Reactance and personality: assessing psychological reactance using a biopsychosocial and person-centered approach

Paulo A. S. Moreira1,2 • Richard A. Inman2 • C. Robert Cloninger3

Accepted: 16 December 2020 / Published online: 4 January 2021
© Springer Science+Business Media, LLC, part of Springer Nature 2021

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 = 1837) 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

Psychological Reactance Theory (PRT; Brehm 1966; Brehm and 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 and 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 and Shen 2005; Quick and Stephenson 2007a; Rains and 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 et al. 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 and Ryan 2008), particularly the needs for autonomy and competence (Grolnick et al. 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 et al. 2015) and that psychological control leads to increased emotional and behavioral problems in adolescents via reactance (Laird and 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 and Seibel 1990), and indeed processes linked to differentiation of the self significantly predict reactance (Johnson and 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 and McCrae 1992) suggest that openness, conscientiousness, and extraversion decrease from early adolescence before recovering in later adolescence (Gölner et al. 2017; Van den Akker et al. 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 et al. 2018). The finding that adolescence is a period of elevated impulsivity and emotional instability is further support by cross-sectional studies comparing older and younger adolescents (Moreira et al. 2012, 2015). 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 et al. 1991; Shoham et al. 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 and Shen 2005; Quick and 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 and 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 and Dowd 1999). Studies have shown that patients with higher trait reactance are less compliant with therapy (Seibel and Dowd 1999) and are at risk of worse prognoses (Beutler et al. 2002). Trait reactance has also been linked to antivaccination attitudes and beliefs (Finkelstein et al. 2020; Hornsey et al. 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 et al. 2010). For example, a recent meta-analysis has shown that high reactance individuals have better psychotherapy outcomes when therapists are less directive (Beutler et al. 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 et al. 2011; Hong and Faedda 1996; Hong and Page 1989; Moreira et al. 2020a, b, c, d; Thomas et al. 2001; Waris et al. 2020; Yost and Finney 2018) and Therapeutic Reactance Scale (TRS; Buboltz et al. 2002; Dowd et al. 1991; Inman et al. 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 and 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 and 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 and Wallbrown 1993; Dowd et al. 1994). In a study of psychotherapy clients, individuals with obsessive-compulsive or borderline personality disorders reported the highest trait reactance (Seibel and 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 and McCrae 1992). Specifically, trait reactance was negatively correlated with agreeableness \( r = -0.47 \), and positively, albeit weakly, correlated with neuroticism \( r = 0.14 \) and openness to experience \( r = 0.19 \; \text{Seemann et al. 2005; Yost and Finney 2018}. \) 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 and Lee 2007; Cloninger et al. 1993) because it relies on linear factor analysis to derive personality factors from lexical terms (Veselka et al. 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 et al. 2000). Because theories based on evidence from behavioral genetics, neurobiology, and psychology allow for a more comprehensive understanding of the structure of personality (Munafo and 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, b, 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 et al. 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. 2019a, b). 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 and Zwir 2018; Zwir et al. 2018a, b, 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 and Zwir 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 (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 et al. 2020a, b, c, d; Rettew et al. 2008; Thomas et al. 1968; Zwir et al. 2018b). Distinct character profiles have also been identified in several studies. Recently, Zwir 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 and Zohar 2011; Moreira et al. 2015; Moreira et al. 2020a, b, c, d; Zwir et al. 2018a). In turn, unhealthy characters are linked to increased risk of personality disorders (Svrakic et al. 1993).

Joint Temperament-Character Networks An important recent discovery was that peoples’ genetically distinct temperament and character profiles are integrated via genetic-environment interactions (Zwir et al. 2019a, b). 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 et al. 2020a, b, c, d). 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. 2019a, b), 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 et al. 2020a, b, c, d; Zwir 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; Zwir 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-β) 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 1840 individuals. Thus, we chose to maximize power by aiming to recruit roughly this number of participants.

In total, 1842 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 1837 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 5th to 12th 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**

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.

**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 (ω; Gadermann et al. 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 and Page 1989). Past studies show the HPRS has adequate psychometric properties (e.g. Brown et al. 2011; Hong and Faedda 1996; Yost and Finney 2018), including in Portuguese samples (Moreira et al. 2020a, b, c, d). 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 et al. 2020a, b, c, d). Hence, for the purpose of this study, we summed responses across items. In the study sample, ω 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.

---

2 The study was not preregistered.
(Buboltz et al. 2002; Inman et al. 2019), although we consid-
ered 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 and Wallbrown 1993; Dowd et al.
1994; Graybar et al. 1989) and internal consistency (Dowd
et al. 1991). We calculated two scale scores to capture these
distinct aspects of reactance. In the study sample, ω 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 JTCI, 71% of participants had no miss-
ing data and 94% had <2 missing items. The number of miss-
ing 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; van Buuren and 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 con-
ducted LPA using the tidyLPA package (Rosenberg
et al. 2018). LPA was appropriate because adolescents’
mean scores for each of the temperament and character
dimensions of the JTCI 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
and Speekenbrink 2010). LCA was appropriate becauseadolescents’ 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 an-
alyzed 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 member-
ship, 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 JTCI di-
ensions, the HPRS total score, and the TRS subscales. It
also presents the correlations between the study mea-
sures 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.

JTCI 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 Fig. 1 (Panel A).

- **Adventurous (n = 53).** The smallest subgroup of adoles-
cents was characterized by high novelty seeking (z =
2.18), and low persistence (z = −1.21), and harm avoid-
ance (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 similar-
ity 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 seek-
ing (z = 0.74), reward dependence (z = 0.63), and persis-
tence (z = 0.83), and low harm avoidance (z = −1.76). The
label for this dimension was also based on Cloninger’s
terms.
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.

- **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

### Table 1

| | Min | Max | M  | SD  | Skew | Kurtosis | Age  | Gender (♀ = 1) |
|---|-----|-----|----|-----|------|----------|------|----------------|
| JTCI |    |     |    |     |      |          |      |                |
| NS | 1.30 | 4.39 | 2.90 | 0.47 | -0.04 | 0.05 | .09 | -0.06 |
| HA | 1.21 | 4.68 | 2.82 | 0.46 | -0.15 | 0.26 | .05 | .19 |
| RD | 1.00 | 4.73 | 3.43 | 0.46 | -0.09 | 0.28 | .00 | .16 |
| PS | 1.61 | 5.00 | 3.35 | 0.52 | 0.05 | -0.02 | -.17 | .16 |
| 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 | .18 |
| ST | 1.00 | 5.00 | 3.62 | 0.58 | -0.24 | 0.29 | .00 | .09 |
| HPRS | 1.29 | 5.00 | 3.20 | 0.55 | -0.14 | 0.27 | .14 | -.01 |
| TRS | 1.54 | 3.79 | 2.52 | 0.27 | 0.33 | 0.78 | .12 | -.05 |
| Behavioral | 1.18 | 3.82 | 2.34 | 0.34 | 0.18 | 0.47 | .08 | -.07 |
| Verbal | 1.91 | 4.00 | 2.80 | 0.34 | 0.31 | -0.09 | .00 | .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 \( p < .05 \)

**Fig. 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.
significant 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 Fig. 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 Fig. 2 Panel A. Labels for these profiles were similar to traditional labels used by Cloninger (Cloninger 2004; Cloninger and Zohar 2011).

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

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 Fig. 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. (2019a, b): 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. (2019a, b), 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 Fig. 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 and Shen 2005; Miller and 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. 2019a, b), 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 et al. 2020a, b, c, d; 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 result 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 and Shen 2005; Quick and Stephenson 2007a; Rains and Turner 2007).

We also identified seven latent distinct character profiles. These were broadly consistent with theoretically predicted character configurations (Cloninger 2004; Cloninger and 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 socio-cognitive resources for mental self-government. This aligns with current understanding that the construct of reactance includes negative cognitions (Dillard and Shen 2005; Quick and Stephenson 2007a; Rains and 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. 2019a, b). 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. (2019a, b) 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 et al. 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 and Cloninger 2020; Zwir 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 socio-cognitive 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, 2006).

**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 and 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 et al. 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.

**Supplementary Information** The online version contains supplementary material available at [https://doi.org/10.1007/s12144-020-01310-1](https://doi.org/10.1007/s12144-020-01310-1).

**Data Availability Statement** The data that support the findings of this study are openly available in OSF at [https://osf.io/nyb8](https://osf.io/nyb8).

**Funding** 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-BIUID/PSI/04375/2019 and PTDC/MHC-CED/2224/2014.

**Compliance with Ethical Standards**

**Conflict of Interest Disclosure** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Also, Paulo Moreira, Richard Inman and C. Robert Cloninger declare that they have no conflicts of interest.

**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).

**References**

Akaike, H. (1974). A new look at the statistical model identification. In Selected papers of Hirotugu Akaike (pp. 215–222). New York: Springer.

Ashton, M. C., & Lee, K. (2007). Advantages of the HEXACO model of personality structure. Personality and Social Psychology Review, 11(2), 150–166. [https://doi.org/10.1177/108886860306294907](https://doi.org/10.1177/108886860306294907).

Beutler, L. E., Moleiro, C., & Talebi, H. (2002). Resistance in psychotherapy: What conclusions are supported by research. Journal of Clinical Psychology, 58(2), 207–217. [https://doi.org/10.1002/jclp.1144](https://doi.org/10.1002/jclp.1144).

Beutler, L. E., Edwards, C., & Someah, K. (2018). Adapting psychotherapy to patient reactance level: A meta-analytic review. Journal of Clinical Psychology, 74(11), 1952–1963. [https://doi.org/10.1002/jclp.22682](https://doi.org/10.1002/jclp.22682).

Brehm, J. W. (1966). A theory of psychological reactance. New York: Academic Press.

Brehm, S. S., & Brehm, J. W. (1981). Psychological reactance: A theory of freedom and control. New York: Academic Press.

Brown, A. R., Finney, S. J., & France, M. K. (2011). Using the bifactor model to assess the dimensionality of the Hong psychological reactance scale. Educational and Psychological Measurement, 71(1), 170–185. [https://doi.org/10.1177/0013164410387378](https://doi.org/10.1177/0013164410387378).

Buboltz, W. C. J., Thomas, A., & Donnell, A. J. (2002). Evaluating the factor structure and internal consistency reliability of the therapeutic reactance scale. Journal of Counseling and Development, 80(1), 120–125. [https://doi.org/10.1002/j.1556-6678.2002.tb00174.x](https://doi.org/10.1002/j.1556-6678.2002.tb00174.x).

Buboltz, W. C. J., Williams, D. J., Thomas, A., Seemann, E. A., Soper, B., & Woller, K. (2003). Personality and psychological reactance: Extending the nomological net. Personality and Individual Differences, 34(7), 1167–1177. [https://doi.org/10.1016/S0191-8869(02)00107-1](https://doi.org/10.1016/S0191-8869(02)00107-1).

Cervone, D. (2005). Personality architecture: Within-person structures and processes. Annual Review of Psychology, 56, 422–452. [https://doi.org/10.1146/annurev.psych.56.091003.070133](https://doi.org/10.1146/annurev.psych.56.091003.070133).

Cloninger, C. R. (1987). A systematic method for clinical description and classification of personality variants. Archives of General Psychiatry, 44, 573–588.

Cloninger, C. R. (2003). Completing the psychobiological architecture of human personality development: Temperament, character, and coherence. In U. M. Staudinger & U. Lindenberger (Eds.), Understanding Human Development (pp. 159–181). [https://doi.org/10.1007/978-1-4615-0357-6_8](https://doi.org/10.1007/978-1-4615-0357-6_8).

Cloninger, C. R. (2004). Feeling good: The science of well-being. Cloninger, C. R. (2006). The science of well-being: An integrated approach to mental health and its disorders. World Psychiatry, 5(2), 71–76.

Cloninger, C. R. (2008). The psychobiological theory of temperament and character: Comment on farmer and Goldberg (2008). Psychological Assessment, 20(3), 292–299. [https://doi.org/10.1037/a0012933](https://doi.org/10.1037/a0012933).

Cloninger, C. R. (2013). What makes people healthy, happy, and fulfilled in the face of current world challenges? Mens Sana Monographs, 1(1), 16–24. [https://doi.org/10.4103/0973-1229.109288](https://doi.org/10.4103/0973-1229.109288).

Cloninger, K. M., & Cloninger, C. R. (2020). The psychobiology of the path to a joyful life: Implications for future research and practice. Journal of Positive Psychology, 15(1), 74–83. [https://doi.org/10.1080/17439760.2019.1685579](https://doi.org/10.1080/17439760.2019.1685579).

Cloninger, C. R., & Zohar, A. H. (2011). Personality and the perception of health and happiness. Journal of Affective Disorders, 128(1–2), 24–32. [https://doi.org/10.1016/j.jad.2010.06.012](https://doi.org/10.1016/j.jad.2010.06.012).

Cloninger, C. R., & Zwir, I. (2018). What is the natural measurement unit of temperament: Single traits or profiles? In What is the natural measurement unit of temperament: Single traits or profiles? (pp. 373). Philosophical Transactions of the Royal Society B: Biological Sciences. [https://doi.org/10.1098/rstb.2017.0163](https://doi.org/10.1098/rstb.2017.0163).

Cloninger, C. R., Srivakic, D. M., & Przybeck, T. R. (1993). A psychobiological model of temperament and character. Archives of General Psychiatry, 50(12), 975–990.

Cloninger, C. R., Cloninger, K. M., Zwir, I., & Keltikangas-Järvinen, L. (2019). The complex genetics and biology of human temperament: A review of recent research. Translational Psychiatry, 9(5), 573–588. [https://doi.org/10.1038/s41398-019-0621-4](https://doi.org/10.1038/s41398-019-0621-4).

Core Team, R. (2019). R: A language and environment for statistical computing. Vienna, Austria: R Core Team.

Costa, P. T., & McCrae, R. R. (1992). NEO PI-R: Professional manual: Revised NEO PI-R and NEO-FFI. Florida: Psychological Assessment Resources, Inc.

De Fruyt, F., Van De Wiele, L., & Van Heeringen, C. (2000). Cloninger’s psychobiological model of temperament and character and the five-factor model of personality. Personality and Individual Differences, 29(3), 441–452. [https://doi.org/10.1016/S0191-8869(99)00204-4](https://doi.org/10.1016/S0191-8869(99)00204-4).

Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health.
Canadian Psychology, 49(3), 182–185. https://doi.org/10.1037/a0012801.
Dillard, J. P., & Shen, L. (2005). On the nature of reactance and its role in persuasive health communication. Communication Monographs, 72(2), 144–168. https://doi.org/10.1080/03637750501118115.
Dowd, E. T., & Seibel, C. A. (1990). A cognitive theory of resistance and reactance: Implications for treatment. Journal of Mental Health Counseling, 12(4), 458–469.
Dowd, E. T., & Wallbrown, F. (1993). Motivational components of client reactance. Journal of Counseling & Development, 71(5), 533–538. https://doi.org/10.1002/j.1556-6676.1993.tb02337.x.
Dowd, E. T., Milne, C. R., & Wise, S. L. (1991). The therapeutic reactance scale: A measure of psychological reactance. Journal of Counseling & Development, 69(6), 541–545. https://doi.org/10.1002/j.1556-6676.1991.tb02638.x.
Dowd, E. T., Wallbrown, F., Sanders, D., & Yesenosky, J. M. (1994). Psychological reactance and its relationship to Normal personality variables. In Cognitive Therapy and Research, 18.
Erikson, E. H. (1968). Identity: Youth and crisis. New York: W.W. Norton & Company.
Ferguson, C. J. (2009). An effect size primer: A guide for clinicians and researchers. Professional Psychology: Research and Practice, 40(5), 532–538. https://doi.org/10.1037/a0015808.
Finkelsstein, S. R., Boland, W. A., Vallen, B., Connell, P. M., Sherman, G. D., & Feemster, K. A. (2020). Psychological reactance impacts ratings of pediatrician vaccine-related communication quality, perceived vaccine safety, and vaccination priority among U.S. parents. Human Vaccines and Immunotherapeutics, 16(5), 1024–1029. https://doi.org/10.1080/21655515.2019.1694815.
Gadermann, A. M., Guhn, M., & Zumbo, B. D. (2012). Estimating ordinal reliability for likert-type and ordinal item response data: A conceptual, empirical, and practical guide. Practical Assessment, Research & Evaluation, 17(3).
Göllner, R., Roberts, B. W., Shen, L., Lüdtke, O., Jonkmann, K., & Finkelstein, S. R., Boland, W. A., Vallen, B., Connell, P. M., Sherman, G. D., & Feemster, K. A. (1990). A cognitive theory of resistance and reactance: Implications for treatment. Journal of Mental Health Counseling, 12(4), 458–469.
Gough, H. G. (1987). California psychological inventory administrator’s guide. Pafio Afio, CA: Consulting Psychologists Press.
Graybar, S. R., Antonuccio, D. O., Boutillier, L. R., & Varble, D. L. (1989). Psychological reactance as a factor affecting patient compliance to physician advice. Scandinavian Journal of Behaviour Therapy, 18(1), 43–51. https://doi.org/10.1080/15604698955518.
Grolnick, W. S., Deci, E. L., & Ryan, R. M. (1997). Internalization within the family: The self-determination theory perspective. In J. E. Grusec & L. Kuczynski (Eds.), Parenting and children’s internalization of values: A handbook of contemporary theory. Hoboken, NJ: John Wiley.
Hong, S.-M., & Faedda, S. (1996). Refinement of the Hong psychological reactance scale. Educational and Psychological Measurement, 56(1), 173–182. https://doi.org/10.1177/0016631596056001014.
Hong, S.-M., & Page, S. (1989). A psychological reactance scale: Development, factor structure and reliability. Psychological Reports, 64(3c), 1323–1326. https://doi.org/10.2466/pr0.1989.64.3c.1323.
Hong, S.-M., Giannakopoulos, E., Laing, D., & Williams, N. A. (1994). Psychological reactance: Effects of age and gender. Journal of Social Psychology, 134(2), 223–228. https://doi.org/10.1080/00224549.1994.9711385.
Horsey, M. J., Harris, E. A., & Fielding, K. S. (2018). The psychological roots of anti-vaccination attitudes: A 24-nation investigation. Health Psychology, 37(4), 307–315. https://doi.org/10.1037/hea0000586.
Inman, R. A., Sousa, A. M., Cunha, D., & Moreira, P. A. S. (2019). Therapeutic reactance in adolescents: The psychometrics of the therapeutic reactance scale in adolescents. Scandinavian Journal of Child and Adolescent Psychiatry and Psychology, 7, 20–28. https://doi.org/10.21307/sjcpp-2019-003.
Johnson, P., & Buboltz, W. C. J. (2000). Differentiation of self and psychological reactance. Contemporary Family Therapy, 22(1), 91–102. https://doi.org/10.1023/A:1007774600764.
Karno, M. P., Longabaugh, R., & Herbeck, D. (2010). What explains the relationship between the therapist structure × patient reactance interaction and drinking outcome? An examination of potential mediators. Psychology of Addictive Behaviors, 24(4), 600–607. https://doi.org/10.1037/a0020526.
Laird, R. D., & Frazer, A. L. (2020). Psychological reactance and negative emotional reactions in the link between psychological control and adolescent adjustment. Social Development, 29(1), 159–177. https://doi.org/10.1111/sode.12407.
Lowenthal, E., Matesva, M., Marukutira, T., Bayani, O., Chapman, J., Tshume, O., Matshaba, M., Hickson, M., & Gross, R. (2020). Psychological reactance is a novel risk factor for adolescent antiretroviral treatment failure. AIDS & Behavior. https://doi.org/10.1007/s10461-020-02986-z.
Luby, J. L., Svakic, D. M., Mccallum, K., Przybeck, T. R., & Cloninger, C. R. (1999). The junior temperament and character inventory: Preliminary validation of a child self-report measure. Psychological Reports, 84, 1127–1138.
Miller, C. H., & Quick, B. L. (2010). Sensation seeking and psychological reactance as health risk predictors for an emerging adult population. Health Communication, 25(3), 266–275. https://doi.org/10.1080/1041023090369045.
Miron, A. M., & Brinin, J. W. (2006). Reactance theory - 40 years later. Zeitschrift Fur Sozialpsychologie, 37(1), 9–18. https://doi.org/10.1024/0044-3514.37.1.9.
Moreira, P. A. S., & García, D. (2019). Person-centered schools. In D. García, T. Archer & R. M. Kostzrewa (Eds.), Personality and brain Disorders: Associations and interventions (pp. 183–228). Contemporary clinical neuroscience series title. Springer. https://doi.org/10.1007/978-3-319-90065-0_9.
Moreira, P. A. S., Oliveira, J. T., Cloninger, K. M., Azevedo, C., Sousa, A., Castro, J., & Cloninger, C. R. (2012). The psychometrics and validity of the junior temperament and character inventory in Portuguese adolescents. Comprehensive Psychiatry, 53(8), 1227–1236. https://doi.org/10.1016/j.comppsych.2012.04.014.
Moreira, P. A. S., Cloninger, C. R., Dinis, L., Sá, L., Oliveira, J. T., Dias, A., & Oliveira, J. (2015). Personality and well-being in adolescents. Frontiers in Psychology, 5, 1494. https://doi.org/10.3389/fpsyg.2014.01494.
Moreira, P. A. S., Cunha, D., & Inman, R. A. (2020a). Addressing a need for valid measures of trait reactance in adolescents: A further test of the Hong psychological reactance scale. Journal of Personality Assessment, 102(3), 357–369. https://doi.org/10.1080/00223891.2019.1585360.
Moreira, P. A. S., Inman, R. A., & Cloninger, C. R. (2020b). Personality networks and emotional and behavioral problems: Integrating temperament and character using latent profile and latent class analyses. Child Psychiatry and Human Development, Advance online publication. https://doi.org/10.1007/s10578-020-01063-9.
Moreira, P. A. S., Inman, R. A., Cloninger, K. M., & Cloninger, C. R. (2020c). Student engagement with school and personality: A biopsychosocial and person-centred approach. British Journal of Educational Psychology. Advance online publication. https://doi.org/10.1111/bjep.12392.
Moreira, P. A. S., Inman, R. A., Rosa, I., Cloninger, K., Duarte, A., & Robert Cloninger, C. (2020d). The psychobiological model of personality and its association with student approaches to learning: Integrating temperament and character. Scandinavian Journal of Educational Research, 0(0), 1–17. https://doi.org/10.1080/00313831.2020.1739137.
Munafo, M. R., & Flint, J. (2011). Dissecting the genetic architecture of human personality. *Trends in Cognitive Sciences, 15*(9), 395–400. https://doi.org/10.1016/j.tics.2011.07.007.

Quick, B. L., & Stephenson, M. T. (2007a). Further evidence that psychological reactance can be modeled as a combination of anger and negative cognitions. *Communication Research, 34*(3), 255–276. https://doi.org/10.1177/0093650207300427.

Quick, B. L., & Stephenson, M. T. (2007b). The reactance restoration scale (RRS): A measure of direct and indirect restoration. *Communication Research Reports, 24*(2), 131–138. https://doi.org/10.1080/08824090701304840.

Rains, S. A., & Turner, M. M. (2007). Psychological reactance and persuasive health communication: A test and extension of the intertwined model. *Human Communication Research, 33*(2), 241–269. https://doi.org/10.1111/j.1468-2958.2007.00298.x.

Rettew, D. C., Althoff, R. R., Dumenci, L., Ayer, L., & Hudziak, J. J. (2005). Normal personality variables and their relationship to pathology and wellness. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*(3), 273–281. https://doi.org/10.1097/CHI.v0b013e318160b403.

Rosenberg, B. D., & Siegel, J. T. (2018). A 50-year review of psychological reactance theory: Do not read this article. *Motivation Science, 4*(4), 281–300. https://doi.org/10.1037/mot0000091.

Rosenberg, J. M., Beymer, P. N., Anderson, D. J., & Schmidt, J. A. (2018). tidyLPA: An R package to easily carry out latent profile analysis (LPA) using open-source or commercial software. *Journal of Open Source Software, 3*(30), 978. https://doi.org/10.21105/joss.00978.

Schwarz, G. E. (1978). Estimating the dimension of a model. *Annals of Statistics, 6*(2), 461–466. https://doi.org/10.1214/aos/1176344136.

Seemann, E. A., Buboltz, W. C. J., Thomas, A., Soper, B., & Wilkinson, L. (2005). Normal personality variables and their relationship to psychological reactance. *Individual Differences Research, 3*(2), 88–98.

Seibel, C. A., & Dowd, E. T. (1999). Reactance and therapeutic noncompliance. *Cognitive Therapy and Research, 23*(4), 373–379. https://doi.org/10.1023/A:1018751817046.

Seibel, C. A., & Dowd, E. T. (2001). Personality characteristics associated with psychological reactance. In *J Clin Psychol, 57*, 963–969.

Shoham, V., Trost, S. E., & Rohrbaugh, M. J. (2004). From state to trait and back again: Reactance theory goes clinical. In R. A. Wright, J. Greenberg, & S. S. Brehm (Eds.), *Reactance theory and self-determination theory. The processes and phases of change. Development and Psychopathology, 31*, 1–17. https://doi.org/10.1017/S0954579418000159.

Zohar, A. H., Zwir, I., Wang, J., Cloninger, C. R., & Anokhin, A. P. (2018). The development of temperament and character during adolescence: The processes and phases of change. *Development and Psychopathology, 31*, 1–17. https://doi.org/10.1017/S0954579418000159.

Zwir, I., Arnedo, J., Del-Val, C., Puluki-Rcáback, L., Konte, B., Yang, S., & et al. (2018a). Uncovering the complex genetics of human character. *Molecular Psychiatry, 23*, 2295–2312. https://doi.org/10.1038/s41380-018-0263-6.

Zwir, I., Arnedo, J., Del-Val, C., Puluki-Rcáback, L., Konte, B., Yang, S., & et al. (2018b). Uncovering the complex genetics of human temperament. *Molecular Psychiatry, 25*, 2275–2294. https://doi.org/10.1038/s41380-018-0264-5.

Zwir, I., Del-Val, C., Arnedo, J., Puluki-Rcáback, L., Konte, B., Yang, S., & et al. (2019a). Three genetic-environmental networks for human personality. *Molecular Psychiatry, https://doi.org/10.1038/s41380-019-0579-x.

Zwir, I., Del-Val, C., Arnedo, J., Puluki-Rcáback, L., Konte, B., Yang, S., & et al. (2019b). Three genetic–environmental networks for human personality. *Molecular Psychiatry, https://doi.org/10.1038/s41380-019-0579-x.

Publisher’s Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.