Personality and Individual Differences 134 (2018) 16–24

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

The heritability of response styles and its impact on heritability estimates of personality: A twin study

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ARTICLE INFO

Keywords:
Behavioral genetics
Extreme response style
Acquiescence response style
Twin study
ANPS

ABSTRACT

Response styles (RS) are an important research matter in questionnaire research and have even been interpreted as implicit personality variables aside from explicit personality measurement. To better understand RS and their impact on explicit personality measurement, it is necessary to explore causes of variability in RS, including heritability. Therefore, the current study followed two aims: First, we investigated the heritability of two of the most common RS (acquiescence RS and extreme RS; ARS & ERS). Second, we tested whether correcting for RS affects the genetic component for and correlations among explicit personality measures. We used an extended classical twin design with twins (n = 464) and non-twin siblings (n = 242). Personality was measured administering the *Affective Neuroscience Personality Scales* (ANPS). Results indicated a heritability of 37% for ARS and 57% for ERS. This difference between the two RS might be explained by their genesis: ARS has been associated with social adaption, and thus might depend primarily on environmental experiences, while ERS has been related to anxiety and temperament, which are majorly hereditary. Correcting explicit personality for RS did not change estimations of heritability for the ANPS traits suggesting that RS does not majorly influence estimations of heritability for explicitly measured personality.

1. Introduction

The study of factors influencing development and shaping of personality is one of the most important fields in personality research (Roberts, Wood, & Caspi, 2010). Among others, scientists have intensively investigated the heritability of individual differences depicting varying results depending on the respective trait (Polderman et al., 2015). In psychological research, personality traits are mostly measured using self-reports, which are influenced not only by the actual trait level but also by other factors like social desirability, wording of items or response styles (RS) (for example Baumgartner & Steenkamp, 2001; Ellingson, Sackett, & Hough, 1999; Van Sonderen, Sanderman, & Coyne, 2013). Next to direct influences on personality scores, these factors could also have an impact on the aforementioned heritability estimates. This consideration is supported, for example, by the findings of Kam, Schermer, Harris, and Vernon (2013), who reported that RS after all explained > 20% of the variance in personality constructs. Hence, knowledge about causes of individual differences in RS is important for personality research. Therefore, the current paper deals specifically with one of these influencing factors, the response behavior, and follows two major aims: First, we specify heritability estimates for two of the most prominent RS (*acquiescence response style* (ARS) and *extreme response style* (ERS); Weijters, Geuens, & Schillewaert, 2010a) using a twin sibling design and responses given to the *Affective Neuroscience Personality Scales* (ANPS) for measurement of personality. Second, we explore, whether a potential genetic basis of RS affects estimations of heritability of explicit personality measures, which could necessitate a change in the interpretation of findings concerning these

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https://doi.org/10.1016/j.paid.2018.05.023
Received 5 February 2018; Received in revised form 17 May 2018; Accepted 18 May 2018

traits. Hence, our results could contribute to the further development of twin research in personality.

1.1. Response styles and individual differences

RS can be defined as the tendency of giving responses to an item depending on the scale or format the item is presented in (Cronbach, 1946, 1950). They have also been described as a form of systematic individual difference in response to scale use independent of item content and actual trait level (Wetzel, Carstensen, & Böhnke, 2013). Thereby, RS differ from other influences on explicit personality measurement, such as social desirability, which have a relation to the content under investigation (e.g., Nederhof, 1985). Potential RS include the tendency to answer positive or negative or the tendency to use only the middle category of a response scale (Baumgartner & Steenkamp, 2001; Van Vaerenbergh & Thomas, 2013). Investigating RS is very important in empirical research, because they can have an impact on the validity of self-report measurement (Moors, 2012; Mõttus et al., 2012; Ware Jr, 1978). Their influence is especially pronounced when items are ambiguous or relatively unstructured (Cronbach, 1946). Besides, research has demonstrated the pervasiveness, stability and validity of personal RS in several studies (e.g., Austin, Deary, & Egan, 2006; Bachman & O'Malley, 1984a; Clarke I, 2001; Eid & Rauber, 2000) indicating that RS themselves can be considered as personality variables. Therefore, RS are not only a potential confounding variable, but they can also be interpreted as an important alternative to implicitly assess personality via answer behavior.

Two of the most prominent RS are *acquiescence response style* (ARS) and *extreme response style* (ERS) (Weijters et al., 2010a). ARS has been defined as the tendency to agree with items on a Likert scale regardless of content (Baumgartner & Steenkamp, 2001). Among others, ARS have been associated with the method of data collection (more ARS in telephone interviews; Weijters, Geuens, & Schillewaert, 2008), less intelligence (Gudjonsson, 1990), higher cognitive load (Knowles & Condon, 1999), sex (higher ARS in women; Weijters, Geuens, & Schillewaert, 2010b) or lower income (Meisenberg & Williams, 2008). Other positive relations have been shown to cognitive impairment, poor education, low social status or cognitive aging (Kam et al., 2013).

ERS has been defined as the tendency to use the most extreme alternatives on a Likert scale in both directions, positive and negative (Plieger, Montag, Felten, & Reuter, 2014). It has been associated with higher extraversion and conscientiousness (Austin et al., 2006) and extreme responders are peer-rated to be more intolerant of ambiguity, more simplistic thinking, and more decisive (Naemi, Beal, & Payne, 2009). Other associations have been shown for sex (higher ERS in females; Eid & Rauber, 2000), culture (more ERS in the Mediterranean; Johnson, Kulesa, Cho, & Shavitt, 2005; Van Herk, Poortinga, & Verhallen, 2004), social interest (less ERS in participants with higher social interest; Crandall, 1982) and IQ (less ERS in participants with higher IQ; Light, Zax, & Gardiner, 1965).

1.2. The heredity of response style

Although the aforementioned studies suggest a high level of individual differences in RS, there are still few findings on the issue of their heredity: First, Littvay (2010) found a significant heritability component (25–34%) for ARS in the national survey of midlife development in the United States (MIDUS; Brim, Ryff, & Kessler, 2004). Concerning ERS, the author reports that heritability explained < 20% (non-significant) of the variance. Littvay offers two explanations for his findings: First, underpowering of the sample might prevent finding a hereditary component for ERS. Second, ARS but not ERS may be related to satisficing, which is defined as a shift in participants' response strategy when taking part in a questionnaire interview (Krosnick, 1991). It describes the decrease in energy and the increase in cognitive load while answering, which leads participants to compromise their standard to give optimal answers. According to Littvay (2010), satisficing might be related to participants' scores in agreeableness, extraversion and openness, all of which have shown substantial heritability (Jang, McCrae, Angleitner, Riemann, & Livesley, 1998).

In contrast, Kam et al. (2013) investigated the heritability of ARS using the HEXACO personality scales and found neither genetic effects nor effects of shared environment on ARS, leaving non-shared environment as the primary source of variation. The workgroup argues that ARS may be most prominently influenced by non-shared environment due to its cultural and social functioning, because ARS helps individuals to fit into existing social structures and to conform to the goals and wishes of their social reference group. Suitably, respondents from collectivistic cultures depict more pronounced ARS compared to members of individualistic cultures (e.g., Johnson et al., 2005) and ARS has even been interpreted as an aspect of cultural communication style (Smith, 2004). However, the described influence of social and cultural functioning could also lead to higher similarity and could therefore lead to shared environmental influences as well. Recently, Tucker-Drob, Briley, Engelhardt, Mann, and Harden (2016) assessed ARS using a child version of the Big Five Inventory. According to their findings, there were no differences in intraclass correlations between monozygotic and dizygotic twins indicating no relevant hereditary component for ARS.

Finally, Plieger et al. (2014) suggested an association between the serotonin transporter polymorphism (5-HTTLPR) and ERS, indicating that ERS is in parts heritable. Here, carriers of the L-allele depicted a significantly higher number of extreme responses, indicating that endogenous serotonin activity might be a biological root of extreme responding. Besides, the authors found small but highly significant negative correlations between ERS and neuroticism as well as harm avoidance, indicating that ERS might be interpreted as an endophenotype for anxiety (i.e., the more anxious a participant, the fewer extreme responses he or she will give). However, given sample size, these results needs to be replicated.

1.3. Inconsistencies of previous studies and potential explanations

In sum, the previous studies draw a very inconsistent picture concerning the heritability of response styles. One explanation might be that they differed concerning the utilized questionnaires, the sample composition and age. For example, while Kam et al., Tucker-Drob et al. and Plieger et al. used “classic” personality questionnaires, Littvay used a combination of several questionnaires measuring diverse variables. In case of Tucker-Drob et al., personality was measured in children where heritability estimates are typically lower while the other samples consisted of adults. Finally, Plieger et al. used a molecular genetic approach while all other studies utilized a twin design. Overall, this leaves only one study that examines the heritability of RS based on personality questionnaires in adults (Kam et al., 2013).

1.4. Expectations

Due to the inconsistency of previous findings, it is difficult to name the expected amount of heritability for ARS and ERS. Following Kam et al. (2013) and the findings of Littvay (2010), we expect that ARS will have a comparably small heritably component. In case of ERS, we follow the idea of Plieger et al. (2014) that this response style may have a closer relationship to anxiety and temperament, because taking a strong stand in a questionnaire requires the courage and drive to expose oneself. Both temperament (Saudino, 2005) and anxiety are substantially genetically determined, which gives reason to believe that the same could be true for ERS. Since, to our knowledge, this is the first time the impact of RS on estimates for heritability and genetic correlation of personality is investigated, we will refrain from phrasing expectations for the part of our study.