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Why do angry people overestimate their intelligence? Neuroticism as a suppressor of the association between Trait-Anger and subjectively assessed intelligence

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ABSTRACT

Trait-Anger and Neuroticism are substantially inter-correlated positively. However, there is some theoretical and empirical research that supports the notion that Trait-Anger and Neuroticism are influenced by several processes differentially. For instance, Trait-Anger is linked to optimistic bias, increased sense of control, approach motivation and high Narcissism. In contrast, Neuroticism correlates with pessimism, low sense of control, withdrawal motivation and low Narcissism. Building on these previous findings, we hypothesized that Trait-Anger and Neuroticism would be positively and negatively, respectively, associated with subjectively assessed intelligence (SAI). Furthermore, we expected that these two traits would act as mutual suppressors in predicting SAI. The results of two studies (*ns* = 303 and 225) supported our hypotheses. Trait-Anger was positively and Neuroticism negatively related to SAI, even after controlling for objective intelligence. These results are consistent with previous research which suggests that SAI is more substantially associated with personality than objective intelligence. Additionally, in study 2, we found that Narcissism mediated (partially) the relationship between Trait-Anger and SAI. In the discussion, we suggest that there might be two faces of Trait-Anger: one related to anxiety and one to overconfidence. Finally, a potential role of intelligence positive illusions in Trait-Anger is proposed.

1. Introduction

In the area of personality and cognition, one of the most consistent findings is the adverse influence of negative emotionality on various cognitive functions, including intelligence test performance. Traits that reflect tendencies toward negative emotions, e.g. neuroticism, anxiety, and depression have been all shown to be correlated negatively with cognitive ability test scores (Ackerman & Heggestad, 1997; Austin et al., 2002). Furthermore, substantial, negative correlations have been reported between these traits and self-assessed intelligence (SAI; Chamorro-Premuzic & Furnham, 2004; Chamorro-Premuzic, Moutafi, & Furnham, 2005).

In contrast to Neuroticism, Trait-Anger, another negative emotionality trait, has not been studied in the context of SAI. Although Trait-Anger has shown a weak, negative correlation with objective intelligence test scores (e.g. Austin et al., 2002), there is indirect evidence to suggest that angry people may not exhibit a corresponding tendency toward reporting relatively low SAI. Such a possibility is interesting, given that Neuroticism and Trait-Anger have been shown to correlate positively and substantially (Bettencourt, Talley, Benjamin, & Valentine, 2006; Ode, Robinson, & Wilkowski, 2008). Some recent findings suggest that anger may differ from other negatively valenced emotions, with respect to motivational and belief systems (e.g., Harmon-Jones et al., 2009; 2010; Lerner & Keltner, 2001), which, in turn, may influence SAI positively, rather than negatively.

In light of the above, the primary purpose of this investigation was to evaluate the potentially differential predictive validity of Neuroticism and Trait-Anger as predictors of SAI, controlling for individual differences in objective intelligence. Additionally, the role of Narcissism was examined as a hypothesized mediator of any effects between negative emotionality (Neuroticism and Trait-Anger) and SAI.

2. Differential processes underlying anger and neuroticism

Although Neuroticism and Trait-Anger are known to inter-correlate positively (Bettencourt, et al., 2006; Ode et al., 2008), there appear to

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be several contrasting processes that influence their manifestation. For example, optimistic bias, sense of control, approach motivation, and Narcissism. As we document below, all four of these processes may be expected to differentiate Neuroticism from Trait-Anger, and, furthermore, support hypotheses for the differential effects associated with Neuroticism and Trait-Anger as correlates of SAI.

An increasing amount of research suggests that the valence-based approach to the distinction between positive and negative affect fails to explain many important phenomena, e.g. how negative and positive emotions influence cognition (Gable, Pool & Harmon-Jones, 2015; Lerner & Keltner, 2001). It has been suggested that additional features of emotions should be considered in the context of cognitive processing, such as motivational intensity (Gable, et al., 2015) or emotion's appraisal theme (Lerner & Keltner, 2001). Beyond the valence-based distinction, anger has been shown recently to differ substantially from other negative emotions; in some cases, anger appears to behave in a manner similar to positive affect.

For example, one of the counterintuitive findings concerns the positive association between anger (trait and state) and optimism. Across a series of studies, Lerner and Keltner (2001) tested the hypothesis that each emotion has its own unique appraisal theme, which influences subsequent judgment and other cognitive processes. Correspondingly, Lerner and Keltner (2001) differentiated the cognitive dimensions underlying different emotions. Importantly, their analysis revealed that emotions of the same valence differ across multiple appraisal dimensions. Most noteworthy, fear and anger, although both negative, differ in terms of the certainty and control dimensions. Additionally, whereas a sense of situational control and uncertainty defines fear, a sense of individual control and certainty defines anger. Lerner and Keltner (2001) supported further this concept by showing that dispositional anger, contrary to dispositional fear, predicted more frequent risk-seeking choices and a more optimistic attitude toward future life events. Interestingly, in these studies, trait anger was associated with a correlation pattern similar to dispositional happiness, rather than fear. Consequently, it may be suggested that the valence approach to emotions fails to explain these results.

Finally, it should be noted that the opposing patterns of risk perception and optimism emerged not only for dispositional traits, but also experimentally induced states of fear and anger. Importantly, appraisal tendencies accounted for these effects: appraisals of certainty and control moderated and (in the case of control) mediated the emotion effects. Consistent with the Lerner and Keltner's (2001), there are studies linking emotions with goals planning. In a recent investigation, Maglio, Gollwitzer and Oettingen (2014) tested the role of emotions in the formation and execution of plans. Specifically, the authors hypothesized that anger and sadness would differentially impact planning and the implementation of plans, on the theoretical basis that anger and sadness possess distinct cognitive appraisal patterns. Similar to Lerner and Keltner (2001), Maglio et al. (2014) assumed that anger and sadness differ with respect to sense of control. Specifically, whereas sadness is characterized by little control to respond, anger is characterized by a strong sense of control. Consequently, Maglio et al. (2014) predicted that experiencing anger should more effectively influence implementation intentions, in comparison to people experiencing sadness. Indeed, the authors confirmed their hypothesis: anger was related to a greater sense of control and led to the formation of more plans for goal-directed behavior and faster execution of real behavior as prescribed by predetermined plans.

In addition to a sense of control, another characteristic of anger that may have consequences for SAI is approach motivation. Based on their review of the literature, Carver and Harmon-Jones (2009) suggested that anger, in contrast to other negative emotions, such as anxiety, relates to an appetitive and/or behavioral approach system (BAS). One source of evidence supporting this conclusion is research on asymmetrical frontal activity. Numerous studies have revealed that approach motivation is associated with relative left frontal activity, whereas withdrawal motivation is linked to relative right frontal activity (Coan & Allen, 2004). Consequently, both trait and state anger were shown to correlate with greater left frontal activity and lesser right frontal activity (Harmon-Jones & Allen, 1998). This finding seems to have surprising consequences, since other studies by Harmon-Jones and colleagues (Harmon-Jones & Harmon-Jones, 2010; Harmon-Jones et al., 2009) revealed that anger is associated with both negative affect (NA) and positive affect (PA). The former result might be explained by the fact that NA includes items referring to anger, however, the correlation of anger with PA requires further consideration. Harmon-Jones and colleagues (Harmon-Jones & Harmon-Jones, 2010; Harmon-Jones et al., 2009) pointed that in the development of the Positive and Negative Affect Schedule (PANAS), Watson, Clark, and Tellegen (1988) used factor analysis in order to select items with a large loading on the one factor and a near-zero loading on the other factor. This approach resulted in elimination of items from PA that measure pure positivity and retention of items that measure additional aspects, such as approach motivation (items such as *enthusiastic, excited, strong*). Consistent with the findings on anger and BAS (Carver & Harmon-Jones, 2009), Harmon-Jones et al. (2009) found that anger-evoking situations produced higher levels of both anger and PA, in comparison to neutral conditions without emotion induction. Moreover, they found that PA was positively correlated with anger. The size of the correlation between PA and anger increased, controlling statistically for happiness. Harmon-Jones et al. (2009) concluded that PA includes two dimensions: positive emotionality and approach motivation. In summary, anger may be described as an approach-oriented, but negatively-valenced, emotion.

In contrast to anger, Neuroticism has been found to correlate positively with Behavioral Inhibition System (BIS) and negative affect and negatively with BAS and PA (Watson, 2000). Moreover, Neuroticism has been linked with right frontal activity, suggesting a tendency toward withdrawal motivation (e.g. McNaughton, DeYoung, & Corr, 2016). Again, this pattern of findings is all the more interesting, given the substantial, positive correlation between Neuroticism and Trait-Anger (Bettencourt, et al., 2006; Ode et al., 2008).

Finally, a trait that has shown an interesting pattern of correlations with Trait-Anger and Neuroticism is Narcissism. However, it needs to be acknowledged that recent studies suggest that there might be two types of Narcissism: Grandiose and Vulnerable (Miller et al., 2011). The former is characterized by an inflated positive self-image, high self esteem, exhibitionism, attitudes of entitlement, a tendency toward exploitativeness, self-assuredness, and the need to be admired by others, whereas Vulnerable Narcissism is characterized by hypersensitivity, vulnerability, low sense of self-worth, defensiveness, and insecurity (Miller et al., 2011). Among the two types of Narcissism, Grandiose Narcissism has shown differential correlations with Trait-Anger and Neuroticism: positive and negative, respectively (Miller et al., 2011).

Processes that differentiate Trait-Anger from Neuroticism also seem to have different influence on SAI. Empirical investigations have shown that optimism, happiness and positive affect are all associated with a general tendency toward self-enhancement, including overestimation of one's intelligence (e.g. Dufner et al., 2012). Moreover, many researchers point that the self-enhancement is usually observed with respect to agentic traits (e.g., competence, intelligence, uniqueness) rather than on communal traits (e.g., kindness, helpfulness; Brummelman, Thomaes, & Sedikides, 2016). This may suggest that the increased sense of control, a characteristic of agency, is likely to be associated with SAI positively. Finally, it has been shown repeatedly that grandiose narcissists tend to overestimate their own cognitive abilities (Gabriel, Critelli & Ee, 1994; Dufner et al., 2012; Zajenkowski & Czarna, 2015).

3. Subjectively assessed intelligence

Standardized intelligence tests are regarded as an objective method with a well-established methodology and substantial predictive validity

(Gottfredson, 1997). By contrast, self-assessed intelligence (SAI) has been shown to be affected by non-intellective factors such as personality (Chamorro-Premuzic & Furnham, 2004; Chamorro-Premuzic & Furnham, 2006a). Correspondingly, the convergent validity between SAI and objectively measured intelligence has been reported to be moderate ($r \approx .30$; Freund & Kasten, 2012; Gignac, Stough & Loukomitis, 2004; Zajenkowski, Stolarski, Maciantowicz, Malesza & Witowska, 2016). With respect to personality, SAI has been found to be correlated positively with extraversion, openness and narcissism, and correlated negatively with agreeableness and neuroticism, with the latter correlation estimated at $r \approx -.25$ (Chamorro-Premuzic & Furnham, 2006a; Chamorro-Premuzic, Moutafi, Furnham, 2005). Among the lower order factors from the Big Five, SAI has been found to be correlated appreciably and negatively with anxiety, and positively with activity and excitement seeking (Chamorro-Premuzic, et al., 2005). Overall, the research suggests that SAI is more substantially predicted by personality than objective intelligence, which suggests that personality traits influence people's insight into their intellectual abilities (Chamorro-Premuzic & Furnham, 2004).

The review above supports the contention that people's estimations of their intelligence is likely affected by non-intellective factors. Several studies suggest that variables which reflect negative emotionality are usually related negatively to self-assessed intelligence, even though they are essentially unrelated to objective intelligence. However, as described above, anger differs in many ways from negative emotions such as anxiety, fear or depression. In contrast to these emotions, anger was found to correlate with an optimistic bias, optimistic risk perception (Lerner & Keltner, 2001), positive affect (Harmon-Jones et al., 2009; 2010; Zajenkowski, 2017), and an increased sense of individual control and certainty (Lerner & Keltner, 2001). Moreover, such a pattern of correlations is similar to dispositional happiness, rather than fear. Several studies have also shown that optimism, happiness, extraversion and positive affect are all associated with a general tendency toward self-enhancement, including overestimation of one's intelligence (Dufner et al., 2012). Thus, the valence approach to emotions may not be sufficient to explain the belief system characteristic for high Trait-Anger individuals. Furthermore, SAI tends to correlate negatively with agreeableness and neuroticism (Chamorro-Premuzic & Furnham, 2004). Finally, previous studies have shown positive effects between Trait-Anger and disagreeableness (Ode et al., 2008) and BAS (Carver & Harmon-Jones, 2009), which is believed to be a primary characteristic of extraversion (McNaughton et al., 2016). Arguably, the primary difference between SAI and Anger, with respect to personality correlates, is Neuroticism.

4. Summary and purpose

In light of the above, we conducted two studies to evaluate the possibility of differential associations between Neuroticism and Trait-Anger as correlates of SAI. Specifically, in study 1, we hypothesized that Neuroticism and Anger would be negatively and positively correlated with SAI, respectively. However, Neuroticism and Anger were hypothesized to be correlated positively. Consequently, given such a pattern of correlations, we additionally hypothesized that Neuroticism and Anger would act as mutual suppressors, with respect to their relations to SAI. A suppressor effect is observed when the validity coefficient of one variable is enhanced by the inclusion of another variable to the model (Paulhus, Robins, Trzesniewski, & Tracy, 2004).

To foreshadow study 2, we focused upon the replication of the hypothesized effects within study 1 (although some measures differed from study 1). Furthermore, we tested the hypothesis that Narcissism mediates the effect between Trait-Anger and SAI, as well as the effect between Neuroticism and SAI. The idea about mediating role of Grandiose Narcissism is based on several premises. First, Grandiose Narcissism correlates positively with Trait-Anger (Krizan & Johar, 2015) and negatively with Neuroticism (Miller et al., 2011). Secondly, Grandiose Narcissism is associated with inflated self-views and positive illusion about intelligence (Gabriel et al., 1994; Dufner et al., 2012; Zajenkowski & Czarna, 2015). Finally, grandiose narcissists exhibit increased self-esteem, positive emotionality, optimism and agency (Sedikides, Rudich, Gregg, Kumashiro, & Rusbult, 2004). Thus, one may wonder whether Narcissism represents the processes that differentiate Trait-Anger and Neuroticism. In particular, a question arises to what extent the sense of control and certainty, optimistic bias and approach motivation observed in anger (but not in Neuroticism) are similar to the feelings of grandiosity and exaggerated self-worth present in Narcissism.

5. Study 1

All data were uploaded to Open Science Framework and are available under the following address: osf.io/82dkp.

5.1. Participants

Complete data were available for 303 participants (206 female and 97 male). Mean age was 24.25 ($SD = 5.66$; range 18 to 45). The sample was composed of undergraduate students from various universities in Warsaw, Poland. Volunteer participants were recruited via publicly accessible social networking websites. Each participant gave informed consent and was offered a small gift for taking part in the study.

5.2. Measures

5.2.1. Trait Anger

Trait Anger was assessed with the subscale from a widely used measure, i.e. the State Trait Anger Expression Inventory-2 by Spielberger (1999) in the Polish adaptation (Bąk, 2016). It consists of ten items (e.g.,) with a 4-point type response format (from 1 – *Almost Never* to 4 – *Almost Always*). The Trait Anger scale measures a person's general predisposition to become angry, that is how often angry feelings are experienced by an individual over time. The exemplary items are "I have a fiery temper", "I am a hothead person", "I am quick tempered", "When I get mad, I say nasty things", "I fly off the handle".

5.2.2. Subjectively assessed intelligence (SAI)

Participants assessed their own intelligence on a 1 - 25 point rating scale. Five groups of five columns were labeled as very low, low, average, high or very high, respectively (see Fig. 1). Participants' SAI was indexed with the marked column counting from the first to the left; thus the score ranged from 1 to 25 (see Zajenkowski et al., 2016 for more details). Prior to providing a response to the scale, the following instruction was presented:

> "People differ with respect to their intelligence and can have a low, average or high level. Using the following scale, please indicate where you can be placed comparing to other people. Please mark an X in the appropriate box corresponding to your level of intelligence."

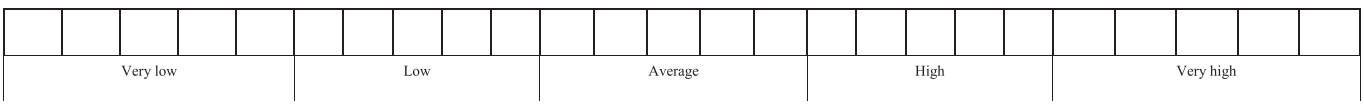

Fig. 1. The measure of subjectively assessed intelligence (SAI) used in the studies.

In order to place the 25-point scale SAI scores onto a scale more comparable to a conventional IQ score (i.e., $M = 100$; $SD = 15$), we transformed the scores such that values of 1, 2, 3, 4, 5… 21, 22, 23, 24, 25 were recoded to 40, 45, 50, 55, 60… 140, 145, 150, 155, 160. As the transformation was entirely linear, the results derived from the raw scale SAI scores and the recoded scale SAI scores were the same.

5.2.3. Objectively assessed intelligence

Objective intelligence was measured with four fluid intelligence tests, as any single test of fluid intelligence would be associated with a non-negligible amount of test specific method variance (Colom & García-López, 2002; Gignac, 2015). The *Raven Advanced Progressive Matrices* (RAPM; Raven; Raven, Court, & Raven, 1983) consists of items that include a three-by-three matrix of figural patterns with a missing bottom-right pattern, and eight response options that can potentially match the missing pattern. The goal is to discover the rules that govern the matrix and to apply them to the response options in order to choose the single right pattern. We used 18 odd-numbered items out of 36 original items, and the administration time was 20 min. The *Figural Analogies Test* (FAT: Chuderski, Taraday, Nęcka, & Smoleń 2012) consists of analogies in the form of "A is to B as C is to X", where A, B, and C are patterns of figures. A is related to B according to two, three, four, or five rules (e.g., rotation, change in size, color etc.), and X is an empty space. The task is to choose one figure from a choice of four which relates to figure C, as B relates to A. Participants were given 15 min to solve 18 analogies with progressive difficulty. The test shows high internal consistency and correlates highly with other fluid intelligence measures, e.g. Raven's test (Chuderski et al., 2012). The *Number Series Test* (NST), the task was to find the hidden rule, according to which a sequence or an array of numbers was constructed, and to complete the sequence or the array with the missing number. For example, the sequence "1, 5, 12, 22, 35, ..." should be completed with "51". Participants were given 18 minutes to solve 18 number series problems with progressive difficult. The *Anagrams Test* included 18 problems with progressive difficulty. In each problem a category was presented (e.g. animals, tools etc.) with three groups of letters below the category. Only one group of letters was an anagram that could be rearranged to construct a commonly known word matching the category. The task was to find this word and write it down. For example, only the first group of letters out off "SEHOR, KEODMN, WAYHLI" can be arranged to construct a word matching the category "animals". Administration time was 13 min. In order to create a composite general intelligence variable, the four intelligence tests were submitted to a principal components analysis and component scores were saved (regression-based). Internal consistency reliability for the general intelligence component scores (theta; Armor, 1973) was estimated at .78.

5.2.4. Neuroticism

The NEO-Five Factor Inventory (NEO-FFI; Costa and McCrae, 1992) in the Polish adaptation (Zawadzki et al.,1998) was used to measure Neuroticism. The scale contains twelve items. Participants rate themselves with respect to the extent to which each item applied to them on a 5-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*).

5.3. Data analysis

To test the primary hypotheses in this investigation, a series of latent variable models were tested. Neuroticism and Trait-Anger were modeled as latent variables defined by three indicators each. Each indicator consisted of an item parcel (i.e., sum of the three to four items). As SAI was measured with a single item, it was included in all of the models as an observed variable. To control for the influence of objective intelligence on SAI, a fluid intelligence latent variable (defined by the four fluid intelligence tests) was linked to the SAI observed variable. Finally, because age is known to correlate negatively with intelligence in adulthood (Wechsler, 2008), we controlled statistically for age across all three models, by linking age with the four intelligence tests.

Consistent with the typical description of statistical cooperative suppression (Cohen & Cohen, 1975; Maassen & Bakker, 2001; Pedhazur, 1997), it was expected that the Trait-Anger and Neuroticism multiple-regression beta-weights would be larger than each variable's corresponding regression beta-weight that excluded the other variable from the model. Additionally, in order to evaluate the suppressor effect hypotheses from an effect size perspective, the beta-weights were converted into squared semi-partial correlations, based on a simple re-arrangement of the formula specified by Tzelgov and Stern (1978, p. 330) to derive a beta-weight from a semi-partial correlation.[1] Furthermore, on the basis of Paunonen and LeBel's (2012) simulation research, increases in percentages of variance accounted for equal to 1% and 2% were considered moderate and large suppressor effects, respectively.All models were tested within Amos. To overcome any issues of non-normality, the point estimate standard errors and confidence intervals were estimated via the standardized bootstrap (2000 re-samples). An indicator loading for each latent variable was fixed to 1 for the purposes of scaling/identification, as recommended by Hancock and Nevitt (1999) for bootstrapping in latent variable modeling. Finally, models were considered acceptably well-fitting based on the observation of SRMR and RMSEA $< .08$ and CFI $> .95$ (Schweizer, 2010).

6. Results

6.1. Descriptive statistics

As can be seen in Table 1, the SAI mean was 113.61, which suggested that, as a group, the participants rated their intelligence above average. However, there was a substantial amount of variability in SAI ($SD = 16.01$; range: 40 to 160).

6.2. Inter-correlations

Trait-Anger and SAI were not found to be statistically significantly correlated, $r = .08$, $z = 1.28$, $p = 0.201$, 95%CI = -.04/.21, $r_c = .09$. By comparison, the correlation between Neuroticism and SAI was significant statistically, $r = -.20$, $z = -3.57$, $p < 0.001$, 95%CI = -.31/-.09, $r_c = -.21$. Thus, higher Neuroticism scores were associated with lower SAI. Trait-Anger and Neuroticism were correlated positively, $r = .35$, $z = 6.52$, $p < 0.001$, 95%CI = .24/.45, $r_c = .40$. Finally, fluid intelligence and SAI were correlated positively, $r = .30$, $z = 4.04$, $p < 0.001$, 95%CI = .16/.44, $r_c = .34$.

6.3. Latent variable modeling

As can be seen in Fig. 2 (Model 1), Trait-Anger was associated with a standardized beta weight $\beta = .13$ (semi-partial $r^2 = .017$) onto SAI, controlling for the effects of general intelligence on SAI ($\beta = .31$); however, the SAI beta-weight was not significant statistically, $z = 1.91$, $p = 0.056$, 95%CI = -.01/.26. The model accounted for 11.5% of the variance in SAI. Furthermore, the model was associated with acceptable levels of model close-fit, $\chi^2(23) = 49.23$, $p = 0.001$, SRMR = .051, RMSEA = .062, CFI = .964.

As can be seen in Fig. 2 (Model 2), Neuroticism was associated with a standardized beta weight $\beta = -.20$ (semi-partial $r^2 = .038$) onto SAI, controlling for the effects of general intelligence on SAI ($\beta = .30$). Additionally, the Neuroticism beta-weight was significant statistically, $z = -3.23$, $p = 0.001$, 95%CI = -.31/-.08. The model accounted for 13.0% of the true score variance in SAI. Furthermore, the model was associated with acceptable levels of model close-fit, $\chi^2(23) = 28.62$, $p = .193$, SRMR = .041, RMSEA = .028, CFI = .994.

[1] Specifically, we used: $r_{Y(1.2)} = \beta_{Y1.2}{}^{*}\sqrt{(1 - r^2_{12})}$

Table 1
Observed score Pearson correlations between all variables (Study 1).

	1.	2.	3.	4.	5.	6.	7.	8.	M	SD	Skew
1. SAI	(n/a)								113.61	16.01	-.47
2. Trait Anger	.08	(.85)							23.54	5.96	.23
3. Neuroticism	-.20	.35	(.89)						36.59	9.57	.01
4. Raven's	.24	.01	-.08	(.75)					11.19	3.18	-.57
5. Figural Analogies	.30	-.10	-.08	.66	(.73)				12.10	3.25	-.53
6. Anagrams	.19	.07	.01	.34	.37	(.70)			11.00	3.44	-.37
7. Numbers	.20	-.01	-.05	.56	.52	.37	(.79)		9.31	3.70	-.09
8. Fluid intelligence (Gf)	.30	-.02	-.07	.84	.84	.62	.80	(.78)	.00	1.00	-.52

Note: N = 302; coefficients on the main diagonal (in parentheses) are internal consistency reliability estimates; correlations ≥ |.11| were statistically significant ($p < 0.05$; 2000 bootstrapped samples).

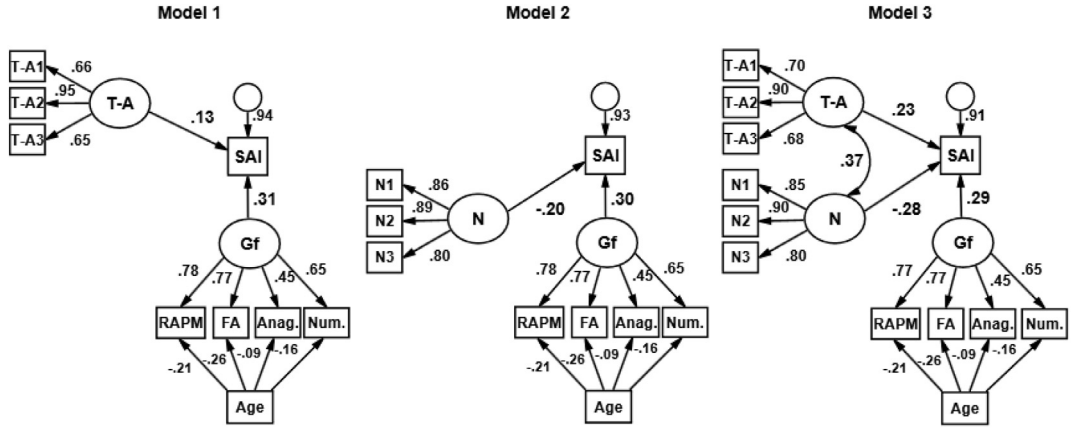

Fig. 2. Latent variable modeling results associated with Study 1; T-A = Trait-Anger; N = Neuroticism; SAI = Self-Assessed Intelligence; Gf = fluid intelligence; Narci = Narcissism; Model 1 structural model depicting the completely standardized association between Trait-Anger (T-A) and Self-Assessed Intelligence (SAI), controlling for the effects of fluid intelligence (Gf) on SAI; Model 2 structural model depicting the completely standardized associations between Neuroticism (N) and SAI, controlling for the effects of Gf on SAI; Model 3 structural model depicting the completely standardized associations between T-A, Neuroticism (N) and SAI, controlling for the effects of Gf on SAI; (all Study 1, N = 302); indicator uniquenesses omitted for clarity.

Finally, as can be seen in Fig. 2 (Model 3), when combined into a single model, both Trait-Anger and Neuroticism yielded larger standardized beta weights as predictors of SAI, in comparison to the preceding models. Specifically, the Trait-Anger standardized beta weight increased from .13 (Model 1) to .23 (semi-partial $r^2 = .05$). Similarly, the Neuroticism standardized beta weight increased from -.20 (Model 2) to -.28 (semi-partial $r^2 = .07$). Furthermore, from an effect size perspective, both predictors increased their predictive influence on SAI by ≈4% (Trait Anger $\Delta r^2 = .035$; Neuroticism, $\Delta r^2 = .037$), which was considered a large effect, based on Paunonen and Lebel's (2012) simulation research. Furthermore, the Trait-Anger standardized beta weight was significant statistically, $z = 3.19$, $p = .001$, 95%CI = .08/.36. Correspondingly, the Neuroticism standardized beta weight was significant statistically, $z = -4.16$, $p < 0.001$, 95%CI = -.40/-.14. Thus, Trait-Anger was a positive contributor to the model and Neuroticism was a negative contributor to the model, even though Trait-Anger and Neuroticism were inter-related positively, $r = .37$, $p < 0.001$. The model accounted for 16.9% of the true score variance in SAI. Furthermore, the model was associated with acceptable levels of model close-fit, $\chi^2(48) = 89.52$, $p < 0.001$, SRMR = .053, RMSEA = .054, CFI = .968.

7. Discussion

Study 1 revealed that, as hypothesized, Trait-Anger was correlated positively with Neuroticism. Furthermore, Neuroticism was associated negatively with SAI. By contrast, Trait-Anger did not correlate significantly with SAI, although the direction of the non-significant zero-order effect was consistent with our hypothesis (positive). Importantly, the hypothesis that the combined influence of Trait-Anger and Neuroticism on SAI would evidence statistical suppression was supported. Specifically, controlling for the influence of Neuroticism on SAI, Trait-Anger revealed itself to be a statistically significant and positively associated with SAI. Additionally, Trait-Anger also acted as a suppressor of the negative effect between Neuroticism and SAI.

The question arises about the nature of this remaining aspect of Trait-Anger (after controlling for Neuroticism) associated with positive intelligence illusions. As mentioned above, Grandiose Narcissism may represent the processes that differentiate Trait-Anger and Neuroticism. Thus, although both Trait-Anger and Neuroticism were found to relate to SAI uniquely and statistically significantly in Model 3, it remains to be determined how the differential effects may be influenced by individual differences in Narcissism. Consequently, study 2 included Narcissism in the latent variable model.

8. Study 2

8.1. Participants

A total of 225 subjects took part in the study (119 female and 106 male). Their mean age was 23.48 (SD = 3.67). The sample was composed of undergraduate students from various universities in Warsaw, Poland. Volunteer participants were recruited via publicly accessible social networking websites. Each participant gave informed consent and was offered a small gift for taking part in the study.

8.2. Measures

8.2.1. Trait Anger

Same as study 1.

8.2.2. Subjectively assessed intelligence (SAI)

Same as study 1.

8.2.3. Objectively assessed intelligence

Objective intelligence was measured with two fluid intelligence tests. As per study 1, the *Raven Advanced Progressive Matrices* (RAPM; Raven; Raven, Court, & Raven, 1983). In study 2, we used all 36 items, and the administration time was 30 min. The second fluid intelligence test was *Cattell's Culture Fair Intelligence Test* (CFT; Cattell, 1973) which consists of four nonverbal subtests with strict time limits. The first part, *Series*, consists of 13 items each comprising a series of 3 abstract shapes/figures with one piece missing. Respondents must complete the series by selecting the single correct answer from six options. In the subtest *Classifications* respondents are required to identify the two patterns from a set of five which do not belong to the group; there are 14 set of patterns. The *Matrices* subtest is similar to the RAPM test: only one of six choices fits the blank the blank space in each of 13 matrices. The *Conditions* subtest (10 items) requires the respondent to select one out of five answers in order to replicate the relationships between figures and dot in the model. The total number of correct answers across all subtests constituted the CFT final score.

8.2.4. Neuroticism

Neuroticism was measured with the Polish version (Strus, Cieciuch, & Rowiński, 2014) of the 10-item set of International Personality Items Pool (IPIP) Big-Five Factor Markers questionnaire (Goldberg, 1992). The measure has a five-point Likert-type response format, from 1 (*very inaccurate*) to 5 (v*ery accurate*) and the exemplary items are "Dislike myself", "Am often down in the dumps", "Have frequent mood swings", "Panic easily".

8.2.5. Narcissism

Narcissism was assessed with the Narcissistic Personality Inventory (NPI; Raskin & Hall, 1979). The validated Polish adaptation of the NPI (Bazińska & Drat-Ruszczak, 2000) is composed of 34 items (e.g. "I tend to want others to admire me", "I tend to expect special favors from others", "I tend to seek prestige or status") with a five-point response format, from 1 (does *not apply to me*) to 5 (*applies to me*). The adaptation manifests good reliability ($\alpha = .92$) as well as convergent and discriminant validity (Bazińska & Drat-Ruszczak, 2000).

9. Results

9.1. Descriptive statistics

As can be seen in Table 2, the SAI mean was 120.06, which suggested that, as a group, the participants rated their intelligence above average. However, as per study 1, there was also a substantial amount of variability in SAI ($SD = 14.70$; range: 90 to 160).

9.2. Inter-correlations

As per study 1, the correlation between Trait-Anger and SAI was positive in direction, but not significant statistically, $r = .10$, $z = 1.46$, $p = 0.144$, 95%CI = -.04/.24, $r_c = .11$. Additionally, the correlation between Neuroticism and SAI was negative in direction but not significant statistically, $r = -.14$, $z = -1.89$, $p = 0.058$, 95%CI = -.28/.01, $r_c = -.15$. However, Trait-Anger and Neuroticism were correlated significantly, $r = .50$, $z = 9.62$, $p < 0.001$, 95%CI = .39/.60, $r_c = .60$. Finally, Gf and SAI were correlated positively, $r = .40$, $z = 7.20$, $p < 0.001$, 95%CI = .29/.52, $r_c = .45$.

9.3. Latent variable modeling

Model 1 was found to be associated with acceptable model close-fit, $\chi^2(31) = 71.24$, $p < 0.001$, RMSEA = .076, SRMR = .070, CFI = .945. Furthermore, as can be seen in Fig. 3, Trait-Anger ($\beta = .36$, semi-partial $r^2 = .124$) and Neuroticism ($\beta = -.31$, semi-partial $r^2 = .094$) were associated with positive and negative statistically significant standardized beta-weights ($p = 0.001$ and $p = 0.002$, respectively). Furthermore, as the semi-partial r^2 associated with Trait-Anger in Model 1 increased by more than 2% (i.e., $\Delta r^2 = .086$), in comparison to the same model that excluded Neuroticism (i.e., $\beta = .20$, $p = 0.004$, semi-partial $r^2 = .038$; see supplementary materials, Fig. S1), evidence for a large suppressive effect of Neuroticism on Trait-Anger was suggested. Similarly, as the semi-partial r^2 associated with Neuroticism in Model 1 increased by more than 2% (i.e., $\Delta r^2 = .082$), in comparison to the same model that excluded Trait-Anger (i.e., $\beta = -.11$, $p = 0.118$, semi-partial $r^2 = .012$; see supplementary materials, Fig. S2), evidence for a large suppressive effect of Trait-Anger on Neuroticism was observed.

Next, a model which included Narcissism as a hypothesized mediator of the effect between Trait-Anger and Neuroticism as predictors of SAI was tested and found to be associated with acceptable model close-fit, $\chi^2(58) = 126.18$, $p < 0.001$, RMSEA = 0.073, SRMR = 0.074, CFI = 0.947. As can be seen in Fig. 3 (Model 2), both Trait-Anger ($\beta = .18$, $p = .032$) and Neuroticism ($\beta = -.22$, $p = 0.013$) were associated with statistically significant direct effects as predictors of SAI. Additionally, Narcissism ($\beta = .39$, $p = 0.001$) was associated with a direct effect on SAI. Furthermore, both Trait-Anger ($\beta = .18$, $z = 4.19$, $p < 0.001$, 95%CI: .10/.30) and Neuroticism ($\beta = -.11$, $z = 2.20$, $p < 0.028$, 95%CI: -.23/-.04) were associated with statistically significant indirect effects. Thus, the hypothesis that Narcissism would, at least partially, mediate the effects between Trait-Anger and Neuroticism as predictors of SAI was supported. SAI was associated with a model $R^2 = .372$, $p = .006$, 95%CI: .26/.46.

Finally, as the specification of Narcissism as a mediator in Model 2 cannot be established unequivocally (either empirically or theoretically), an additional model which specified Trait-Anger, Neuroticism, and Narcissism as predictors of SAI was tested and found to be associated with acceptable model close-fit, $\chi^2(59) = 126.26$, $p < 0.001$, RMSEA = .071, SRMR = 0.074, CFI = .948. As can be seen in Fig. 3

Table 2
Observed score Pearson correlations between all variables (Study 2).

	1.	2.	3.	4.	5.	6.	7.	M	SD	Skew
1. SAI	(n/a)							120.06	14.70	.37
2. Trait Anger	.10	(.82)						2.48	5.39	.48
3. Neuroticism	-.14	.50	(.86)					20.98	7.32	.01
4. Raven's	.40	-.05	-.06	(.89)				22.38	6.66	-.66
5. Cattell's	.33	-.01	-.03	.66	(.68)			25.12	4.84	-.58
6. Fluid intelligence (Gf)	.40	-.04	-.05	.92	.91	(.79)		.00	1.0	-.72
7. Narcissism	.46	.23	-.02	.16	.15	.18	(.92)	101.53	19.98	.14

Note: N = 224; coefficients on the main diagonal (in parentheses) are internal consistency reliability estimates; correlations ≥ |.15| were statistically significant ($p < 0.05$; 2000 bootstrapped samples).

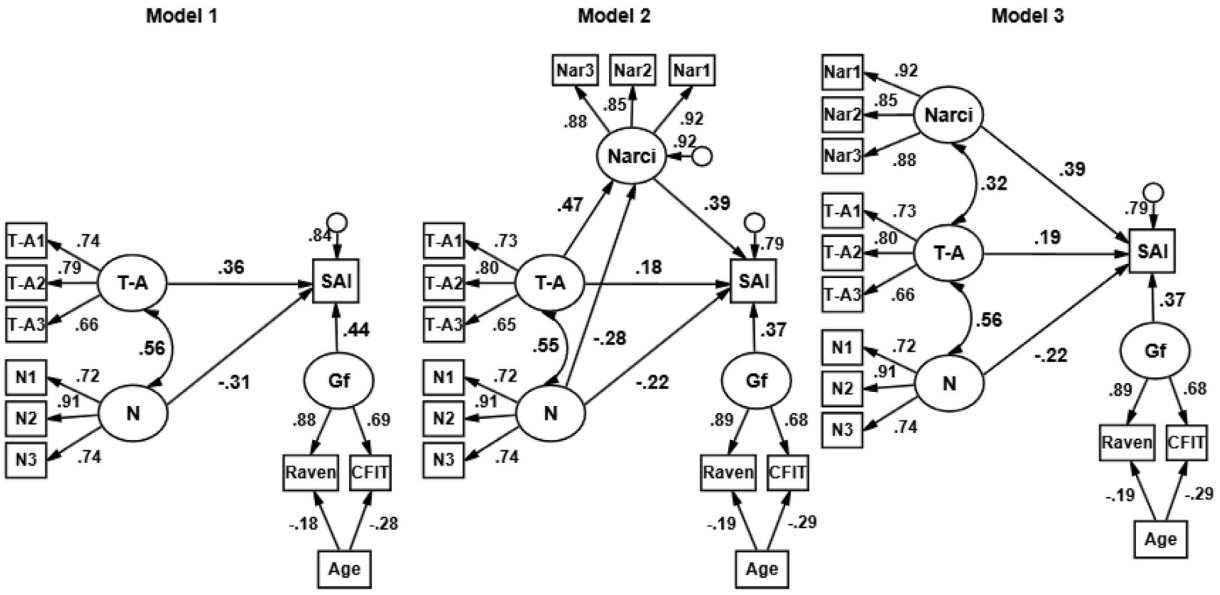

Fig. 3. Latent variable modeling results associated with Study 2; T-A = Trait-Anger; N = Neuroticism; SAI = Self-Assessed Intelligence; Gf = fluid intelligence; Narci = Narcissism; Model 1 = unique effects of Trait-Anger (T-A) and Neuroticism (N) on Self-Assessed Intelligence (SAI), controlling for the effects of fluid intelligence (Gf) on SAI; Model 2 = Model 1 + Narcissism (Narci) as a mediator; Model 3 = Model 1 + Narcissism as a unique predictor of SAI (all Study 2, N = 224); all effects are completely standardized; all coefficients were statistically significant ($p < 0.05$); indicator uniquenesses omitted for clarity.

(Model 3), Trait-Anger (β = .19, $p = 0.033$), Neuroticism (β = -.22, $p = 0.013$), and Narcissism (β = .39, $p = .001$) were associated with statistically significant standardized beta-weights. SAI was associated with a model $R^2 = .371$, $p = .005$, 95%CI: .26/.46.

10. Discussion

The results of study 2 confirmed our main hypothesis. Specifically, Trait-Anger (β = .35) and Neuroticism (β = -.32) evidenced differentially directed unique effects as predictors of SAI, even though Trait-Anger and Neuroticism were inter-correlated positively ($r = .56$). Correspondingly, evidence for suppression was observed, as hypothesized. Specifically, the unique effects of Trait-Anger and Neuroticism on SAI were larger than the corresponding zero-order correlations, which is considered consistent with statistical suppression (Paulhus et al., 2004). Given the relatively rare occurrences of replicated statistical suppression in the literature, the importance of the consistent effects reported across studies 1 and 2 is underscored. Thus, it may be contended with some confidence that the effects of Trait-Anger and Neuroticism onto a positively valued construct, SAI, are mutually suppressive.

An important, novel contribution of study was the observation that Narcissism mediated partially the effects between Trait-Anger and Neuroticism as predictors of SAI. Furthermore, the nature of the mediated effects was consistent with the hypotheses. Specifically, the indirect effect between Trait-Anger and SAI via Narcissism was positive in nature, whereas the indirect effect between Neuroticism and SAI via Narcissism was negative in nature.

11. General discussion

In the following, we discuss the key results associated with the two studies reported in this investigation. First, we discuss the nature of the positive association between Trait-Anger and Neuroticism and the differential effects between Trait-Anger and Neuroticism, as correlates of a socially valuable characteristic – intelligence. Correspondingly, we propose a theoretical account for the Trait-Anger and Neuroticism differential effects. Then, we focus on the relations of Trait-Anger with intelligence and suggest potential role of intelligence overestimation. Subsequently, we discuss the indirect effect via Narcissism, with respect to how it helps us understand the distinctions between Trait-Anger and Neuroticism. Finally, we describe some limitations and provide a conclusion.

11.1. Trait-Anger and neuroticism: differential effects and suppression

Across both studies in this investigation, a large, positive association between Trait-Anger and Neuroticism was observed ($r \approx .40$ to .55). Thus, higher levels of Neuroticism were associated with higher levels of Trait-Anger. Such a positive correlation is consistent with previously published research (e.g. Bettencourt, et al., 2006; Ode et al., 2008). Although, positively inter-correlated, Neuroticism and Trait-Anger were found in prior works to be differentially associated with several processes and dispositions, such as optimistic bias, sense of control, approach motivation, and Narcissism. Thus, we hypothesized that they would manifest differential effects on subjectively assessed intelligence. Indeed, across both studies, we found that Trait-Anger and Neuroticism acted as mutual suppressors in predicting SAI. Specifically, when analyzed together in one model, Trait-Anger was positively associated with SAI, whereas Neuroticism was negatively so. These results shed new light on the nature of Trait-Anger by revealing its heterogeneity. Below, we propose an account that Trait-Anger might actually have two faces, or aspects.

First, one has to consider the construct underlying Neuroticism's scales. Theoretically, Neuroticism refers to a broad tendency toward negative emotionality, which includes a wide spectrum of affect such as anxiety, depression or anger (Costa & McCrae, 1992). However, many measures of Neuroticism, especially short forms, primarily reflect anxiety (Costa & McCrae, 1992; Goldberg, 1992). For instance, with respect to the measures of Neuroticism used in this investigation (i.e., NEO-FFI and IPIP Big-Five Factor Markers), only one item refers to anger, whereas the other items are relevant to anxiety, worry and tension. Consequently, it is possible that in the analyses of the present studies, the anxious relevant variance associated with Trait-Anger was removed, which allowed the remaining Trait-Anger variance relevant to unrealistic optimism and overconfidence to display its effects onto SAI. Thus, the current studies suggest that there might be two faces of Trait-Anger. One is associated with Neuroticism and possibly reflects an

anxious aspect of Trait-Anger, which results in a more negative view of the self, at least with respect to perceived cognitive ability. The second face of Trait-Anger reflects overconfident optimism.

The notion of two potential aspects of Trait-Anger finds some support in the literature. As mentioned above, anger is predominantly associated with approach motivation and relative left frontal activity (Carver & Harmon-Jones, 2009). However, there is some evidence to suggest that, in some cases, it might be also linked to relative right frontal cortical activity and possibly withdrawal motivation and anxiety (Harmon-Jones & Harmon-Jones, 2016). For instance, Zinner, Brodish, Devine, and Harmon-Jones (2008) found that in a provocative situation in which anger was considered socially inappropriate, individuals experienced increased levels of both anger and anxiety which manifested relative right frontal activity. In another study, Hewig, Hagemann, Seifert, Naumann, and Bartussek (2004) examined the relationship between resting baseline brain activity and two aspects of Trait-Anger distinguished by Spielberger (1999): Anger-Out (tendency to openly express angry feelings) and Anger-Control (controlling angry feelings by preventing the expression of anger). Hewig et al. (2004) found that the former was associated with greater relative left frontal activity, whereas the latter correlated with greater right frontal activity. In the current investigation, the Trait-Anger measure reflected a general tendency toward experiencing anger, however, it does not describe the individual differences in anger expression. Therefore, it is possible that, after controlling for Neuroticism, the withdrawal-motivation is removed from the variance of Trait-Anger. This process increases the positive effect of Trait-Anger on SAI, and reveals a second face of Trait-Anger. The remaining part of Trait-Anger (observed when Neuroticism is controlled) might be associated with all of the aforementioned phenomena, i.e. optimism, approach motivation, sense of control and Narcissism. Indeed, the latter construct accounted for some of the variance in the Trait-Anger and SAI relationship suggesting that Trait-Anger may reflect also feelings of grandiosity and superiority.

11.2. Trait-Anger and objective and subjective intelligence

In both studies, we noted that Trait-Anger and objective intelligence were essentially unrelated. Previous work on this topic is associated with mixed results. Although in some cases the two constructs showed weak negative correlation ($r \approx$ -.20; e.g. Zajenkowski & Zajenkowska, 2015), in other studies the association was closer to zero (e.g. Austin et al., 2002). This is in line with the meta-analytic findings showing that personality traits and cognitive abilities are generally associated weakly (e.g. Ackerman & Heggestad, 1997). As mentioned above, much stronger correlations are observed between SAI and personality (Chamorro-Premuzic & Furnham, 2004). As mentioned above, SAI is more probably a part of personality, rather than objective intelligence (Chamorro-Premuzic & Furnham, 2004). This was also the case in the current studies: personality traits correlated more strongly with SAI than with objective intelligence.

Finally, it worth noting that in study 2, 37.2% of the variance in SAI was accounted for by all four predictors in the model (Trait-Anger, Neuroticism, Narcissism, and Fluid Intelligence). To our knowledge, such a percentage of variance accounted for in SAI is the largest observed in the literature, as previous investigations have reported effect sizes closer to model $R^2 \approx .30$, based on Big Five, objective intelligence and gender (e.g. Chamorro-Premuzic & Furnham, 2006b). Larger model R^2 values are conceivable with the addition of other variables, including socially desirable responding, for example.

11.3. The role of overestimation in Trait-Anger

The question arises about the role of intelligence overestimation observed among high Trait-Anger individuals. It is worth recalling that anger is typically defined as a negative emotion that occurs in response to a blocked goal (Berkowitz, 1993; Carver & Harmon-Jones, 2009). Anger may play important evolutionary functions, as well. For instance, it regulates social interactions and organizes processes to assist with goal-directed action (Harmon-Jones & Harmon-Jones, 2016). According to Sell, Tooby and Cosmides (2009), anger evolved to bargain for better treatment and its primary function is to resolve conflicts of interest in favor of the angry individual. Challenging the blockage of approach motivation or bargaining for better treatment may require psychological strength, which might be fueled by increased optimism, sense of control, the feeling of competence, and perhaps the overestimation of competence and ability.

The belief that high intelligence is beneficial has roots in both studies showing its consequences for real life outcome as well as social perception of smart people.

Numerous studies have revealed that intelligence leads to success in many life domains, such as health and longevity (Gottfredson & Deary, 2004), job performance (Schmidt, 2002), and earnings (Zagorsky, 2007). Additionally, intellectual self-enhancement is regarded as more agentic rather than communal (Brummelman, et al., 2016). Indeed, lay people consider intelligence as a socially desirable characteristic and stereotypically think about a typical person with high cognitive ability as having other characteristics that are usually seen as socially beneficial, such as low Neuroticism, and high levels of Extraversion, Openness and Conscientiousness (Mőttus, Allik, Konstabel, Kangro, & Pullmann, 2008). Interestingly, although agreeableness is regarded as socially advantageous, lay judges do not believe that it is a necessary characteristic of a smart person (Mőttus et al., 2008). Thus, a belief that one possesses a high level of cognitive ability may encourage an individual with high Trait-Anger to approach and *fight*, rather than engage in *flight* behavior.

Although positive intelligence illusions are likely to serve adaptive functions in anger, such as overriding obstacles on the way to desired goal, cognitive overconfidence may have also negative consequences. In a recent study, Ehrlinger, Mitchum and Dweck (2016) have shown that individuals who overestimate their performance on ability tests exhibit a biased tendency to allocate attention away from difficulty. Specifically, the authors examined people holding different theories of intelligence, i.e. a more incremental view of intelligence — characterized by the belief that intelligence is malleable and can be developed over time—and a more entity view—characterized by the belief that intelligence is fixed and unchangeable. They found that the latter group tended to overestimate their abilities and focused more on easy tasks, rather than difficult ones. Ehrlinger et al. (2016) suggested that facing difficulty while completing a task can serve as a cue that one is performing poorly, and, by extension, might not be smart. Similarly, experiences of ease when performing a task serve as implicit cues that one is succeeding or performing well. Consequently, motivations to avoid negative feedback might lead entity theorists to allocate less attention to difficult problems and more attention to easy problems on intellectual tasks, compared to incremental theorists. In the current studies, we did not analyze the processes underlying cognitive performance of high Trait-Anger individuals. However, one may wonder whether they would manifest tendencies similar to these described by Ehrlinger et al. (2016). Because Trait-Anger is associated with overestimation of abilities, it would be interesting to examine whether it is also related to entity theory of intelligence. Additionally, it is likely that the biased allocation in attention observed by Ehrlinger et al. (2016) among overconfident individuals generalize to angry people, as well. Such findings would be consistent with other results suggesting that Trait-Anger is associated with poorer performance on relatively difficult tasks (e.g. cognitive control; Wilkowski & Robinson, 2010), whereas, on some easy tasks, Trait-Anger has a beneficial influence (e.g. simple reaction time tasks; Bresin, Hilmert, Wilkowski & Robinson, 2012).

11.4. The role of Narcissism

In study 2, we found that Narcissism mediated partially the

relationship between Trait-Anger and SAI. This result might shed some light on the nature of the intelligence overestimation observed among individuals with high Trait-Anger. Many researchers have noted that thinking positively about oneself is not the exclusive domain of the narcissist (Brummelman et al., 2016). However, narcissists typically build their positive self-views in comparison to others, whereas many high self-esteemers simply feel satisfied with themselves as a person. By contrast, Neuroticism is negatively associated with Narcissism (e.g. Miller et al., 2011), self-esteem, as well as general negative self-view (Matthews, Deary & Whiteman, 2009).

The question arises whether tendencies observed in Narcissism are also characteristic for people with high Trait-Anger. In particular, one may speculate that their intelligence positive illusions have roots in narcissistic feelings of grandiosity and superiority to others, rather than high self-worth in general. Moreover, researchers emphasize that the narcissistic inflated self-views may have consequences in the social realm. Specifically, individuals with high Narcissism do not establish deep, intimate bonds with others, but rather surpass and dominate others (Campbell, Rudich, & Sedikides, 2002). Correspondingly, Trait-Anger is associated with problems in relationships (Wilkowski & Robinson, 2010). We speculate that these difficulties may be related to the thoughts of superiority to others, especially in the ability domain. Often, experiences of anger might result in thoughts such as, “I am smart” and “You are stupid”, which may, in turn, cause problems in creating positive relations with others.

12. Limitations

The present investigation is associated with several limitations. First, we used a relatively simple measure of SAI. However, some researchers suggest that there might be different ways to assess overconfidence. For instance, Moore and Healy (2008) noted that the research literature distinguishes between overestimation of one’s actual ability/performance, overplacement of one’s ability/performance relative to others, and excessive precision in one’s beliefs. Although these processes are often treated as interchangeable manifestations of self-enhancement, they might have different sources and consequences (Moore & Healy, 2008). Thus, it would be valuable in future studies to carefully distinguish between various methods of assessing overconfidence and their relation to Trait-Anger.

Secondly, the effects reported in this investigation are non-experimental in nature, consequently, we cannot infer, justifiably, any causal connections between any of the hypothesized predictors of SAI. Additionally, we assessed anger as a trait. However, many of the effects described in the introduction often refer to anger as a transient state. Therefore, it would be useful to determine whether experimentally manipulated state anger can be shown to have concomitant effects on SAI. Such evidence would help support a causal influence of anger onto SAI.

13. Conclusion

Although observed rarely in the literature, substantially positively inter-related dimensions can be found to relate differentially to an outcome. In the context of this investigation, Trait-Anger and Neuroticism revealed themselves to be such dimensions, which highlights the limitations associated with the interpretation of scores independently of each other. The results also highlight the multiple trait processes that may lead to the generation of impressions of intellectual ability.

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Appendix A. Supplementary data

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