behavioral and verbal reactance. To complement this, we also explored how adolescents with distinct personalities varied in an independent measure of 'global' trait reactance (the HPRS).

We had some tentative expectations about the type of latent classes that would emerge from the analyses (Moreira, Inman, & Cloninger, 2020; Moreira, Inman, Cloninger, et al., 2020; Zvir et al., 2019b), but we did not make explicit hypotheses because the results are sample dependent. However, we expected that the emergent classes would present differences in trait reactance. Given past research, we expected that a combination of high novelty seeking and low persistence, and unhealthy character profiles would be linked to higher reactance (Cloninger, 2004; Inman et al., 2019; Zvir et al., 2018a). We also hypothesized that adolescents occupying phenotypic networks implying high emotional reactivity, due to poor regulation of temperamental conflicts, and low self-awareness (i.e. personality incoherence) would have the highest scores for trait reactance.

## **Method**

### **Participants**

To maximize the representativeness of our adolescent sample, we recruited individuals aged between 12 and 18 years from several schools in Portugal. Schools were recruited using a convenience sampling strategy. Within participating schools, all students between the ages of 12 and 18 were offered the opportunity to participate in the study. Prior to data collection, we estimated the required sample size for our planned analyses (primarily between-subjects ANOVAs with up to 8 independent

groups) using G\*Power. Alpha was set at .05 and power ( $1-\beta$ ) was set at .90.

Anticipating a medium effect size ( $f = .25$ ), the determined total sample size was 304 individuals. Anticipating a small effect size ( $f = .10$ ), the determined total sample size was 1,840 individuals. Thus, we chose to maximize power by aiming to recruit roughly this number of participants.

In total, 1,842 adolescent students from six schools in the North of Portugal participated in the study. For the analysis, we excluded five participants from the original sample for having more than 85% missing data for at least one of the study measures. Thus, the final sample for the study comprised 1,837 adolescents, of which 977 (53.2%) were female. Individuals included in the sample were aged between 12 to 18 years ( $M = 15.5$ ,  $SD = 1.8$ ), corresponding to students enrolled in the 5<sup>th</sup> to 12<sup>th</sup> grades of school. Most adolescents were Portuguese (98%) and of those who were not, most were either Brazilian or from other European countries.

### **Ethical Issues**

The study was granted ethical approval from the Universidade Lusíada-Norte ethics committee. All participants gave informed consent to participate and were made aware that they could withdraw from the study at any point, without consequence. To be eligible for participation, adolescents under the age of 18 required written consent from a parent/legal guardian.

### **Study Design & Measures<sup>2</sup>**

In addition to providing basic demographic information (student gender, age, nationality, etc.), all participants completed a series of self-report questionnaires. Because these measures were completed at one moment in time, the study had a cross-sectional design.

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<sup>2</sup> The study was not preregistered.

### ***Junior Temperament and Character Inventory (JTCI)***

Participants completed a validated Portuguese translation of the JTCI (original by Luby et al., 1999) as a measure of the temperament and character dimensions outlined by Cloninger's biopsychosocial model of personality. This version of the JTCI has 127 items, each scored on a five-point scale from 1 (*completely false*) to 5 (*completely true*). Several items require reverse coding so that higher scores reflect elevations in the personality dimension. A psychometric assessment of the Portuguese JTCI provides evidence that this scale has construct validity (Moreira et al., 2012). In the study sample, values for ordinal omega ( $\omega$ ; Gadermann, Guhn, & Zumbo, 2012) across the JTCI dimensions were: novelty seeking = .82, harm avoidance = .77, reward dependence = .73, persistence = .83, self-directedness = .81, cooperativeness = .88 and self-transcendence = .78.

### ***Hong Psychological Reactance Scale (HPRS)***

Participants also completed the 14-item Portuguese version of the HPRS (original by Hong & Page, 1989). Past studies show the HPRS has adequate psychometric properties (e.g. Brown et al., 2011; Hong & Faedda, 1996; Yost & Finney, 2018), including in Portuguese samples (Moreira, Cunha, & Inman, 2020). HPRS items are scored on a five-point scale from 1 (*completely disagree*) to 5 (*completely agree*). Items measure emotional responses, reactance to compliance, resisting influence from others, and reactance to advice (example item: "Regulations trigger a sense of resistance in me"). Despite multidimensionality, recent studies suggest a total HPRS score is interpretable as a measure of a unidimensional global reactance construct (Moreira, Cunha, & Inman, 2020). Hence, for the purpose of this study, we summed responses across items. In the study sample,  $\omega$  for the HPRS global reactance score was .82. The average ICC across items was .05, implying little variation in HPRS scores was explained at the school level.

### ***Therapeutic Reactance Scale (TRS)***

We also administered a Portuguese translation of the TRS (Dowd et al., 1991). This scale has 28 items, each scored from 1 (*completely disagree*) to 4 (*completely agree*). Nine items required reverse coding so that high scores reflect increased reactance (example item: “I often follow the suggestions of others”). Authors have proposed various competing factor structures for the TRS (Buboltz et al., 2002; Inman et al., 2019), although we considered the original two-factor structure for the TRS (Dowd et al., 1991), which captures expressions of reactance in observable behaviors (Behavioral reactance; example item: “If I am told what to do, I often do the opposite”) and verbal expressions of reactance (Verbal reactance: example item: “I find that I often have to question authority”). Studies have shown the TRS has construct validity (Dowd & Wallbrown, 1993; Dowd et al., 1994; Graybar, Antonuccio, Boutilier, & Varble, 1989) and internal consistency (Dowd et al., 1991). We calculated two scale scores to capture these distinct aspects of reactance. In the study sample,  $\omega$  values were .75 (behavioral reactance) and .70 (verbal reactance). The average ICC across the TRS items was .04, indicating that little variation in TRS scores could be explained at the school level.

### **Data Analysis**

All analyses were conducted using R (R Core Team, 2019). The data that support the findings of this study and supporting R code are available at <https://osf.io/x2u9k/>.

### **Missing Data**

For the JTCL, 71% of participants had no missing data and 94% had < 2 missing items. The number of missing responses per item ranged from 3 to 25. For the HPRS, 92% of participants had no missing data and 99% had < 2 missing items. The number of missing responses per item ranged from 3 to 36. For the TRS, 85% of participants



had no missing data and 98% had < 2 missing items. The number of responses per item ranged from 5 to 30. For all measures, missing data were imputed using Multiple Imputation using Chained Equations (*mice*; Buuren & Groothuis-Oudshoorn, 2011).

### ***Person-Centered Analysis***

First, we used latent profile analysis (LPA) to reduce the full sample into subgroups of adolescents characterized by (a) shared temperament profiles, and then (b) shared character profiles. We conducted LPA using the *tidyLPA* package (Rosenberg, Beymer, Anderson, & Schmidt, 2018). LPA was appropriate because adolescents' mean scores for each of the temperament and character dimensions of the JTCl represent continuous variables. Second, we used latent class analysis (LCA) to reduce the full sample into subgroups of adolescents characterized by shared temperament-character profile combinations. We conducted LCA using the *depmixS4* package (Visser & Speekenbrink, 2010). LCA was appropriate because adolescents' temperament and character profiles represent categorical variables. In all cases, the optimum number of latent profiles/classes was determined by comparing the fit of a series of models with increasing numbers of classes. For the character LPA, there was theoretical reason to anticipate as many as eight profiles (Cloninger, 2004), and we, therefore, analyzed models with between 1 and 8 classes. We anticipated fewer profiles for the temperament LPA (Moreira, Inman, Rosa, et al., 2020; Rettew et al., 2008) and integrated temperament-character LCA (Zwir et al., 2019a), so analyzed models with between 1 and 5 classes. Model fit was compared using the Akaike Information Criterion (AIC; Akaike, 1974) and Bayesian Information Criterion (BIC; Schwarz, 1978). Participants were assigned to classes based on the probability of membership, and these classes were then treated as independent groups. After classifying participants into profiles, we conducted ANCOVAs to test differences in reactance after controlling for student age and student gender.

## **Results**

## **Descriptive Statistics**

Table 1 presents descriptive statistics for the JTCl dimensions, the HPRS total score, and the TRS subscales. It also presents the correlations between the study measures and age and gender. These coefficients showed that older adolescents had a weak tendency to be more reactive than younger adolescents. There was also an indication that males were more reactive than females, although this association was weak.

## **JTCl Profiles and Reactance**

### ***Temperament Profiles***

LPA model fit indices (AIC, BIC, SABIC, and entropy) favored a five-profile model (see Supplementary Table S1 for values). Temperament z scores for the five profiles are shown in Figure 1 (Panel A).

- **Adventurous ( $n = 53$ ).** The smallest subgroup of adolescents was characterized by high novelty seeking ( $z = 2.18$ ), and low persistence ( $z = -1.21$ ), and harm avoidance ( $z = -1.30$ ). In keeping with the classical descriptors used by Cloninger we assigned the label 'adventurous'.
- **Disengaged ( $n = 872$ ).** The largest subgroup consisted of adolescents with modest elevations in novelty seeking ( $z = 0.49$ ), and moderately low reward dependence ( $z = -0.39$ ) and persistence ( $z = -0.69$ ). Because of its similarity to the disengaged profile identified by Rettew et al. (2008), we adopted the same label.
- **Passionate ( $n = 79$ ).** A small number of adolescents had a temperament profile characterized by high novelty seeking ( $z = 0.74$ ), reward dependence ( $z = 0.63$ ), and persistence ( $z = 0.83$ ), and low harm avoidance ( $z = -1.76$ ). The label for this dimension was also based on Cloninger's terms.
- **Steady ( $n = 716$ ).** The second largest subgroup comprised adolescents with moderately low novelty seeking ( $z = -0.55$ ) and moderately high persistence ( $z =$

0.57). Because of its similarity to the steady profile identified by Rettew et al. (2008) we adopted the same label.

- **Extreme-steady ( $n = 117$ ).** This smaller subgroup of adolescents had an extreme version of the steady profile; i.e. low novelty seeking ( $z = -1.77$ ) and high persistence ( $z = 1.70$ ) and reward dependence ( $z = 0.80$ ).

These temperament profiles differed significantly in average age,  $F(4, 1832) = 8.92$ ,  $p < .001$ ,  $\omega^2 = .02$ . Post-hoc comparisons showed that the extreme-steady profile was significantly younger ( $M = 14.77$  years,  $SD = 1.92$ ) than the adventurous ( $M = 15.79$  years,  $SD = 1.67$ ), disengaged ( $M = 15.70$  years,  $SD = 1.67$ ), and steady profiles ( $M = 15.44$  years,  $SD = 1.82$ ). The temperament profiles also differed in their gender compositions,  $\chi^2(4) = 37.39$ ,  $p < .001$ . Notably, the steady and extreme-steady profiles contained mostly girls (60% and 66% female respectively), whereas the adventurous profile contained mostly boys (43% female). The disengaged and passionate profiles were more evenly distributed (47% and 48% female respectively).

A series of ANCOVAs tested the main effect of temperament profile on HPRS global reactance, TRS behavioral reactance, and TRS verbal reactance after controlling for the effects of age and gender (see Table 2). For all three dependent variables, the main effect of temperament profile was statistically significant, with the largest observed effect for TRS behavioral reactance ( $\omega^2 = .21$ ). Differences in reactance between temperament profiles are illustrated in Figure 1. Profiles sharing the same letters were not significantly different. An inspection of these plots reveal that adolescents with an adventurous temperament tended to be the most reactive, and those with extreme-steady temperament tended to be the least reactive. Adolescents with a passionate temperament also showed high verbal reactance but roughly average behavioral reactance.

### **Character Profiles**

LPA model fit indices favored several different models (see Supplementary Table S2). Because the five-, six-, seven-, and eight-profile models differed little in AIC, BIC and SABIC, we chose the model from this selection with the greatest entropy (seven-factor model). Character z scores for these seven profiles are shown in Figure 2 Panel A. Labels for these profiles were similar to traditional labels used by Cloninger (Cloninger, 2004; Cloninger & Zohar, 2011). There were four profiles of adolescents with relatively adaptive personalities. Adolescents with a *creative* profile ( $n = 283$ ) had elevations for the character dimensions. Adolescents with an *organized* ( $n = 87$ ) profile had high self-directedness and cooperativeness but were low in self-transcendence. Adolescents with a *fanatical* ( $n = 16$ ) profile had high self-directedness and self-transcendence, but low cooperativeness. Adolescents with a *moody* ( $n = 396$ ) profile were average in terms of self-directedness but had elevated cooperativeness and self-transcendence. A large group of adolescents ( $n = 565$ ) had close to average values for self-directedness, and slightly decreased cooperativeness and self-transcendence. Based on these characteristics, we refer to this as the *bossy* profile. There were also two profiles of adolescents with relatively maladaptive personalities. Those with a *disorganized* ( $n = 180$ ) profile were not well self-directed but had high self-transcendence and average cooperativeness. Finally, adolescents with an *apathetic* profile ( $n = 310$ ) had low values for all three aspects of character development.

Character profiles did not differ in terms of their average age,  $F(6, 1830) = 1.10$ ,  $p = .357$ . There were significant differences in the distribution of males and females,  $\chi^2(6) = 37.78$ ,  $p < .001$ . The apathetic and fanatical profiles contained mostly boys (43% and 37% female respectively) whereas the moody and organized profiles contained mostly girls (63% and 61% female respectively). The disorganized (56% female), bossy (50% female), and creative (57% female) profiles were more evenly distributed.

Table 2 shows summaries from a series of ANCOVAs testing the main effect of character profile on HPRS global reactance, TRS behavioral reactance, and TRS verbal reactance after controlling for the effects of age and gender. For all three dependent variables the main effect of character profile was significant, although the magnitudes of these effects were small compared to the effects observed for temperament profile ( $\omega^2 = .05, .10, \text{ and } .03$ ). Differences in reactance between character profiles are illustrated by the box plots in Figure 2 (Panels B, C, and D). An inspection of these plots revealed an elevation in reactance in adolescents with a fanatical character profile. Another finding was that adolescents with the adaptive organized and creative personalities had lower behavioral reactance than adolescents with the maladaptive apathetic, disorganized, and bossy personalities. In contrast, adolescents with the adaptive creative personalities had higher verbal reactance than adolescents with the maladaptive apathetic and disorganized personalities.

### ***Integrated Temperament-Character Networks***

The AIC and BIC model fit indices for LCA favored a three-class model (Supplementary Table S3). SABIC was lowest for the five-class model, but because the numerical difference between the three- and five-class models was small, we selected the three-class model. Figure 3 Panel A illustrates the composition of these integrative profiles. In the first profile ( $n = 770$ ), 91% of adolescents had an adventurous or disengaged temperament profile, and 90% had a maladaptive apathetic, disorganized, or bossy character profile. Because these people were emotionally reactive and maladapted, with a typically unreliable temperament style (high novelty seeking and low persistence), we adopted the label used by Zwir et al. (2019): The *Emotional-Unreliable* profile. In a second profile ( $n = 360$ ), 81% of the adolescents had a typically reliable temperament (steady or extreme-steady profile), and over half (56%) had a creative character profile, with most of the remainder with an organized character (23%). Hence, consistent with Zwir et al. (2019), this integrated profile was labelled the

*Creative-Reliable* profile. In the third profile ( $n = 707$ ), most students had a steady temperament (63%), although the profile included disengaged temperaments (32%), and most had a bossy (45%) or moody (39%) character. Because these people tended to have a reliable temperament style but only moderately developed self-regulation, we labelled this profile the *Emotional-Reliable* profile.

The composition of males and females differed across these integrated profiles,  $\chi^2(2) = 34.56, p < .001$ . Specifically, the emotional-unreliable profile contained mostly boys (46% female), while the emotional-reliable and creative-reliable profiles contained mostly girls (60% and 58% respectively). There were also significant differences in age,  $F(2, 1834) = 3.39, p = .034, \omega^2 = .00$ , although the size of the effect suggested this difference was not practically relevant.

As is indicated in Table 2, the effects of profile on HPRS global reactance, TRS behavioral reactance, and TRS verbal reactance were statistically significant. This effect was largest for TRS behavioral reactance ( $\omega^2 = .13$ ). The magnitude of the effect for TRS verbal reactance was below what can be considered a practically significant effect ( $\omega^2 < .01$ ). Panel B of Figure 3 presents the differences in reactance across the three integrated temperament-character profiles. For HPRS global reactance and TRS behavioral reactance adolescents with an emotional-unreliable profile had higher scores than those with a creative-reliable profile. In contrast, for TRS verbal reactance, adolescents with an emotional-unreliable profile had lower scores than those with a creative-reliable profile.

## Discussion

Trait reactance is an important individual difference to consider by those working with adolescents. Trait reactance is a key moderator of therapeutic success (Shoham et al., 2004) and has a role in influencing how adolescents react to important health messages (Dillard & Shen, 2005; Miller & Quick, 2010). Despite its relevance for human functioning, past works have had little to say about how structural differences in

personality relate to trait reactance. The current study addressed this issue by showing how adolescents with distinct personality characteristics, reflecting distinct organizations of psychobiological systems, differ in trait reactance. Because personality is organized at different levels of complexity (Zwir et al., 2019), we examined differences in trait reactance as a function of multi-trait temperament and character profiles, and then joint temperament-character networks. By doing so, we contribute to current knowledge by indicating which psychobiological processes may underly adolescents' proneness for negative emotions and cognitions when freedoms are threatened (i.e. trait reactance). Specifically, by testing differences in reactance as a function of profiles and networks we were able to uncover the independent influences of emotional dispositions (temperament) and socio-cognitive processes (character) on the expression of psychological reactance, as well as the effect of personality coherence.

### **Differences in Reactance across Multi-Trait Temperament and Character Profiles**

A first finding of the study was the identification five latent temperament profiles. Notably, three of these temperament profiles were similar to those identified in numerous past studies using independent samples of adults and adolescents (Moreira, Inman, & Cloninger, 2020; Moreira, Inman, Cloninger, et al., 2020; Moreira, Inman, Rosa, et al., 2020; Rettew et al., 2008; Zwir et al., 2018b). Given the large sample size, it was unsurprising that our analyses also revealed two additional, less-common, temperamental styles. The adventurous profile was like the disengaged profile (with high novelty seeking and low persistence) but differentiated by lower harm avoidance and more extreme novelty seeking. These adolescents have a tendency to be more impulsive, more comfortable with taking risks, and more readily discouraged and apathetic than those with the more common disengaged profile. The passionate profile was also characterized by high novelty seeking and low harm avoidance, but these adolescents had a tendency to be more sentimental and sociable, and more ambitious.

Overall, we found that adolescents with an adventurous or passionate temperament profile tended to have the highest levels of reactance. In contrast, adolescents with a steady-type profile, and particularly the extreme version of this profile, tended to have the lowest levels of reactance. Because these differences in reactance appeared to mirror the level of novelty seeking present in the profile, this finding implies that reactance is intricately linked to adolescents' temperamental tendencies for behavioral activation. This results makes intuitive sense given that adolescents who are high in novelty seeking are characterized as impulsive, excitable, unpredictable, and quick-tempered (Cloninger, 1987), and corresponds to past studies that have identified positive correlations between trait reactance and novelty seeking (Inman et al., 2019). However, it was also evident that the disengaged and passionate profiles, despite having similar levels of novelty seeking, differed in reactance (most notably for the verbal oppositional style). Indeed, the passionate profile had higher reactance than the disengaged profile even though it had some characteristics of the steady-type profiles; namely high reward dependence and persistence. This result highlights that individual differences in reactance are an expression of interacting temperament dimensions, despite the strong influence of novelty seeking. In other words, the proneness of adolescents to experience reactance varies systematically as a function of the heritable dispositional tendencies for temperament profiles that shape emotional tendencies. This aligns with current conceptualizations of reactance that include an affective component (Dillard & Shen, 2005; Quick & Stephenson, 2007a; Rains & Turner, 2007).

We also identified seven latent distinct character profiles. These were broadly consistent with theoretically predicted character configurations (Cloninger, 2004; Cloninger & Zohar, 2011) and profiles identified by similar methods in past studies (Zwir et al., 2018a). Within our sample, we identified adolescents with unhealthy characters, the most unhealthy being the apathetic profile with low levels for all dimensions, and adolescents with healthy characters, the most healthy being the



creative profile. Research shows constantly that people with an apathetic profile are typically unhappy, maladaptive, and dissociated from others, while those with a creative profile are typically happy, tolerant, empathic, and spiritual (Cloninger, 2004). Consistent with this literature, we found a general trend of higher reactance scores for the least healthy personalities and lower scores for the most healthy personalities. Most adolescents with an apathetic character had higher than average behavioral reactance while most adolescents with an organized or creative character had lower than average behavioral reactance. This finding indicates that trait reactance, and particularly its behavioral expression, is a phenotypic characteristic of an unhealthy personality, reflecting poor sociocognitive resources for mental self-government. This aligns with current understanding that the construct of reactance includes negative cognitions (Dillard & Shen, 2005; Quick & Stephenson, 2007a; Rains & Turner, 2007).

### **Differences in reactance across multi-trait temperament and character profiles**

A major contribution of the present study is that it recognizes a) that personality is organized at different levels of descriptive complexity, and therefore b) that genetically independent temperament and character profiles are integrated into complex adaptive networks via genetic-environment interactions (Zwir et al., 2019). These joint networks capture differences in how individuals learn to shape and adapt to their internal and external environments via the integrated configuration of three systems of learning and memory. We identified three of such networks that were sufficiently similar to those described by Zwir et al (2019) to share the same label: the emotional-unreliable network (poorly regulated an unreliable temperament and low self-awareness), the emotional-reliable network (adequate self-government of temperament but low self-awareness), and the creative-reliable network (adequate self-government of temperament and developed self-awareness). Comparing these networks, we found that the emotional-unreliable network had the highest level of global reactance (as measured by the HPRS) and TRS behavioral reactance, while the creative-reliable

network had the lowest level for these measures. These results align with research that shows certain combinations of temperament and character (namely an adventurous temperament and unhealthy character) are linked to personality disorders characterized by oppositional (reactive) behaviors (Svrakic, Whitehead, Przybeck, & Cloninger, 1993). Moreover, because reactance was most associated with an integrative network theoretically and empirically considered an incoherent personality, and least associated with a network considered to be representative of a coherent personality (Cloninger, 2004, 2013; Cloninger & Cloninger, 2020; Zvir et al., 2019b), our results suggest that reactance, and particularly behavioral reactance, is an expression of an personality coherence; that is, the extent to which the mind functions as a unified integrative system (Cloninger, 2003). Notably, the pattern of results for TRS verbal reactance indicate that a verbal oppositional style may be an expression of reactance in a healthy personality (although the size of the effect was small). We shall consider this finding in more detail in the following section.

### **Verbal versus Behavioral Reactance**

Although reactance is often conceptualized and scored as a unidimensional construct, the TRS includes two subscales that capture a behavioral versus verbal style of reactance. Past research indicates that these aspects of reactance are related yet also relatively distinct (Dowd et al., 1991), and we were therefore interested whether they had different patterns of association with personality. As described above, adolescents with the most healthy characters (creative and organized profiles) tended to have higher TRS verbal reactance than those with the least healthy character (apathetic profile); the opposite pattern than observed for behavioral reactance. While the magnitude of the main effect of character profile on verbal reactance was too small to be considered of practical significance (Ferguson, 2009), this result reveals an important distinction between these two expressions of reactance. Theoretically, it should be relatively easy for adolescents in the creative-reliable network to control and regulate behavioral expressions of reactance, particularly those that may be socially

inappropriate, due to mature and adaptive organizations of sociocognitive processes, and thus superior mental self-government. Moreover, these mature cognitive abilities mean that these adolescents may be more likely to express reactance more abstractly (i.e. in the form of language). In short, this finding suggests that adolescents' tendencies for verbal versus behavioral reactance are dependent on individual differences in personality coherence (Cloninger, 2003).

### **Study Limitations**

The first limitation of the study was that the measures of personality and trait reactance were all self-reported. This type of data is susceptible to biases that can misconstrue the true nature of relationships between variables. Future studies will benefit from considering alternative sources of information, such as parent-reports, or by controlling for bias, such as by including measures of social-desirability response bias (van de Mortel, 2008). Second, it is important to acknowledge that the sample, despite being large and capturing a relatively broad age range (including students aged 12 to 18 from multiple different schools), was acquired using a non-probabilistic sampling technique. This aspect of the design should be considered a limitation to generalizability and encourage replications in independent samples, both within Portugal and other cultural contexts.

### **Practical Implications**

The study provides a more nuanced understanding of individual differences in reactance, including in the specific style of opposition (e.g. behavioral versus verbal) and the possible psychobiological roots of these differences. These findings have implications for understanding adolescent functioning in various contexts.

From a preventive perspective, our study suggests that a systematic approach to the promotion of healthy personality development is warranted if we want to prevent reactance and its negative consequences, especially in vulnerable and at-risk populations. Such a systematic promotion of healthy personality development requires that the educational system assume its responsibility in promoting individuals' holistic

development, rather than logical-propositional learning only. This implies that schools become person-centered schools (Moreira & Garcia, 2019), intentionally planning and implementing systematic strategies for the promotion of healthy personality development, such as the promotion of social and emotional skills. The development of these psychological resources is crucial for the development of higher-order self-regulatory socio-cognitive processes that mediate the expression of dysregulated responses, including reactance.

From a treatment point of view, our results support classic works on systematic treatment selection and on prescriptive psychotherapies which highlight the efficacy of psychotherapy interventions depends on the matching between patients' non-diagnostic characteristics (e.g., personality) and treatment characteristics (Beutler, Edwards, & Someah, 2018). Our results suggest that personality needs to be considered in assessment and when planning the treatment approach (from treatment modality to therapeutic relation, such as deciding on directedness vs. support). This is also pertinent to medical treatment where reactant adolescents are substantially more likely to fail treatment than non-reactant adolescents (Lowenthal et al., 2020). Especially in more vulnerable populations, the prescription of treatment needs to include interventions aimed at avoiding the activation of negative thoughts and emotions and promoting the development of self-regulatory processes and adaptive locus of control. Moreover, understanding personality differences underlying behavioral and verbal reactance will help clinicians identify people more at risk of expressing reactance in a behavioral manner (e.g., by stopping taking medication) and, therefore, include appropriate interventions.

Our results are also relevant for communication sciences. Communication strategies need to take into consideration how individual differences in personality relate to different reactance responses (verbal or behavioral) so they can create communication messages and strategies that are targeted, and thus more effective. Finally, these results have implications at a societal level, particularly concerning

contemporary global issues, such as climate changes and sustainable development. Our results imply that societal change may benefit from promoting healthy personality development in adolescents, thus minimizing individual reactance to behavioral change (Cloninger, 2013).

## **Conclusions**

The study provides the first evidence that individual differences in trait reactance reflect structural differences in normal personality. Specifically, we found that unreliable temperament profiles, unhealthy character profiles, and integrative temperament-character networks indicative of personality incoherence were linked to elevated reactance (and particularly its behavioral expression). Thus, our study indicates that trait reactance is an expression of a maladaptive personality, which reflects emotional reactivity and immature sociocognitive resources.

## **Compliance with Ethical Standards**

### **Ethical Approval**

All procedures performed in studies involving human participants were following the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Experiment Participants** All procedures performed in studies involving human participants were following the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

### **Informed Consent**

Informed consent was acquired for each participant (in this case, from adolescents parents/legal guardians).

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Table 1.

*Descriptive statistics for the JTCI, HPRS, and TRS.*

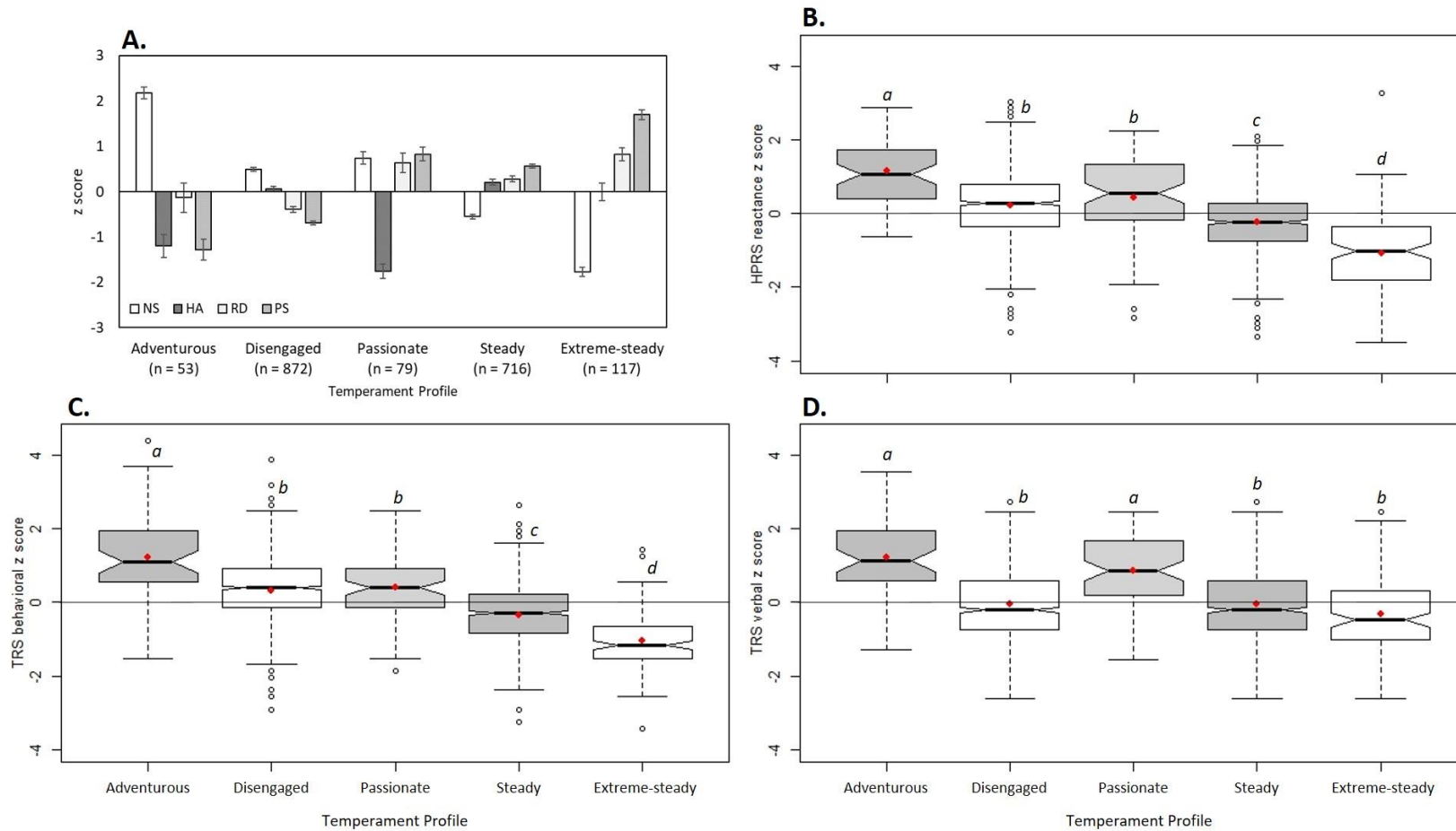
		Min	Max	<i>M</i>	<i>SD</i>	Skew	Kurtosis	Correlations ( <i>r</i> )	
								Age	Gender (♀ = 1)
JTCI									
	NS	1.30	4.39	2.90	0.47	-0.04	0.05	<b>.09</b>	<b>-.06</b>
	HA	1.21	4.68	2.82	0.46	-0.15	0.26	<b>.05</b>	<b>.19</b>
	RD	1.00	4.73	3.43	0.46	-0.09	0.28	.00	<b>.16</b>
	PS	1.61	5.00	3.35	0.52	0.05	-0.02	<b>-.17</b>	<b>.16</b>
	SD	2.29	4.96	3.60	0.42	0.11	-0.30	.01	.00
	CO	1.63	5.00	3.84	0.50	-0.35	0.13	-.03	<b>.18</b>
	ST	1.00	5.00	3.62	0.58	-0.24	0.29	.00	<b>.09</b>
HPRS		1.29	5.00	3.20	0.55	-0.14	0.27	<b>.14</b>	-.01
TRS		1.54	3.79	2.52	0.27	0.33	0.78	<b>.12</b>	<b>-.05</b>
Behavioral		1.18	3.82	2.34	0.34	0.18	0.47	<b>.08</b>	<b>-.07</b>
Verbal		1.91	4.00	2.80	0.34	0.31	-0.09	<b>.12</b>	.01

*Note.* JTCI = Junior Temperament and Character Inventory; HPRS = Hong Psychological Reactance Scale; TRS = Therapeutic Reactance Scale. NS = Novelty Seeking. HA = Harm Avoidance. RD = Reward Dependence. PS = Persistence. SD = Self-Directedness. CO = Cooperativeness. ST = Self-Transcendence. Correlation coefficients in **bold** are significant at  $p < .05$ .

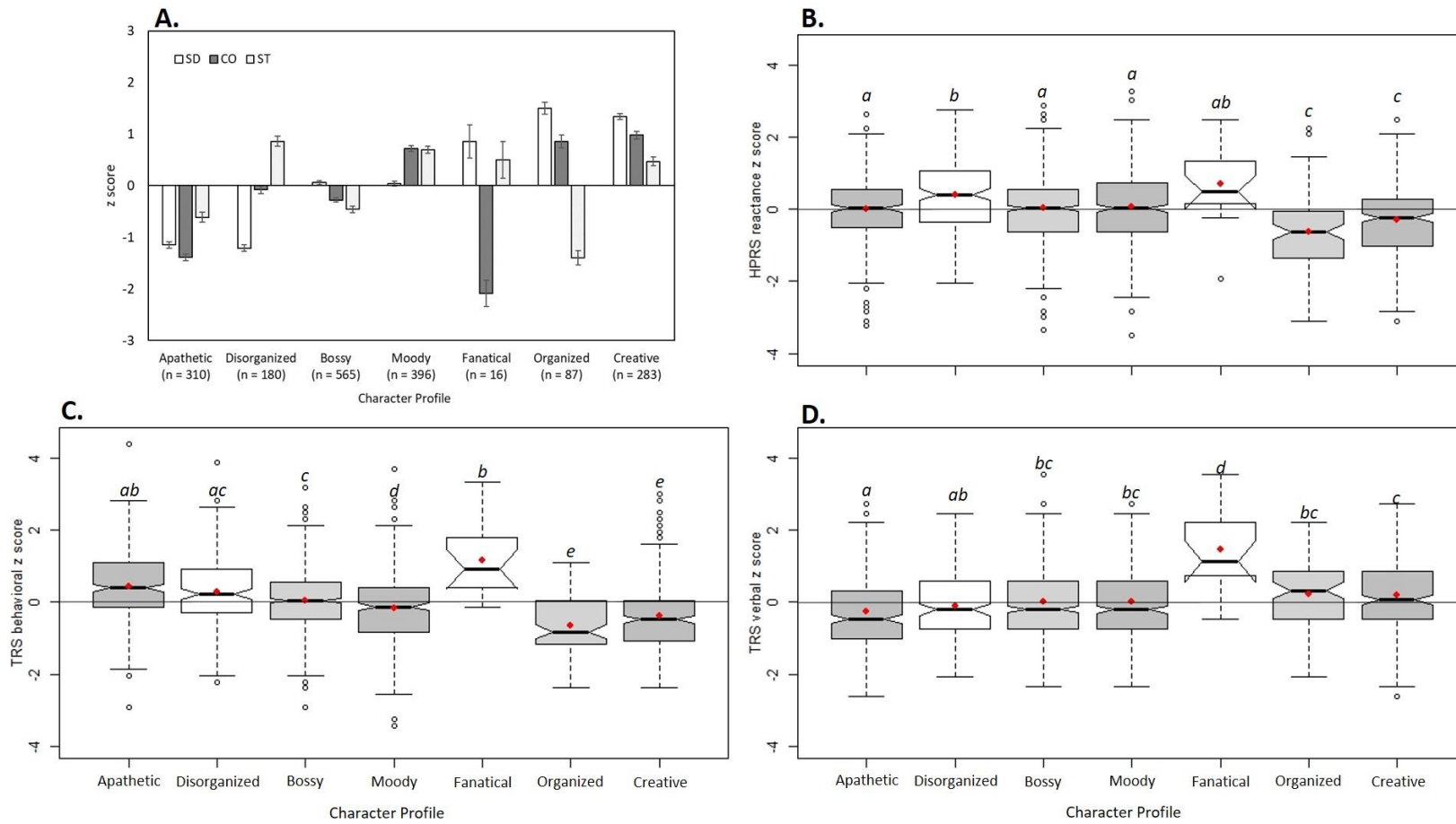
Table 2.

*Summary of ANCOVA outputs*

	HPRS global reactance				TRS behavioral reactance				TRS verbal reactance			
	<i>df</i>	<i>F</i>	<i>p</i>	$\omega^2$	<i>df</i>	<i>F</i>	<i>p</i>	$\omega^2$	<i>df</i>	<i>F</i>	<i>p</i>	$\omega^2$
Temperament												
Age	1	18.12	<.001	.02	1	1.62	.204	.01	1	25.45	<.001	.01
Gender	1	5.00	.025	.00	1	0.15	.702	.01	1	1.64	.201	.00
Profile	4	88.79	<.001	<b>.16</b>	4	124.52	<.001	<b>.21</b>	4	42.74	<.001	<b>.08</b>
Character												
Age	1	34.31	<.001	.02	1	12.66	<.001	.01	1	23.49	<.001	.01
Gender	1	0.02	.876	.00	1	2.77	.096	.01	1	0.07	.796	.00
Profile	6	17.62	<.001	<b>.05</b>	6	34.37	<.001	<b>.10</b>	6	11.71	<.001	<b>.03</b>
Combined												
Age	1	29.39	<.001	.02	1	7.20	.007	.01	1	27.95	<.001	.01
Gender	1	0.89	.345	.00	1	1.64	.201	.01	1	0.12	.734	.00
Profile	2	70.67	<.001	<b>.07</b>	2	135.06	<.001	<b>.13</b>	2	3.80	.023	.00



**Figure 1.** **A.** Temperament z scores for the five temperament profiles revealed by LPA. Error bars represent 95% CIs **B.** HPRS reactance z scores for the five temperament profiles. **C.** TRS behavioral reactance z scores for the five temperament profiles. **D.** TRS verbal reactance z scores for the five temperament profiles. Profiles sharing the same letters are not significantly different.



**Figure 2.** **A.** Character z scores for the seven character profiles revealed by LPA. Error bars represent 95% CIs **B.** HPRS reactance z scores for the seven character profiles. **C.** TRS behavioral reactance z scores for the seven character profiles. **D.** TRS verbal reactance z scores for the seven character profiles. Profiles sharing the same letters are not significantly different.

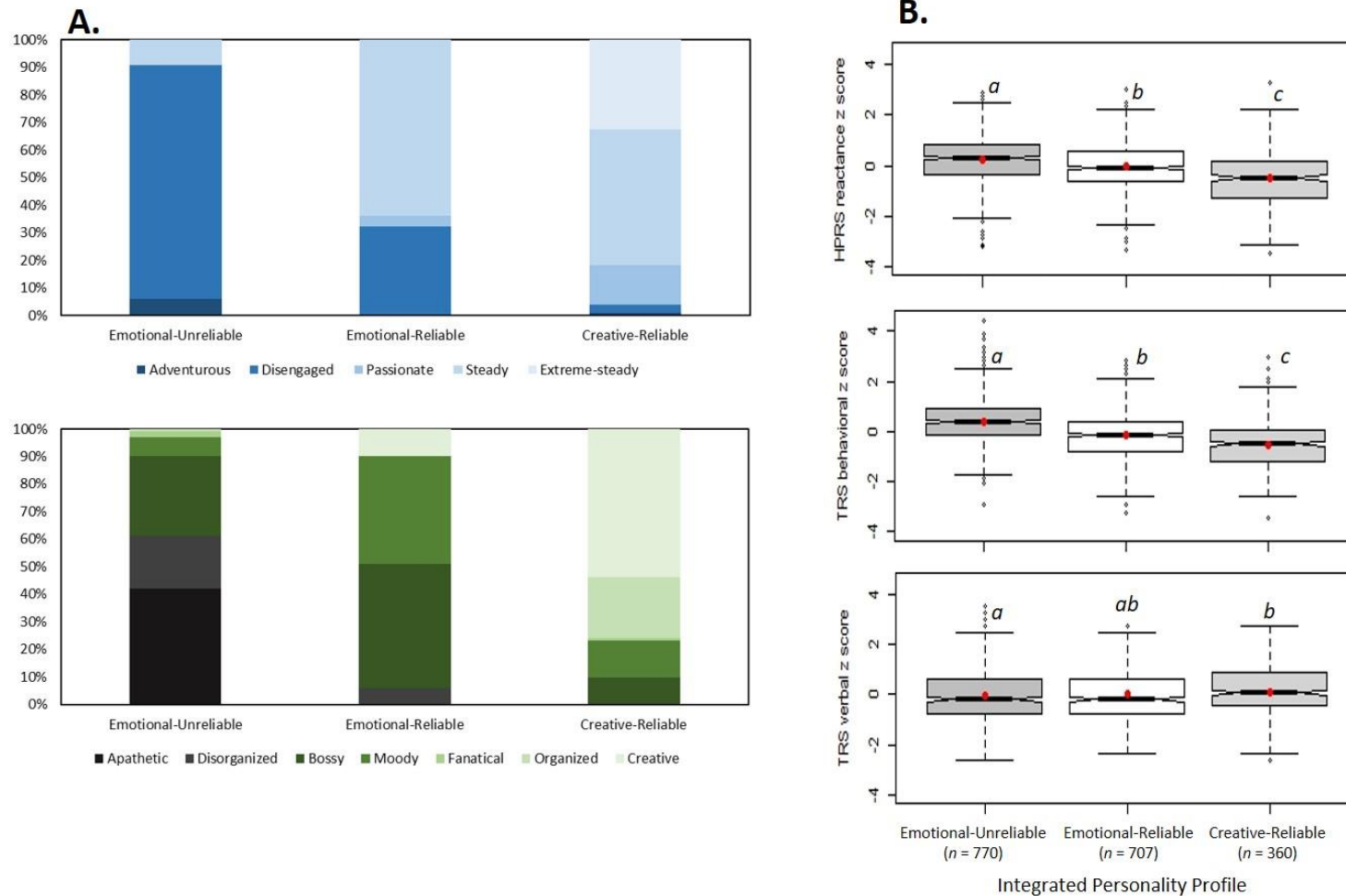


Figure 3. **A.** Composition of the three integrated temperament-character profiles revealed by LCA. **B.** Reactance z scores for the three integrated profiles.