The General Factor of Personality
Its Relation to Leadership and Creativity

Peiqian Wu

GFP

Leadership

Creativity

INVITATION

You are cordially invited to
the public defense of
my PhD thesis

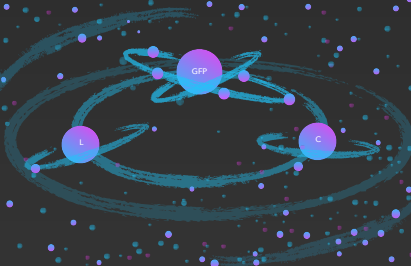## The General Factor of Personality:
Its relation to leadership and creativity

on Wednesday, November 16th, 2022
at 13.00 hours

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The General Factor of Personality:
Its relation to leadership and creativity

De Algemene Persoonlijkheidsfactor (GFP): zijn relatie tot leiderschap en creativiteit

Thesis

to obtain the degree of Doctor from the

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The public defence shall be held on

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by

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Content

Chapter 1
General Introduction

In the area of personality research, one of the core topics is the structure of personality. In exploring that topic, several pioneers provided multiple models for the structure of personality, of which the following are the most well-known: Cattell's 16 factors model, Eysenck's (1993a) Giant Three, the Five-Factor model also known as the Big Five (Goldberg, 1990; McCrae & Costa, 1987), and more recently, the Six-Factor HEXACO model (Lee & Ashton, 2006), which latter model is 'winning terrain' in personality research. Each of these models distinguishes different traits/dimensions and all have provided useful contributions to understanding the fundamental nature of personality.

During the past two decades, there has been increasing emphasis on the possibility that beyond these current models also higher-order personality factors may exist. One of these presumably higher-order personality factors has been labeled the general factor of personality, or the GFP in short (Figueredo et al., 2004). The GFP is regarded as reflecting the variance that is shared by the underlying personality traits and by some researchers the GFP is assumed to occupy the summit position in the personality hierarchy (Musek, 2007; van der Linden et al., 2010b). Regarding its content, the GFP seems to capture the socially desirable ends of more specific personality dimensions (van der Linden et al., 2016). For example, in terms of the Big Five, high–GFP individuals can be described as relatively open-minded, hard-working, sociable, friendly, and emotionally stable (van der Linden et al., 2021b). Given the socially desirable behavior that is captured by the GFP, it may not be surprising that some scholars consider the GFP to mainly reflect bias, such as socially desirable response tendencies. However, others have suggested that the GFP may not merely reflect methodological or statistical bias, but that it contains a relevant substantive component, reflecting a truly broad trait.

While the scientific debate on the GFP is ongoing, the present dissertation contains a set of empirical studies aimed to contribute insight into the nature of this higher-order construct. In this introduction, I will provide an elaborate background on GFP research, followed by an introduction of four empirical chapters included in this dissertation that test various aspects of the GFP specifically related to creativity and leadership.

History of the GFP

Although systematic research on the GFP is relatively recent, its conjecture can actually be traced back to more than one hundred and fifty years ago, when Darwin (1871) mentioned the possibility of a single general personality dimension. He speculated that through natural selection, humans, overall, have become more cooperative and less contentious compared to other primates. Webb (1915) was credited as the first to conduct an empirical study testing for a general factor in personality. Nevertheless, perhaps due to

the lack of adequate statistical methods, the test on this factor had been largely paused until around early 2000 when Figueredo et al. (2004) and later Musek (2007) re-emphasized the existence of a general factor in the Big Five personality model, which they labeled the GFP. Their findings were confirmed in a large meta-analysis by van der Linden et al. (2010b; $k = 212$, total $N = 144,117$).

Fig 1

The conceptual personality hierarchy
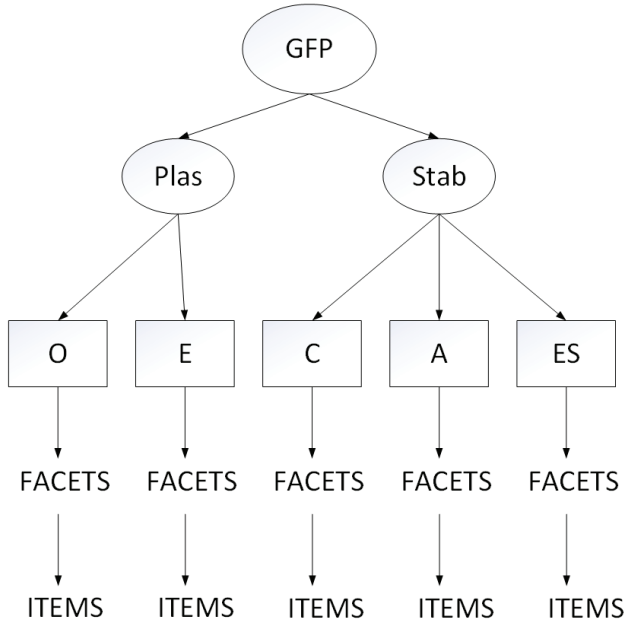
Note. Stab, Stability; Plas, Plasticity; O, Openness; C, Conscientiousness; E, Extraversion; A, Agreeableness; ES, Emotional Stability (the reverse of Neuroticism).

In initial studies on the GFP, the factor was mainly extracted from the Big Five personality model. In that personality model, the GFP has been found to be the broadest factor, while there also seem to be two intermediate, higher-order factors between the Big Five and the GFP, namely Alpha and Beta (Digman, 1997). Alpha consists of the shared variance of Conscientiousness (C), Agreeableness (A), and Neuroticism (N), while Beta was extracted from Openness to new experience (O) and Extraversion (E). Digman (1997) proposed that the Alpha factor referred to the sociability of individuals, while the Beta indicates personal growth. Based on their content, DeYoung et al. (2002) renamed these two factors stability and plasticity, respectively. It has been consistently found that stability

and plasticity are intercorrelated, indicating the presence of an even higher-order factor, the GFP. Figure 1 presents the full Big Five hierarchy as mentioned in previous studies such as by Figueredo et al. (2004), Musek (2007), Rushton and Irwing (2008), and van der Linden et al. (2010b).

To test whether the GFP is truly 'general', scholars tested it using other personality questionnaires or inventories than the Big Five, such as Cattel's 16-Factor Questionnaire, the HEXACO questionnaire, the MMPI, the EPQ, the California psychological inventory, the Hogan personality inventory, and the Temperament and character inventory (Anglim et al., 2019; Loehlin, 2012a, 2012b; Rushton et al., 2009a; Veselka et al., 2009a). The GFP has been reported to be found in all of these models and instruments, although there were some exceptions of studies that did not find a clear general factor (e.g., de Vries, 2011; Hopwood et al., 2011). Several studies have also confirmed that general factors extracted from different personality models/surveys show substantial overlap, suggesting that they reflect the same construct (Irwing et al., 2012; van der Linden et al., 2011)

Overall, the GFP seems to be a stable construct across various personality questionnaires. Table 1 displays studies testing the GFP with different versions of the Big Five inventories and other personality inventories in alphabetical order. In that table, we only listed the main authors of studies for space reasons. Titles and other information for those listed studies can be found in the references chapter of this thesis.

Apart from testing the robustness of the GFP using different personality inventories, another approach to test the generalizability of the GFP is to examine the construct in samples from different countries or cultures. Most studies in the table above tested the GFP in so-called WEIRD (Western, Educated, Industrialized, Rich, and Democratic Henrich et al., 2010) samples. Thus, testing the GFP with non-WEIRD samples is important in order to address questions regarding its generalizability. For that aim, some scholars have focused on non-WEIRD samples. Due to such endeavors, results show that the GFP has now also been found in samples from Iran (Erdle & Aghababaei, 2012), Jamaica (Hull & Beaujean, 2011), Japan (Dunkel, 2013a), and South Korea (Rushton et al., 2009b). More recently, a study confirmed the GFP structure in indigenous inhabitants of the lowlands of Bolivia (van der Linden et al., 2018). To provide more large non-WEIRD samples testing the GFP, we conducted a meta-analysis with data collected from mainland China (Chapter 2).

Table 1

The Used Personality Inventories in Testing the GFP

Personality Inventories		Publications
Inventories based on the Big Five or five-factors model	BFI	van der Linden et al. (2010b); Musek (2007); Dunkel et al. (2012); Rushton and Erdle (2010); Erdle and Rushton (2011); Şimşek (2012); Erdle et al. (2010): van der Linden et al. (2018); Pelt et al. (2020); Bäckström et al. (2020)
	Multiple Big Five inventories or meta-analysis	Rushton et al. (2009a); Figueredo et al. (2004); Dunkel (2013a); Rushton and Irwing (2008); Dunkel et al. (2018); Pelt et al. (2017); van der Linden et al. (2016); van der Linden et al. (2011); Davies et al. (2015); Oltmanns et al. (2018); Do and Minbashian (2020); Chang et al. (2012); Anusic et al. (2009); van der Linden et al. (2010b)
Inventories based on the Big Five or five-factors model	NEO	van der Linden et al. (2010b); Dunkel et al. (2014a); Dunkel et al. (2014b); Dunkel et al. (2014c); Dunkel et al. (2016); Loehlin (2012a); Dunkel and van der Linden, (2014); Schermer et al. (2012); Rushton et al. (2009a); Rushton and Irwing (2008); van der Linden et al. (2014); van der Linden et al. (2016); van der Linden et al. (2017b) ; Veselka et al. (2009a); Kowalski et al. (2016); Bäckström et al. (2020); Hopwood et al. (2011); Bäckström (2021)
	IPIP	van der Linden et al. (2010b); Musek (2007); Aghababaei (2013); Erdle and Aghababaei (2012): Bäckström et al. (2020); Lebuda et al. (2019); Dunkel et al. (2017); Bäckström (2021)

Personality Inventories		Publications
Inventories based on the Big Five or five-factors model	Other versions (less commonly-used) of the Big Five Questionnaire, such as Big Five Observor	van der Linden et al. (2010b); Musek (2007); Dunkel et al. (2012); van der Linden et al. (2012); Rushton et al. (2009a); van der Linden et al. (2014); van der Linden et al. (2012); Bäckström et al. (2020); Rodriguez et al. (2020)
Non-Big Five-based inventories	California Psychological Inventory(CPI)	Rushton and Irwing (2009a); Loehlin (2013); Loehlin (2012a); Dunkel and van der Linden (2014); Loehlin (2011); Dunkel et al., (2014a); Hopwood et al. (2011)
	California Q-Sort (Chirld/Adult)	Dunkel (2013b); Dunkel et al. (2016); Dunkel and de Baca, (2016)
	Cattell's Sixteen Personality Factor Questionnaire (16PF)	Loehlin (2013); Loehlin (2012b); Hopwood et al. (2011)
	Cloninger Tridimensional Personality Questionnaire (TPQ)	Loehlin (2013); Loehlin and Martin (2011)
	Colorado Child Temperament Inventory (CCTI)	Dunkel et al. (2019)
	Comrey Personality Scales Minnesota	Rushton and Irwing (2009b)
	Dark Triad	Veselka et al. (2011); van der Linden et al. (2017b)
	Dimensional Assessment of Personality Pathology	Rushton and Irwing (2009b)

Personality Inventories		Publications
Non-Big Five-based inventories	EAS Temperament Survey	Rushton and Irwing (2008)
	Eysenck Personality Questionnaire (EPQ)	Rushton and Irwing (2008); Loehlin (2013); Rushton and Erdle (2010); Loehlin and Martin (2011)
	General Factor of Personality Questionnaire(GFPQ)	Micó et al. (2012)
	Gough Adjective Checklist	Dunkel and van der Linden (2014)
	Guilford–Zimmerman Temperament Survey	Rushton and Irwing (2009a)
	HEXACO personality inventory	Loehlin (2012a); Veselka et al. (2009a); Anglim et al. (2019); van der Linden et al. (2016); Hopwood et al. (2011); de Vries (2011); Ashton et al. (2020)
	Hogan Personality Inventory (HPI)	Rushton et al. (2009b); Loehlin (2012a); Dunkel and van der Linden (2014); Hopwood et al. (2011)
	International Personality Item Pool (IPIP)	Rushton et al. (2009b)
	Jackson Personality Inventory	Rushton et al. (2009a); Schermer and MacDougall (2013)
	Millon Clinical Multiaxial Inventory-III	Rushton and Irwing (2009b)
	Minnesota Multiphasic Personality Inventory-2	Rushton and Irwing (2009b); Dunkel et al., (2014a); Irwing et al. (2012)

Personality Inventories		Publications
Non-Big Five-based inventories	Multicultural Personality Questionnaire (MPQ)	Hopwood et al. (2011); Loehlin (2013); Loehlin, (2012a); Rushton and Irwing (2009a)
	Multidimensional personality questionnaire	Loehlin (2012b); Rushton and Irwing (2009a)
	Performance Motivation Test (PMT)	van der Linden et al. (2016)
	Personal Characteristics Inventory (PCI)	Rushton et al. (2009b)
	Personality Assessment Inventory	Rushton and Irwing (2009a)
	Personality Research Form	Rushton et al. (2009a); Schermer and MacDougall (2013); Dunkel and van der Linden (2014)
	Prosocial Scale of the Strengths and Difficulties Questionnaire	Rushton et al. (2009a)
	Six-factor personality questionnaire	Loehlin (2012b); Hopwood et al. (2011)
	Student Activities Inventory (SAI)	Dunkel and van der Linden (2014)
	Supernumerary Personality Inventory (SPI)	Veselka et al. (2011)

Personality Inventories		Publications
Non-Big Five-based inventories	Temperament and Character Inventory (TCI)	Rushton and Irwing (2009b); Loehlin (2012a); Hopwood et al. (2011)
	Thurstone Temperament Schedule (TTS)	Loehlin (2013)
	Work-related Personality Inventory (WPI)	Pelt et al. (2020)

Beyond survey-based studies, Rushton et al. (2009a, 2009b), van der Linden et al. (2018), and Veselka et al. (2009a, 2009b, 2011) conducted a series of behavioral genetic studies with twin samples. They found the estimated heritability of the GFP to be approximately 50% (see also Bell et al., 2012), supported by the finding that about 50% of the genetic variance in the GFP was non-additive. Through those behavioral genetic studies, the construct of the GFP seemed more robust and related to evolutionary underpinnings.

Based on a large number of studies such as those listed in the present paragraphs, the existence of the GFP can be thought of as rather convincing. Nevertheless, the question of what is the nature of the GFP still remains. That is the topic of the subsequent paragraphs.

The Nature of the GFP

As mentioned before, the idea of a substantive general mechanism behind personality had its origin in Darwin's evolution theory. This may also be one of the reasons for the fact that the initial empirical studies that led to the revival of the idea of a GFP were conducted in light of the so-called life history theory (LHT; Figueredo et al., 2004). *"Life history (LH) theory is a mid-level evolutionary based theory premised on the idea that organisms must make trade-offs in the allocation of bioenergetic resources."* (p53, Dunkel, et al., 2018). According to LHT, it has been suggested that social competition and reproductive dynamics have helped direct human evolution, which rendered a cluster of socially effective personality traits and facets that converge into a GFP (Rushton et al., 2009a). A core of that explanation is that the GFP plays a vital role in humans' adaptation. Rushton et al. (2009a) stated:

"In a competitive world, there are always rewards (personal and professional) for more efficient persons—those who are more level-headed, agreeable, friendly, dependable, and open. We close by noting Tolstoy's (1875/1918) famous opening in Anna Karenina, 'All happy families resemble one another, but each unhappy family is unhappy in its own way.' Perhaps a similar principle applies to individuals: 'All happy [or efficient] people resemble one another; each unhappy [inefficient] person is unhappy [inefficient] in his or her own way.' (p. 1183) Regarding those notes, the General Factor of Personality (Figueredo et al., 2016) and Dark Triad of personality (Paulhus & Williams, 2002) seemed to provide perspectives for thinking from scientific scopes in reversed directions (Kowalski et al., 2016).

In contrast to this perspective, Ashton et al. (2009) stated that there are no higher-order factors above the Big Five or HEXACO model. They suggested that the intercorrelations among the narrower traits (the reason for the existence of higher-order factors) are caused by the intercorrelations among the lower-order personality facets. Thus, Ashton et al. concluded that the GFP is an artifact due to the way we measure personality. Ashton et al. were correct by suggesting that after controlling for those intercorrelations among either facets or traits higher-order factors such as the GFP 'disappeared'. Nevertheless, a crucial question would be what is the reason for controlling for those intercorrelations among traits of facets? No direct theoretical justification can be based on when doing so, to the best of our knowledge. In our interpretation, traits or facets intercorrelate with other traits or facets because they all may be influenced by a set of broad psychological mechanisms. As a comparison, think about the intercorrelations between specific facets of general intelligence (Jensen, 1998). If one would control for the correlations at the facet level, then surely the general factor of intelligence, g, will strongly diminish or even disappear. Yet, that does not imply there is no general intelligence.

Apart from the discussion about controlling for intercorrelations, other researchers have suggested that the GFP merely reflects common method variance (CMV), and thus it needs to be controlled for (Anusic et al., 2009; Chang et al., 2012; Revelle & Wilt, 2013). Similarly, Bäckström et al. (2009) suggested the GFP is reflective of socially desirable bias or a fixed positive response style to the personality inventory because the GFP was found from self-reported measures of personality. There is some evidence supporting this view (Bäckström et al., 2009), but there is also a wide range of evidence to the contrary (Dunkel et al., 2016; Pelt et al., 2020). In addition, as will be outlined below, controlling for the GFP in measures of personality would take away much of the criterion-related validity of personality dimensions.

In contrast to the artifact perspectives mentioned above, other scholars advocated the so-called social effectiveness interpretation of the GFP. Rather than being the results of individuals merely responding to the personality inventory in a socially desirable way, the social effectiveness account proposes that the effectiveness of behaving in a socially desirable way reflects a genuine psychological entity that contributes to the extent to which individuals can achieve their (social) goals (Ferris et al., 2002). For example, behaving in a socially desirable way could help individuals to get better ratings in a job interview. To examine this idea researchers tested the GFP's criterion-related validity. Accordingly, the GFP has been found to relate to, for example, other-rated likeability and popularity (van der Linden et al., 2010a), job performance (van der Linden et al., 2010b), leadership (Pelt et al., 2017) and to the number of offsprings in forager farmers of the Bolivian Amazon (van der Linden et al., 2018). These empirical findings provide support for the social effectiveness account of the GFP.

To confirm that social effectiveness is not just a semantic alternative to social desirability, Dunkel et al. (2016) conducted a study in which they simultaneously tested the social effectiveness, socially desirable response bias, and positive self-evaluation interpretation of the GFP. In their study, social effectiveness, socially desirable response bias, and positive self-evaluation all played a role in the variance of the GFP, but social effectiveness (other-measured) explained the largest proportion of the variance.

Pelt et al. (2021) tested whether socially desirable responses affect the construct of the GFP. In their study, the authors considered the motivational test-taking context (development vs. selection) and the opportunity to distort responses (forced-choice vs. Likert response format) on a personality questionnaire. When comparing these four conditions, the structure of the GFP remained similar. Although socially desirable responding may affect mean scores on personality traits, that did not appear to affect the factor structure. Therefore, the GFP was hardly influenced by motivational pressures for response distortion and can be regarded as a common variance in a personality questionnaire to be consistently found.

In a later study, Pelt et al. (2020) re-analyzed diary data to examine whether the GFP is related to individuals' daily experiences. They found that high-GFP persons experienced fewer daily interpersonal conflicts and better relationship quality, and made better impressions on others. As the authors summarized, the findings were in line with the notion of the GFP as social effectiveness, with important consequences for people's daily social life and well-being. Yet, in a more recent study, Bäckström (2021) only found little support for the correlation between the GFP and the frequency of Agreeable,

Conscientious, Emotionally Stable, Extraverted, and Open Behaviors. Thus, support for social effectiveness account from daily life experiences is still under debate so far.

Introducing four empirical studies on the GFP

Overall, the GFP as grounded in evolutionary theory (Figueredo et al., 2004; Rushton and Irwing., 2008), has gained substantial attention in past decades (van der Linden et al., 2021b). A large number of studies confirmed the stability and universality of the GFP by testing it with various personality questionnaires (Anglim et al., 2019; Loehlin, 2012a; Rushton & Irwing, 2009b; Veselka et al., 2009a) and in samples from different cultures and areas in the world (Erdle & Aghababaei, 2012; Hull & Beaujean, 2011; Rushton et al., 2009b; van der Linden et al., 2018). Some researchers claimed that the GFP is a substantive entity indicating social effectiveness (van der Linden, Dunkel, et al., 2016), while others criticized the GFP as an artifact reflecting common method variance (Chang et al., 2012) or social desirability bias (Bäckström, 2007). To test if the GFP is substantively social effectiveness or an artifact variance, four studies (three of them are multi-studies) in total were conducted in the present thesis. Below we will introduce the studies in the present dissertation, and which aspects of the GFP are studied.

Topics and Research Questions of the Thesis

1. Testing the generalizability of the GFP to Non-WEIRD samples

Although the GFP has currently been found in hundreds of thousands of participants including WEIRD (Western, Educated, Industrialized, Rich, and Democratic; Henrich et al., 2010) and non-WEIRD samples, the majority of studied samples in previous studies contained WEIRD samples. To investigate whether the GFP is generalizable to non-WEIRD samples (van der Linden et al., 2018), testing it with non-WEIRD samples is informative. Thalmayer et al. (2020) discussed the lack of non-WEIRD samples in psychological studies and stated that about 89% of the world's population is underrepresented. The question then was raised by these researchers (p1) *"How can psychologists trust that these models and results generalize to all humans, if the evidence comes from a small and unrepresentative portion of the global population?"*. To contribute to the answer to this question, in Chapter 2 of this thesis we report a meta-analysis testing the GFP construct with a large number of non-WEIRD samples from mainland China. If the GFP can also be found from such a large non-WEIRD sample, then the generalizability of the GFP would be further supported.

2. Testing the social effectiveness account in the non-WEIRD samples

Apart from the test the GFP structure from the non-WEIRD samples, we also plan to the explanation of the GFP in the non-WEIRD samples. Referring to the substantive explanation, the GFP most likely reflects social effectiveness. To indicate whether this is also the case in samples from Mainland China, in Chapter 2 we examine the relationship between the GFP and leadership emergence. As Do and Minbashian (2020) and Pelt et al. (2017) stated, leadership emergence can be regarded as an outcome that is an effective indicator of social effectiveness. If the GFP can be found to correlate with leadership emergence among Chinese samples, then the social effectiveness account of the GFP can be regarded as fitting for Chinese culture as well.

3. Testing the relationship between the GFP and leadership emergence

To further test the social effectiveness account of the GFP and its linkage with leadership, in Chapter 3 we report a study that tests whether the GFP can predict leadership emergence. Do and Minbashian (2020) and Pelt et al. (2017) previously found that the GFP correlated stronger with leadership effectiveness than any of the specific Big Five traits, pointing to the possibility that social effectiveness is the most important reason for individuals' leadership effectiveness. Yet, such findings were mainly cross-sectional and correlational in nature and did not allow tests of predictive validity. To address this point, we simulated student representative elections in Chinese colleges (Chapter 3). As far as we know, this is the first study testing the predictive validity of the GFP on leadership emergence with high ecological validity, compared to the common survey tests.

4. GFP and Creativity

Beyond leadership, the GFP has also been reported to be associated with a wide range of other variables (Musek, 2017a). Among these are variables that represent human abilities such as cognitive intelligence (Dunkel, 2013b; Irwing et al., 2012), emotional intelligence (van der Linden et al., 2017a, 2017b), and specific cognitive abilities (Musek & Musek, 2017; Schermer & MacDougall, 2013). One of the reasons why the GFP correlates with those abilities may be their shared evolutionary underpinnings. Specifically, it has been proposed by Figueredo et al. (2005) that human abilities and motivations do not reflect a loose combination of factors, but often are orchestrated to achieve more general evolutionary goals. In this light, the GFP has been proposed to be associated with other abilities, such as creativity, and adaptability for common goals to survive, develop, and reproduce (Figueredo et al., 2004; Musek, 2007; Rushton and Irwing., 2008). Like the GFP, creativity has been argued to associate with humans' evolution (Findlay &

Lumsden, 1988) and contributes to adapting to the environment. Therefore, a relationship between the GFP and creativity can be expected. Nevertheless, the test on such a relationship is a few so far. This dissertation would add more scientific tests on the GFP-creativity relationship.

5. Testing the relationship between the GFP and creativity through surveys

Chapter 4 discusses a survey study on the correlation between the GFP and creativity and revisits the classical topic of "creative personalities" (Guilford, 1950). This study addresses a core issue on creativity, namely whether creativity encapsulates social aspects (Feist, 1998). According to one of the well-acknowledged definitions of creativity, it also includes social aspects. Plucker et al. (2004) stated that… "*Creativity is the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context*" (p. 90, original italics). Feist states that creativity is both novel and *"socially useful"*. Based on these ideas, the GFP and creativity can be expected to be positively related to each other.

To test the relationship between the GFP and creativity, we conducted a study by survey, reported in Chapter 4. Parallel to the GFP, the literature also suggested other higher-order personality factors, namely the Big Two personality factors (Digman, 1997). We, therefore, would also test the relationship between the Big Two factors and creativity. By including the GFP and the Big Two factors, we aim to find the higher-order personality indicators of creativity, beyond the Big Five traits.

7. GFP correlates and different measures of creativity

Although creativity has been studied extensively, the question of how to measure it still is largely open, with researchers often using various inventories to measure creativity. As Puryear et al. (2017) reported, no less than nine measures of creativity have been used by researchers in the studies on creativity and those nine measures of creativity showed different correlations with the Big Five personality traits. Hence, in a later study Puryear et al., (2019) argued that the relationship between the Big Five personality traits and creativity largely depends on how to measure creativity. Therefore, in the studies reported in Chapters 4 and 5, we considered using different measures of creativity. If the measures of creativity that we used in our study all show correlations with the GFP, the GFP-creativity relationship can be viewed as systematic, and less influenced by the measures. For doing so, we used the self-reported/peer-reported measures of creativity (creativity questionnaire [Tierney et al., 1999]), Alternative Uses Test (AUT; Guilford, 1959), and

the Remote Association Test (RAT; Lee et al., 2014). Both AUT and RAT are considered to be relatively objective, particularly when compared to the creativity questionnaires.

If significant correlations could always be found between different measures of creativity and the GFP, the GFP-creativity relationship can be thought of as being validated. Moreover, although different measures of creativity may all significantly correlate with the GFP, the size of those correlations can be different. The study reported in Chapter 4 will investigate to which extent these relations are different from each other.

### *8. A Meta-analytical test of the GFP-creativity relationship*

Chapter 5 further dives into the GFP-creativity relationship by using a meta-meta-analytic approach. We take the same approach as Pelt et al. (2017) who revisited meta-analytic data to examine the relationship between the GFP and leadership, to test the relationship between creativity and the GFP. We collected summary data from three published meta-analyses. These meta-analyses tested the relationship between the Big Five personality traits and creativity, but each had a different approach and research question. Specifically, the first meta-analysis (Puryear et al., 2017) focused on various measures of creativity, whereas the second meta-analysis was centered on various measures of creative self-beliefs—individuals' convictions about their creative abilities (CSBs: Karwowski & Lebuda, 2016)). The third meta-analysis (Feist, 1998) examined whether the scores of the Big Five traits can differentiate between three groups according to their creativity: scientists vs. non-scientists; creative- vs. less creative-scientists; and artists vs. non-artists. By retesting the outputs of t three meta-analyses, we aimed to provide a more extensive test of the relationship between the GFP and creativity.

Overview of Chapters

As displayed in Figure 2, Chapter 2 reports on a meta-analysis with many samples from mainland China. In that study, the structure of the GFP was tested, based on Chinese meta-analytic Big Five intercorrelations. In the same chapter, a study of the GFP-leadership effectiveness relationship is presented, using a selection of Chinese samples. Chapter 3 describes a study that tested whether the GFP can predict leadership emergence. Chapters 4 and 5 present two studies on the relationship between creativity and the GFP. Chapter 4 reports on a multiple-survey study and Chapter 5 reports on a meta-meta-analysis.
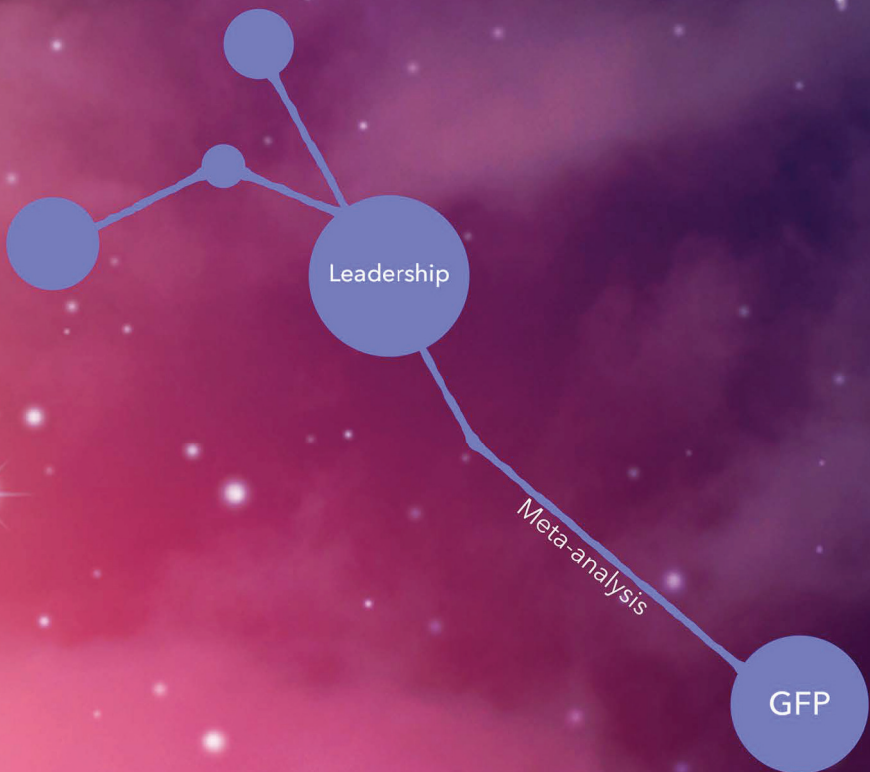
Figure 2

The conceptual chart of studies reported in the later chapters
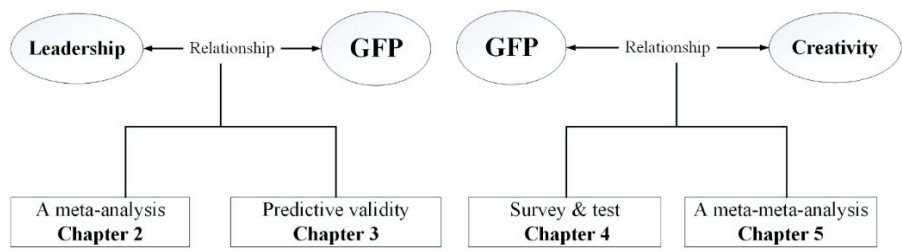
Chapter 2

A Meta-analysis on the General Factor of Personality and Its Relation with Leadership Outcomes: Evidence from Mainland China

Leadership

Meta-analysis

GFP

Abstract

In the past decades, many studies have confirmed that specific personality traits correlate such that a general factor of personality (GFP) emerges. In order to test whether the characteristics of this general factor are universal, thorough tests in various cultures are required. Accordingly, we conducted a meta-analysis on the GFP in mainland China. After testing the sensitivity of the GFP, correcting for attenuation, and testing for samples' geographical distribution, types of samples, and types of questionnaires, we confirmed the GFP in the population of mainland China (N = 30,863, K = 53). To further examine the nature of the GFP, we tested whether it is indicative of general social effectiveness by studying the associations of the GFP with (1) leadership effectiveness and (2) abusive supervision. The results implied that high-GFP leaders indeed work more effectively (r = .17) and were less abusive (-.20), as rated by their subordinates. This study among Chinese samples adds to the literature by showing the consistency of the GFP in a large Eastern country.

Keywords: general factor of personality; social effectiveness; non-WEIRD population; leadership effectiveness; abusive supervision; mainland China; cross-culture; meta-analysis.

1. Introduction

In the literature on individual differences, various personality taxonomies assume multiple independent personality traits, such as the well-known Big Five (McCrae & Costa, 1987; Goldberg, 1985), and the Six-Factor HEXACO model (Ashton & Le, 2006), or Eysenck's (1992) Giant Three. These models have proven to be useful for understanding the nature of personality and are influential in guiding research in this area. In the past decade, however, there has been an increasing focus on the possibility of higher-order personality factors that subsume several of the specific dimensions. One of those is the general factor of personality or GFP that reflects the shared variance among narrower personality dimensions (Figueredo et al. 2004, Musek, 2007; Rushton et al., 2008; van der Linden et al.,2010). The GFP represents the socially desirable end of personality scales, which implies that, for example, in terms of the Big Five, being high on the GFP suggests open-mindedness, diligence, sociability, friendliness, and emotional stability, and displays the pattern: O+, C+, E+, A+, and ES+/N-.

Although systematic research on the GFP is relatively recent, the notion of the general factor in personality or character actually dates back to Darwin (1871). He mentioned the possibility of a single general personality dimension, which, he assumed, was shaped by

natural selection. For survival and developmental reasons, humans overall became more cooperative and less contentious. However, probably partly due to the limitations of methodology at that time, this idea was largely in suspense (Just, 2011) until Figueredo and colleagues (2004) and Musek (2007) re-emphasized the possibility of a general factor in the Big Five personality structure.

The notion of the GFP was subsequently supported by a meta-analysis confirming the presence of a viable general factor in the Big Five (van der Linden et al., 2010). Research has also identified the GFP in other commonly used personality inventories, such as Cattel's 16-Factor Questionnaire, the HEXACO, the MMPI, and various less-used inventories (Anglim, Morse, Dunlop, Minbashian, & Marty, 2019; Loehlin, 2012; Rushton & Irwing, 2009; Veselka et al., 2009, although one could see Hopwood et al. 2011).

In the field of personality research, one important question is how universal personality constructs/models are. The Big Five traits have been confirmed as universal personality features (Allik et al., 2017). The same question can be raised for the GFP. A universal GFP would not be in contrast to the Big Five as a valid personality model across cultures but rather focuses on whether personality shows a similar hierarchy across the world. Regarding this, it is important to note that the vast majority of research on the GFP has used Western samples, even though are is a limited set of studies that have tested the GFP in different cultures (Dunkel, 2013a; Erdle & Aghababaei, 2012; Hull & Beaujean, 2011; J. Philippe Rushton et al., 2009). More recently, the GFP has been confirmed in indigenous inhabitants of the lowlands of Bolivia (van der Linden et al., 2018).

Despite the handful of non-Western studies on the GFP, conclusions about its universality, or lack thereof, would be strengthened by more comprehensive studies in different cultures. For example, as far as we know, none of the previous studies on the GFP used samples from mainland China. Therefore to address this gap in the literature, we conducted a meta-analysis on the GFP with a native Chinese dataset collected from 53 studies, including 30,863 participants (Study 1). Beyond testing the viability and characteristics of the GFP in those samples, we also address the criterion-related validity of the GFP in a selection of those samples by testing its relationship with leadership outcomes (Study 2). The latter test builds on the hypothesis that the GFP reflects general social effectiveness – a currently leading explanation of the GFP (Loehlin, 2012; van der Linden et al., 2016; van der Linden et al., 2021). In as far as this is indeed the case, the GFP can be expected to relate to variables such as leadership effectiveness and abusive supervision. We will elaborate on this below. Before going into the specific studies, we

will first provide a brief background of previous GFP research and the debate regarding the artifact versus substantive interpretation of the construct.

1.1. The GFP interpretations

Although there is now ample research confirming the existence of a general factor in personality, the literature shows that there is an ongoing debate about the *interpretation* of this factor. One explanation is that the GFP is merely an artifact. For example, it was proposed that the GFP simply reflects a same-signed blend of orthogonal factors (Ashton et al., 2009), and socially desirable response bias (Bäckström et al., 2009), or a halo effect (Anusic et al., 2009). It has also been suggested that there is no overlap between self-and other rated GFPs (Chang et al. 2012, Revelle & Wilt, 2013). The common theme among the various artifact interpretations is that the GFP does not reflect genuine trait characteristics but is a nuisance in measuring a person's 'true personality'.

The different types of artifact explanations of the GFP have been extensively discussed in several previous studies (Just, 2011; van der Linden et al., 2016), which we will not fully repeat here. However, some of the key points against the artifact accounts of the GFP are the following. First, empirical evidence seems to suggest that a large part of the social desirability component in personality, as well as in many other types of self-reports, is substantive and may tap a genuine tendency towards displaying socially desirable behaviors (Pitesa et al., 2013; Zerbe & Paulhus, 1987). For example, relevant overlap exists in social desirability between self and other ratings (Roth & Altmann, 2019).

Second, there are now many studies showing that the GFP is positively related to a wide range of other-rated or objective criteria, such as job performance (Pelt et al., 2017), intelligence (Dunkel, Stolarski, et al., 2014), social status (van der Linden et al., 2010), and even physical attractiveness (Dunkel et al., 2017), and is negatively related to the Dark Triad personality (Kowalski et al., 2016) and psychopathology (Oltmanns et al., 2018). Such relationships would not be obvious if the GFP is only an artifact. Dunkel et al. (2016) systematically tested various sources of explained variance in the GFP and suggested that the general factor likely largely reflects a substantive component but also includes smaller components of response bias and self-esteem. In this sense, the GFP would be similar to all other self-report measures in social science that also include a certain level of bias.

The substantive explanation of the GFP states that it predominantly reflects general social effectiveness(van der Linden et al., 2021; van der Linden, Dunkel, et al., 2016). Specifically, the GFP is assumed to reflect a cluster of social-related capacities, for instance, social knowledge, cognition, ability, and motivation, which drive and facilitate individuals behaving in a socially desirable/effective way, and which, in turn, enhance the

probability of obtaining their social goals. For example, one has a higher probability of being liked and/or supported by others when behaving in more socially effective/desirable ways. This notion has been supported by a study that found that students with higher-GFP scores were rated more likable and popular by their classmates (van der Linden et al., 2010). In the work domain, a reanalysis of meta-analytic data revealed that higher-GFP employees were rated by their managers as having better job performance (Pelt et al., 2017), which was assumed to partly reflect the employees' social effectiveness.

If the GFP indeed reflects social effectiveness, then it can be expected to relate not only to the employees' job performance but also to leadership outcomes. Particularly, being socially effective may help individuals (1) to be selected as a leader in the first place, and subsequently, (2) to be more effective once the leadership position has been obtained (Magnusen & Perrewé, 2016). Based on this notion, in Study 2, we will test the relation between the GFP and two leadership outcomes, namely leadership effectiveness and abusive supervision. Such criterion-related validity tests of the GFP could provide more insight into the nature of the GFP and would be an indirect test of the social effectiveness account and whether this is generalizable to the culture of mainland China.

2. Study 1: A meta-analysis on the GFP using a native Chinese dataset

In Study 1, we aim to test if the GFP exists in the population from mainland China. For this aim, we searched for Chinese academic publications focusing on the Big Five model. For several reasons, these data are not included in well-known internationally scientific databases, such as ScienceDirect, PsychInfo, or EricLit. One reason is that most of those studies from mainland China did not appear in international journals. This can be confirmed when looking at the worldwide meta-analysis of Big Five intercorrelations of van der Linden et al. (2010b). Using the international databases, they searched for all published studies ($K = 212$) on the Big Five between 2000 and 2008. Among those studies, none contained samples from mainland China, while a few contained samples from Taiwan and Hongkong. Although these two latter samples may be somewhat similar to samples from mainland China, there are still relevant cultural and environmental differences between them. Thus, the conclusion drawn from studying samples from Taiwan and Hongkong cannot automatically be extended to samples from mainland China. As such, our meta-analysis might provide a unique and relevant contribution to the literature in this field.

The use of the meta-analytic approach allows us to estimate the true Big Five intercorrelations in Chinese samples and which serves as the basis for testing the GFP.

Beyond that, we also aim to test whether the characteristics of the GFP in Chinese samples differ from Western samples.

2.1. Method

2.1.1. Meta-analysis and sample of studies

To conduct the meta-analysis, we searched for articles on the Big Five in all Chinese academic publications from 1999 to March 2021. We conducted the search in three predominant Chinese academic literature databases: (1) Chinese National Knowledge Infrastructure, (2) Wanfang Data, and (3) the Weipu database (CQVIP). We searched these databases using the Chinese written terms 'Big Five personality' and 'Five-Factor Model (FFM)' or a combination of these terms[1]. Although all articles in these databases are written in Chinese, most of them provided an additional title and abstract written in English for international researchers. Our search initially resulted in 278 studies that were filtered using the following inclusion criteria: (1) the measurement had to be clearly based on the Big Five or the FFM dimensions, and the articles had to report (2) the intercorrelations between the Big Five, and (3) the sample size (n). After filtering, 53 articles remained that were included in the meta-analysis. Figure 1 displays the PRISMA flow diagram (Moher et al., 2009).

Before conducting the meta-analysis, we considered whether it was necessary to est the so-called file drawer problem – the difference in the significance of reported results between published articles and non-published manuscripts (Cooper & Lindsay, 1998). However, as Dalton et al. (2012) stated (p. 222), *" the file drawer problem does not produce an inflation bias and does not pose a serious threat to the validity of meta-analytically derived conclusions as is currently believed",* we, therefore, did not include such tests.

In our dataset, the sample size varied from 60 to 2677, yielding a total N of 30,863. The mean and median sample sizes were 582.32 and 382, respectively. The age of participants ranged from 17 to 58 years. Considering the broad territorial area of mainland China, we took into account the samples' geographical distribution. We found that the samples covered most places of mainland China, namely 26 of the total 31 local administrations[2] (84%). Among the 26 administrations, seven came from the East, three

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[1] The second-level keywords advised by the search engine can be seen in the supplementary materials.

[2] According to traditional Chinese administration division, mainland China contains 31 local administrations: 22 provinces, four municipalities, and five autonomous regions. Those administrations disproportionately locate in seven broader areas: eight in Eastern, three in Southern, three in central, five in northern, five in Northwest, three in Northeast, five in

from the South, three from the Center, five from the North, three from the Northwest, four from the Southwest, and one from the Northeast.

Figure. 1

The PRISMA Flow Diagram
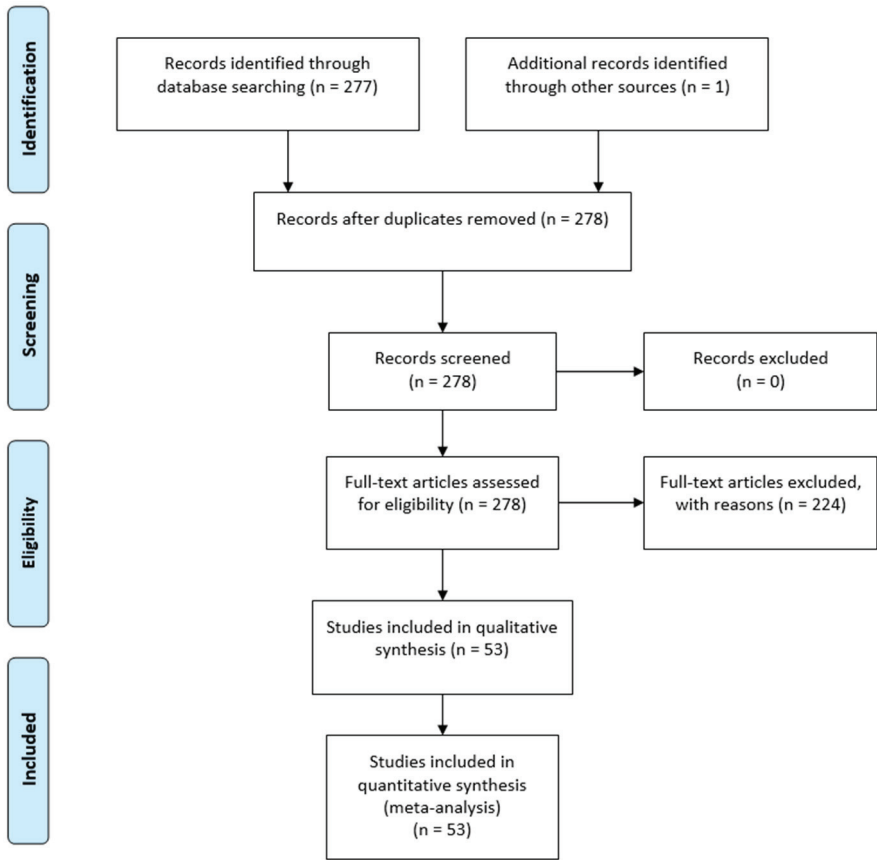
Considering the geographical diversity, it is possible that samples from different areas differ in personality characteristics. To address this point, we assigned the samples to seven groups according to geographical distribution and then separately tested the GFP construct in each group. For the studies which either did not report the location or used area-mixed samples, we categorized them as "other" in the geographical distribution test. We also categorized the type of participants into four groups, namely (1) college students;

Southwest, and three in Northeast.

(2) school students, ranging from fourth-year primary school to high school; (3) employees; (4) leaders; and (5) patients.

Regarding the measurement instruments, we checked whether the type of questionnaire influenced the results. We assigned the samples into six groups based on the type of personality measure, namely (1) NEO-based, (2) BFI-based, (3) IPIP-based questionnaire, (4) Chinese Big Five inventory (CBF; Wang et al., 2010)[3], (5)TIPI, and (6) Other Big Five inventories (Big Five locators, Howard et al. 1996).

2.1.2. Estimation of reliabilities and correction for attenuation

The reliability distributions in our meta-analysis stemmed from 42 coefficients, reported by 42 out of the 53 articles (79%). Of these 42 coefficients, ten only reported the average reliability of all Big Five traits, while seven others only reported the upper and lower limits of the reliabilities. In the case of the latter, we used mean reliability as the estimate. The meta-analytic reliability coefficients were as .73 (openness), .76 (conscientiousness), .75 (extraversion), .74 (agreeableness), and .76 (emotional stability), The mean reliability value was .75.

To correct the correlations for unreliability, we conducted statistical disattenuation using Spearman's (1904) formula. After that, a corrected matrix of the Big Five intercorrelations was established, as the bold values of Table 1 show. This corrected weighted matrix is supposed to better approach the true Big Five intercorrelations.

2.1.3. Statistical Analysis

To test the GFP, we conducted Confirmatory Factor Analysis (CFA). We tested the GFP model in comparison to the competitive Big Two model in which an *Alpha/Stability* factor was extracted from C, A, and ES, and a *Beta/Plasticity* factor from O and E, respectively (DeYoung et al., 2002; Digman, 1997). Both the GFP and Big two are known higher-order factors in personality. Besides testing the omnibus GFP of the total *N*, we also conducted separate meta-analyses and CFAs for each subgroup of moderators (geographical distribution of samples, sample types, instrument types). All analyses were conducted with R-studio (4.0.2), using the "lavaan" (Rosseel, 2012), "psych", "Weighted.Desc.Stat", and "semPlot" (Epskamp, 2015) packages.

2.2. Results

Table 1 revealed the corrected weighted meta-analytic intercorrelations between the Big Five. All intercorrelations were significant, with an average meta-analytic correlation

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[3] Compared to NEO and BFI, CBF is more adaptive of the description habit of Chinese language, and it has been found to have good criterion-related validity with NEO and BFI.

of ρ = .33. In the matrix with the weighed uncorrected intercorrelations, the average correlation was r = .28 (Δr = 0.05, Z = 6.85, p < .001). To test the sensitivity of the GFP model, we also established a) the Big Five matrix in which we took out the largest sample; b) the original and unweighted Big Five matrix; and c) the weighted Big Five matrix. Table 1 shows the values of these different matrices.

Table 1

Matrices of the Big Five Intercorrelations

	$k = 52$; $N = 28186$		$k = 53$; $N = 30863$					
	r_{exc}	SD(r_{exc})	r_{ori}	SD$_{(ori)}$	r	SD(r)	ρ	SD(ρ)
O-C	.31	.17	.30	.19	.32	.16	**.43**	**.22**
O-E	.34	.19	.32	.20	.35	.18	**.47**	**.24**
O-A	.25	.19	.23	.21	.26	.18	**.35**	**.24**
O-ES	.13	.18	.11	.19	.15	.18	**.20**	**.24**
C-E	.29	.22	.31	.19	.30	.21	**.40**	**.28**
C-A	.39	.17	.39	.18	.40	.17	**.53**	**.22**
C-ES	.26	.20	.25	.22	.28	.20	**.37**	**.27**
E-A	.27	.22	.27	.20	.28	.21	**.37**	**.28**
E-ES	.21	.24	.22	.21	.23	.24	**.30**	**.32**
A-ES	.23	.19	.22	.19	.25	.19	**.33**	**.26**
M	.27	.20	.26	.20	.28	.19	**.43**	**.26**

Note. O = openness, C = conscientiousness, E = extraversion, A = agreeableness, ES = emotional stability. Subscript exc, excluded the largest-sample study; Subscript ori, original (unweighted); r, weighted but uncorrected; ρ, weighted and corrected (in bold).

2.2.1. Confirmatory factor analyses

With CFA, we tested two variations of the GFP model with the corrected matrix: (1) a direct GFP model and (2) an indirect GFP model. In the direct model, as delineated in Figure 2, the GFP (as a latent variable) was directly extracted from all Big Fives measures (manifest variables). In this model, similar to Musek (2007), we allowed the unique variances of openness and extraversion to correlate. In the indirect model, namely the Hierarchical model/higher-order factor model (HOM), the GFP was extracted from the

intermediate latent variables: stability/α and plasticity/β (also see Figure 2). The fits of both models were good (Direct model: χ^2 = 461.81, df = 4, CFI = .99, TFI = .97, RMSEA = .06[4]; Indirect model: χ^2 = 464.08, df = 5, CFI = .99, TFI = .97, RMSEA = .06) and no significant difference were found between them when using the χ^2 test ($\Delta\chi^2$ = 2.26, Δdf = 1, p = .13). For comparison, we then tested the competitive model in which the Big Two factors, stability, and plasticity, were independent of each other with no general factor. This model fit the data badly (χ^2 = 10576.98, df = 6, CFI = .69, TFI = .48, RMSEA = .24). Allowing the Big Two factors to be correlated obviously made the model fit of the Big Two model identical to the indirect GFP model.

Figure. 2

Tested Models with Corrected Big Five Matrix

Direct GFP Model

Indirect GFP Model/High-Order Factor Model

Bi-Factor Model (Constrained-GFP)

Bi-Factor Model (Constrained-Big Two)
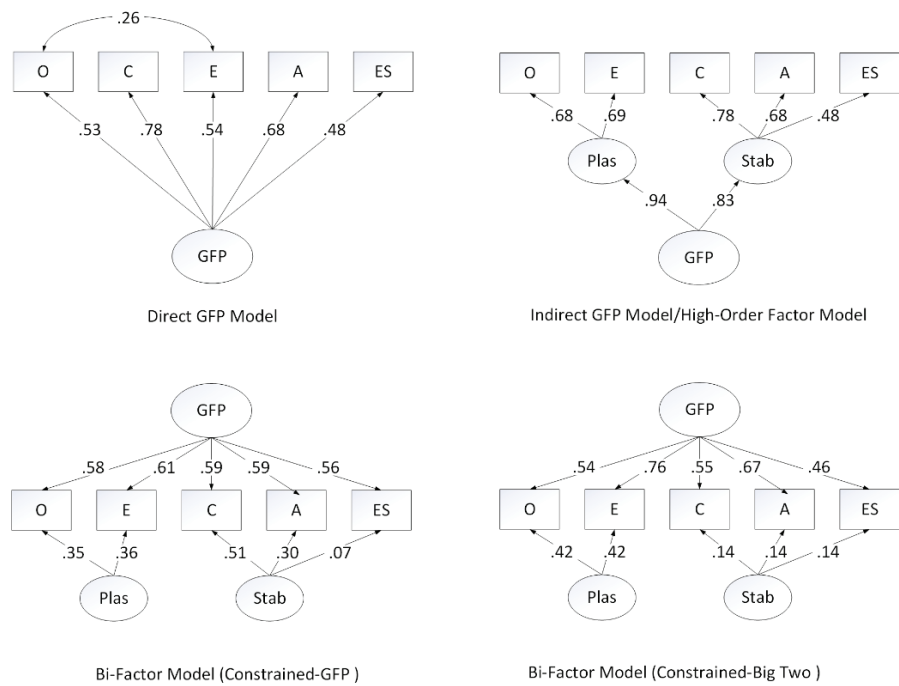
Note. GFP, General Factor of Personality; Stab, stability; Plas, plasticity.

To test the differential influence of the GFP versus the Big Two on Big Five variance, we tested the bifactor model (BFM). As Bäckström and Björklund (2016) suggested,

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4 Excluding the corrected and weighted matrix, The GFP model also fit other three matrices in Table 1 well (χ^2 = 334.59, df = 4, CFI = .98, TLI = .95, RMSEA = .05; χ^2 = 178.25, df = 4, CFI = .99, TLI = .97, RMSEA = .04; χ^2 = 199.82, df = 4, CFI = .99, TLI = .98, RMSEA = .04).

testing such a BFM needs to constrain at least one factor. We thereby built two BFM models in which either the GFP or the Big Two were constrained (in Figure 2). The results showed the constrained-Big Two BFM[5] ($\chi^2 = 460.24$, $df = 3$, CFI = .99, TLI = .96, RMSEA = .07) fit better than the constrained-GFP BFM[6] ($\chi^2 = 1367.80$, $df = 5$, CFI = .96, TLI = .92, RMSEA = .09; $\Delta\chi^2 = 907.55$, $\Delta df = 2$, $p = 0$). Regardless of the type of BFM, however, the GFP always loaded on the Big Five higher than the Big Two. In addition, as could be expected (Credé & Harms, 2015), we found that the BFMs and HOM did not significantly differ ($\Delta\chi^2 = 3.84$, $\Delta df = 2$, $p = 0.15$).

2.2.2. Test for geographical distribution

We ran a confirmatory multi-group analysis to test the stability of the GFP over geographical distribution (see Table 2). To test for invariance, we compared the constrained model (in which all paths were set to be equal across groups; model fit: $\chi^2 = 1051.74$, $df = 60$, CFI = .95, TLI = .94, RMSEA = .07) to the unconstrained model (in which all paths were freely estimated; model fit: $\chi^2 = 549.44$, $df = 32$, CFI = .98, TLI = .94, RMSEA = .07). The unconstrained model showed a better fit than the constrained model ($\Delta\chi^2 = 502.29$, $\Delta df = 28$, $p = 0$), implying that the GFP varied across geographical groups.

Despite some deviations in specific factor loadings (see Table 2 for specific values), however, in all seven groups, the findings were consistent in the sense that they all displayed the same pattern of O+, C+, E+, A+, and ES+, which is in line with the GFP.

2.2.3. Subsamples and questionnaires tests

Table 3 displays the outcomes of confirmatory multi-group analysis across questionnaires and subsamples, respectively. Using the same strategy as in the previous section, we tested the model's invariance first and found that the GFP model with free estimators showed the best fit. However, despite some fluctuations in the GFP factor loadings, it can be observed that the essence of the construct remained robust across questionnaires. Factor loadings can be seen in Table 3, and details for the invariance test and tested models were included in the supplementary material.

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[5] All loadings of the Big Two factors were fixed to 1 while the GFP can freely load on the Big Five.
[6] Opposite to subscript 5

Table 2

Meta-analytic Intercorrelations and GFP Loadings for Samples from Different Areas of China

	1.Eas	2.Sou	3.Cen	4.Nor	5.NoW	6.SoW	7.NoE	8.Oth
n	7866	5764	1204	4687	938	610	2889	6905
O-C	.35	.33	.28	.33	.38	.29	.30	.27
O-E	.33	.32	.23	.42	.47	.46	.36	.33
O-A	.29	.24	.13	.28	.36	.26	.28	.22
O-ES	.17	.08	.16	.11	.13	.16	.11	.22
C-E	.39	.36	.30	.27	.41	.31	.22	.19
C-A	.43	.39	.38	.46	.33	.33	.32	.37
C-ES	.23	.26	.40	.26	.19	.16	.30	.36
E-A	.33	.31	.25	.27	.29	.27	.16	.24
E-ES	.20	.23	.33	.27	.15	.23	.27	.24
A-ES	.22	.17	.36	.26	.04	.10	.34	.32
Mean	.29	.27	.27	.29	.28	.26	.27	.28
Factor loadings B5 dimensions on GFP								
O	.49	.44	.32	.44	.62	.50	.42	.40
C	.71	.71	.67	.69	.65	.59	.58	.63
E	.55	.54	.48	.43	.62	.55	.38	.37
A	.61	.55	.56	.66	.51	.51	.58	.58
ES	.34	.35	.62	.39	.22	.30	.53	.57

Note. Eas, Eastern; Sou, Southern; Cen, Center; Nor, Northern; NoW, Northwestern; SoW, Southwestern; NoE, Northeastern; Oth, others.

2.2.4 Comparison with Western Samples

We also compared the GFP in the Chinese samples to the GFP in Western samples (*n* = 134,453, *k* = 193). The data from the latter were extracted from the van der Linden et al. (2010b) meta-analysis.[7] The Big Five intercorrelations of Western samples were .14 (O-C), .31(O-E), .14 (O-A), .12 (O-ES), .21 (C-E), .31 (C-A), .32 (C-ES), .18 (E-A), .26 (E-ES), .26 (A-ES), respectively. The mean Big Five intercorrelations between the two

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[7] Note that, instead of the corrected matrices of the Big Five intercorrelations (ρ), we used the original (observed correlation) matrices (*r*), considering that the correction for two studies with different *N* and samples may generate statistical errors.

samples differed (Mean $r = .28$ for Chinese samples, Mean $r = .22$ for Western samples; $\Delta r = 0.06$, $Z = 10.14$, $p = 0$).

Table 3

Meta-analytic Intercorrelations and GFP Loadings for Different Questionnaires and Different Subsamples

	Questionnaire categories						Subsample categories				
	1.BFI	2.NEO	3.IPIP	4.CBF	5.TIPIP	6.Others	1.Stud	2.Scho	3.Empl	4.Lead	5Pati
n	8242	13582	1567	4550	780	2142	21630	4258	3604	927	444
O-C	.29	.33	.29	.37	.21	.27	.34	.36	.20	.04	.25
O-E	.34	.32	.28	.48	.16	.42	.37	.43	.23	.12	.09
O-A	.26	.25	.33	.30	.08	.21	.25	.36	.22	.04	.03
O-ES	.23	.12	.00	.09	.17	.25	.18	.07	.10	-.01	.10
C-E	.18	.36	.39	.29	.20	.35	.33	.34	.07	.23	.38
C-A	.36	.41	.42	.39	.28	.48	.39	.49	.38	.20	.19
C-ES	.39	.23	.27	.17	.41	.38	.31	.18	.22	.31	.19
E-A	.15	.32	.37	.25	.19	.48	.28	.41	.12	.10	.21
E-ES	.26	.19	.22	.27	.25	.39	.30	.13	-.03	.18	.22
A-ES	.35	.21	.19	.11	.42	.41	.28	.15	.18	.22	.28
M	.28	.27	.28	.27	.24	.36	.30	.29	.17	.14	.19
Factor loadings on the Big Five											
O	.43	.45	.44	.53	.24	.36	.46	.51	.34	.04	.33
C	.64	.70	.67	.68	.55	.63	.67	.67	.63	.59	.62
E	.33	.53	.59	.46	.34	.63	.52	.54	.12	.35	.61
A	.57	.59	.64	.56	.54	.74	.57	.73	.61	.36	.34
ES	.62	.34	.32	.26	.75	.59	.48	.22	.32	.54	.37

Note: Stud, undergraduate students; Scho, students ranging from primary school to high school; Empl, Employees; Lead, Leaders; Pati, patients.

With the confirmatory multi-group analysis, we then compared the GFPs in Western and Chinese samples. We compared constrained and unconstrained models. The constrained model showed a very good fit ($\chi^2 = 2306.23$, $df = 12$, CFI = .97, TLI = .95, RMSEA = .05) as did the unconstrained model ($\chi^2 = 1149.65$, $df = 8$, CFI = .99, TLI = .97,

RMSEA = .04). However, the unconstrained model showed a significantly better fit ($\Delta \chi^2$ = 1156.6, Δdf = 4, p = 0). This implied that the GFP might be variant over the two groups. The factor loadings were .45 (O), .67 (C), .47 (E), .59 (A), and .42 (ES) for the Chinese samples, and were .24 (O), .58 (C), .40 (E), .50 (A), and .56 (ES), for the Western samples. It can be observed that C and A consistently displayed the highest factor loadings across the two samples. Meanwhile, ES and O separately showed the lowest factor loading in the Chinese and Western samples, respectively.

2.3 Discussion

We conducted a meta-analysis to test whether a viable GFP can be found in samples from mainland China. Using the corrected weighted Big Five intercorrelation matrix, we ran CFA, which supported the GFP. The direct and indirect GFP models were equally good, suggesting that it does not matter much whether one extracts a GFP directly from the Big Five or does so via the two intermediate higher-order factors. This finding is in line with findings from the general factor in the cognitive domain, in which the so-called *g* factor largely remains the same regardless of the extraction method (Jensen, 1998).

The bi-factor approach showed that, compared to the Big Two, the GFP loaded higher on the Big Five traits, indicating that the GFP is a more fundamental construct in the personality hierarchy. This remained the case even when the GFP was constrained. The comparison between the bi-factor model and the hierarchical model led to the same conclusion regarding the general factor. This is in line with Credé and Harms's (2015) statement, *"...admittedly, one of the superior alternative models, the bi-factor model (BFM), would result in an interpretation that is similar to that arising from the higher-order factor model (HOM). That is, both the HOM and BFM are supportive of the presence of a single general factor...* (page. 857). " Although both models converged, the hierarchical model was more in line with the empirical findings (Musek, 2017; van der Linden et al., 2010). Specifically, the HOM takes into account the often replicated correlation between the Big Two (DeYoung et al., 2002; Digman, 1997), whereas this correlation is left unexplained in the BFM.

Subsequent tests indicated that the GFP was relatively robust over geographical distribution, types of samples, and the questionnaires used. Based on all those results, we can conclude that the GFP indeed can be found in samples from mainland China. As such, the present study provides a relevant contribution to addressing the question of the generalization and universality of the GFP.

To go beyond testing the GFP in Chinese samples, we examined whether its characteristics differ from those found in Western samples. The psychometric

characteristics of the GFPs in Eastern and Western samples looked rather similar, which seems to imply that the GFP is stable across Chinese and Western cultures. The similarity does not imply that GFPs in Eastern and Western samples were completely identical. Strictly speaking, the unconstrained model showed a better fit than the constrained model. We found that mainly ES and O differed between the samples. This possibly reflects the influence of cultural differences on the personality hierarchy. Taking ES as an example, as a meta-analysis showed, there are valid cross-cultural differences in emotion (van Hemert et al., 2007).

3. Study 2: Criterion-related validity: Testing the correlations between the GFP and the leadership outcomes

The subsequent question we addressed was whether, in the Chinese samples, there are indications of the GFP reflecting social effectiveness. Roberts and colleagues (2007, p. 314) stated that *"the importance of a predictor lies not only in the magnitude of its association with the outcome but also in the nature of the outcome being predicted."* Following this line of reasoning, we chose leadership outcomes as criteria because several studies have shown that being more socially effective facilitates leadership (Magnusen & Perrewé, 2016; Riggio & Reichard, 2008). If leaders know how to behave in such a way that followers are more likely to act in the desired direction, then those leaders are seen as more effective. Accordingly, it can be expected that the GFP, as social effectiveness, may be related to leadership outcomes. In the present study, we addressed two types of leadership outcomes, namely (1) leadership effectiveness and (2) abusive supervision.

Meta-analytic correlations between personality (mainly the Big Five) and leadership effectiveness have been tested before by Judge et al. (2002). More recently, Pelt et al. (2017) reexamined those correlations by extracting the general factor from the Big Five and found that the GFP was relatively strongly related to leadership effectiveness ($r = .40$). This finding was repeated by Do and Minbashian (2020), who, by using meta-analyses, reported that the GFP was related to transformational leadership behaviors ($\rho = .38$) and leadership effectiveness ($\rho = .30$). Those two studies, however, only used Western samples. Hence, conducting similar tests in Eastern samples would be useful to investigate the generalizability of the relationship between the GFP and leadership effectiveness. To this aim, we searched for relevant data among our Chinese dataset of studies and found one study (Meng & Li, 2004) that could be used to test this.

The other leadership variable we included was abusive supervision, which is viewed as a negative leadership style, and refers to non-socially desirable behaviors of leaders

(Tepper, 2000). A comprehensive review by Harvey et al. (2013) showed that only a few researchers have looked into the relationship between abusive supervision and personality. Moreover, as far as we know, to date, only one study tested the influence of Big Five personality on abusive supervision (Camps et al., 2016). With Dutch and English samples (n = 103), these authors found that none of the Big Five significantly related to abusive supervision. To examine the GFP in relation to abusive supervision, however, we used data from the study of Tang et al. (2016, n = 213), which was also included in the meta-analysis in Study1. In conducting this test, as far as we know, this is the first study that looked at the relationship between the GFP and a negative leadership outcome.

3.1. Method

To test two leadership outcomes (leadership effectiveness and abusive supervision), we selected two samples from the meta-analytic dataset. Below we briefly described each sample and corresponding measure.

3.1.1. Sample 1 and measures: Leadership effectiveness

Meng and Li (2004) tested the associations between leaders' Big Five personality (self-report) with their leadership effectiveness (as rated by subordinates and superiors) and other leadership outcomes (reported by subordinates only). Participants were 210 leaders from 72 organizations (72% male). Their ages ranged from 31 to 41 years. Each leader had one matched superior (n = 210) and two subordinates (n = 420). Thus, in total, there were 630 other ratings.

Leaders self-reported their personality on the 77-item Big Five questionnaire[8] – a brief version of the 300-item International Personality Item Pool (IPIP, Goldberg, 1999). Using the leadership outcome scale – a subscale of Multifactor Leadership Questionnaire 5X (MLQ-5X, Bass & Avolio, 2004), the authors tested the following (reported by two subordinates): (1) the extent to which the subordinates perceived their leaders as being effective (subordinate-rated leadership effectiveness; (α_1 = .88; α_2 = .87; ICC = .34); (2) the subordinates' extra efforts that reflected their work motivation (α_1 = .80; α_2 = .80; ICC = .28); and (3) the subordinates' overall satisfaction with their leaders(α_1 = .89; α_2 = .85; ICC = .36). Furthermore, subordinates reported (4) their own job satisfaction (on the Job Satisfaction Questionnaire; Brayfield & Rothe, 1951; (α_1 = .85; α_2 = .81; ICC = .45); and (5) their work engagement (α_1 = .73; α_2 = .65; ICC = .33) and organizational commitment[9](α_1 = .78; α_2 = .65; ICC = .33). Superiors only reported the perceived

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[8] Those 77 items were picked out by authors themselves from the 300-item IPIP, while other items were ruled out according to the results of item- and content-analyses in the predicted test.
[9] The authors did not spell out the name of the used questionnaires for these two variables. We

leadership effectiveness of the leaders they had to rate (superior-rated leadership effectiveness)[10].

3.1.2. Sample 2 and measures: abusive supervision

Tang et al. (2016) tested the relationship between leaders' Big Five personality and their subordinates' perceptions of abusive supervision from their leaders. Participants consisted of 213 leaders (60.56% were male; M_{age} = 36.72 years [SD = 6.26]) and 213 subordinates (53.58% were male, M_{age} = 33.18 years [SD = 6.86]) from a large manufacture enterprise.

Leaders self-reported their personality on the 30-item Big Five adjective scale (Wong et al., 2011) – a brief version of the 80-item Big Five inventory (McCrae & Costa, 1987). Subordinates reported their perceived abusive supervision of their leaders on the 15-item Abusive Supervision Questionnaire (ASQ; Tepper, 2000; α = .95). The items of the ASQ were prefaced with the statement, "my boss …" and the items included, for example, 1. *Ridicules me*; 2. *Tells me my thoughts or feelings are stupid*; 3. *Gives me the silent treatment*, etc. Subordinates reported the frequency of their received abusive behaviors from their leaders on a 5-point Likert scale, ranging from 1 (I cannot remember him/her ever using this behavior with me) to 5 (He/she uses this behavior very often with me).

3.1.3. Statistical analysis

To test the correlations between the GFP and the leadership outcomes, we built an *omnibus correlation matrix* consisting of (1) the Big Five intercorrelations (as obtained from Study 1) and (2) the correlations between each of the Big Five traits with the leadership outcomes.[11] For the latter, we used the observed correlations (not the corrected ones) since this was the only source available. Yet, for the Big Five intercorrelations, we used the weighted meta-analytic values obtained in our meta-analysis (Study 1). The reason for this is that the meta-analytic values are based on a much larger *N* and, therefore, are more stable than the values of any independent study (Do & Minbashian, 2020; Karwowski & Lebuda, 2016; Pelt et al., 2017; van der Linden et al., 2016; van der Linden et al., 2010). We used the weighted meta-analytic values without correction for attenuation

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contacted the authors by email but did not receive a response.

[10] The authors did not report the reliability of this variable.

[11] Since the authors did not report intercorrelations between leadership outcomes, we were not able to build a fully inclusive matrix to test all correlations at the same time. Nevertheless, it is possible to test those correlations in a model using the multi-group SEM approach. The invariance test showed no difference between the constrained (χ^2=115.22, *df* =100, CFI=.99, TLI=.98, RMSEA=.03) and unconstrained (χ^2=114.82, *df*=72, CFI=.96, TLI=.93, RMSEA=.05) multi-group models (*Δ* χ^2=.40, *Δ df*=28, *p*>1).

since the correlations of the Big Five and variables of leadership outcomes reported by original authors were also uncorrected.

With this correlation matrix, we ran a CFA model in which the GFP (latent variable) was extracted from all Big Five traits (manifest variables). Then we added each of the variables (manifest variables) into this CFA model and linked them to the GFP. Note that the sample sizes of all models were always set to the size that the original authors reported.

3.2. Results

In sample 1, we found the correlation between the leaders' GFP (self-reported) and leadership effectiveness (other-rated) to be positive and significant (see Table 4) when the other raters were subordinates. When rated by their superiors, the correlation did not reach significance. Beyond the direct findings on leadership effectiveness, we found that when their leaders' GFPs were higher, their subordinates also scored higher on job satisfaction, work motivation, and organizational commitment. In contrast, the leaders' GFP was unrelated to subordinates' satisfaction with those leaders and the subordinates' work engagement.

Table 4

The Criteria's Correlations with the Big Five and GFP

Study	Criteria	O	C	E	A	ES	GFP
1($n = 210$)	Effectiveness (subordinate)	.03	.14	.05	.13	.09	.17*
	Effectiveness (superior)	-.15*	.11	.05	.06	.04	.06
	Satisfaction (leaders)	.01	.11	.00	.15	.11	.15
	Satisfaction (job)	.04	.22*	.11	.22*	.12	.28**
	Work motivation	.03	.17*	.06	.22*	.16*	.25**
	Organizational Commitment	.08	.25**	.22*	.26**	.19*	.38***
	Work engagement	-.10	.14	.14	.02	.01	.10
2($n = 213$)	Abusive superior	-.06	-.08	.06	-.25**	-.21**	-.20*

Note. * p <.05. ** p <.01. p ***<.001

In sample 2, we tested the relationship between the leaders' GFP, and the level of abusive supervision as reported by their subordinates. This relation was negative and significant ($r = -.20$), implying that higher GFP scores of leaders were associated with less abusive leadership as reported by their subordinates.

3.3. Discussion

In Study 2, we conducted a criterion-related validity study testing the associations between the GFP, on the one hand, and leadership effectiveness, and abusive supervision, on the other hand. Such tests could be thought of as an indirect examination of the social effectiveness account of the GFP (Dunkel & van der Linden, 2014; Loehlin, 2011). Note that all dependent variables in those studies were based on other ratings, which is relevant considering the alternative explanation that has been given for the GFP, namely that it mainly reflects self-report bias (Backström et al. 2009).

For leadership effectiveness, we found that the GFP, based on self-reported personality, was indeed positively related to leaders' effectiveness when rated by subordinates. This finding supports the notion that high-GFP leaders tend to more often display behaviors that are considered effective by those who are partly dependent on the leader. Beyond this, we found that the leaders' GFP was also related to their subordinates' job satisfaction and organizational commitment. In the literature, job satisfaction (Bogler, 2001; Medley & Larochelle, 1995) and organizational commitment (Waris et al., 2018; Yahaya & Ebrahim, 2016) have been found to be affected by leadership behavior before. Thus, the total pattern of findings regarding subordinate ratings underlines the link between the GFP and effective leadership behavior.

When the raters were superiors, no significant relationship between the GFP and leadership effectiveness was found. One plausible explanation for this discrepancy is that, for obvious reasons, superiors may not be the best informants for their subordinate's (i.e., the rated leaders)' leadership effectiveness. Although superiors are, of course, responsible for the overall job performance of the leaders (e.g., the productivity of the departments they lead), they may have less insight into how those leaders' behaviors directly impact subordinates. As the literature showed, to rate the leaders' leadership, it is rather rare to use superiors as raters. Using subordinates as raters is much more common (Camps et al., 2016; Mawhinney, 2005; Rao & Mawhinney, 1991). One reason for this is that, compared to superiors, subordinates will experience the influence of their leaders' behavior on a daily or weekly basis. In addition, as there were two subordinates and one superior matched with each leader, it can also be expected that the subordinate ratings (the mean of two ratings) may be more reliable.

In the second sample, we found that leaders who scored higher on the GFP were rated as less abusive by their subordinates. Less abusive supervision can be thought of as partly reflecting socially effective/desirable behavior. As far as we know, this is the first study that tested the GFP's relationship with abusive supervision beyond the Big Five. All in all, Study 2 supported the notion that leaders' GFP impacts their social effectiveness, namely being effective and less abusive towards their subordinates.

4. General discussion

The two main aims of the present research were (1) to meta-analytically test the existence of the GFP in samples from mainland China and (2) to examine whether a GFP in Chinese samples also points towards social effectiveness, in this case, through leadership. Below, we separately discuss those two aims.

The meta-analysis clearly confirmed the existence of a GFP in personality data in Mainland China. The relevance of that study, however, goes beyond this specific finding and can be integrated with the body of previous GFP studies, especially those that have tested the GFP in samples in different cultures (Dunkel, 2013a; Erdle & Aghababaei, 2012; Hull & Beaujean, 2011; J. Philippe Rushton et al., 2009). As such, the present findings contribute to answering the question regarding the universality of the GFP (see also van der Linden et al., 2018). To the best of our knowledge, this is the first meta-analysis testing the GFP with a very large set of non-Western samples and the first study to directly compare the GFPs across Eastern and Western samples.

In Study 2, the findings confirmed the findings of previous studies in Western samples, namely that the GFP relates to leadership outcomes (Do & Minbashian, 2020; Pelt et al., 2017). Although leadership obviously is not the same as social effectiveness, the literature clearly supports that social effectiveness plays a substantial role in leadership emergence and effectiveness (Ferris et al. 2002, Wu et al., 2022). As such, the relationship between the GFP and other-rated leadership behavior can be considered an additional building block in delineating the nature of the GFP.

The notion that the GFP reflects social effectiveness is not incompatible with claims that it reflects social desirability. The traditional view of social desirability is that it is a measurement of error or response bias (artifact) that ought to be controlled for (Grimm, 2010). However, there is now a range of studies supporting the idea that measures of socially desirable behavior, in fact, mainly tap a substantive trait that indicates a person's social knowledge, skills, motivations, and abilities (Ferris et al., 2002). Individuals who act in socially effective ways are more likely to achieve their social goals (Dunkel & van

der Linden, 2014; Loehlin, 2012; Pelt et al., 2020; van der Linden et al., 2016). Therefore, it seems reasonable to assume that behaving in socially desirable/effective ways will, on average, also benefit individuals to get more positive ratings from either their subordinates (Pelt et al., 2017) or leaders (Do & Minbashian, 2020) in the work domain. Although the findings in Study 2 are correlational in nature, which implies that no causal inferences can be made, recent research has found that the GFP, as measured before a simulated student election, can predict leadership emergence (Wu et al., 2022).

4.1. Limitations and contributions

One apparent limitation is that the data were collected from Chinese academic publication databases only. However, as stated in the introduction, such a data collection method can also be considered an asset as it likely provides the best way to test the GFP in Chinese personality studies since currently only very few have been published in international journals.

The small difference we found in the GFP scores between Chinese samples and Western samples can be possibly traced to other culture-related variables such as individualism versus collectivism (Van de Vliert et al., 2013). However, that would not conflict with the conclusion that the GFP is relatively stable across populations since the GFP can be consistently found in both Chinese and Western samples.

Future studies could take into account other, non-self-reported outcome variables to further test the nature of the GFP and collect more evidence for the notion that, also in Chinese cultures, the GFP reflects general social effectiveness.

4.2. Concluding remarks

Despite the currently different views on GFP in the literature (Bäckström et al., 2009; Dunkel et al., 2014; Revelle & Wilt, 2013; van der Linden et al., 2016, 2017), knowledge about whether a general factor is present in personality and whether that factor is universal is important for understanding the structure of individual differences. The findings of the present meta-analysis and validity study bring us one step closer to answering those questions. Moreover, they may shed light on humans' common characteristics. As Darwin (1871) proposed, humans have been naturally selected to be more sociable, cooperative, and less contentious and supposedly have a need to seek the approval of others. To get the approval of others, being socially effective/desirable is among the most useful behaviors in order to achieve that (Dunkel et al., 2016; van der Linden, Dunkel, et al., 2016). Subsequently, a tendency for socially desirable behavior or social effectiveness may permeate much of our behavioral repertoire and would cause many narrower traits to intercorrelate.

Supplemental Material

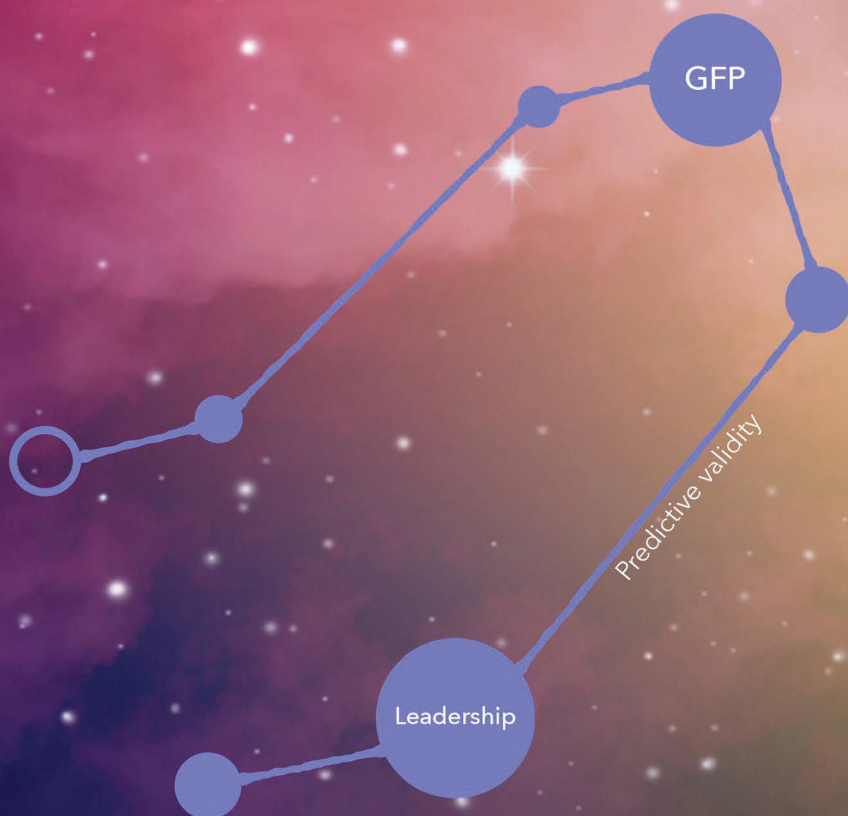Supplemental material for this article is available online.

Chapter 3

The General Factor of Personality (GFP) Predicts Emerging Leadership: Testing An Evolutionary Prediction

GFP

Predictive validity

Leadership

Abstract

Evolutionary accounts of the general factor of personality (GFP) state that high-GFP individuals tend to be selected as leaders more often. We directly tested this assumption using a simulated two-step election campaign to decide who would become a general student leader in a Chinese college. The results showed that GFP scores, as assessed before the start of the election, indeed could predict who became leaders of their subgroups (in step 1) and also who received the most votes to become the general leader (in step 2). Additional analyses revealed that the lion share of the variance in election outcomes accounted for by personality (i.e., The Big Five) could be attributable to individual differences in the GFP. To our knowledge, this is the first study with a high ecological validity showing that the GFP is related to being able to successfully lobby for being elected as a leader. These findings are in line with the evolutionary perspective on the GFP.

Keywords: leadership; general factor of personality; social effectiveness

Public Abstract

It is assumed that during human history, an overarching personality factor evolved that reflects general social effectiveness. We found that participants' scores on this general factor predict who will become a leader and representative of their group. The results contribute to insight into the role of personality in leadership emergence from an evolutionary perspective.

Introduction

Leadership is one of the topics that is receiving considerable attention from various disciplines in psychology. In individual differences research, studies often try to identify traits, such as personality and abilities, that are related to leadership emergence and effectiveness (Antonakis, 2004; Judge et al., 2002). Applied psychology focuses more on the different leadership styles and behaviors, and their impacts on the performance and well-being of subordinates (Breevaart et al., 2014; Dierendonck et al., 2004). Evolutionary approaches to leadership try to reveal the evolved processes that influence leadership emergence and acceptance (Garfield, Hubbard, & Hagen, 2019; van Vugt, 2006).

One specific area in which the various theoretical approaches on leadership may intertwine is in the research on the so-called General Factor of Personality, in short, the GFP (Figueredo et al., 2004; Musek, 2007; Rushton et al., 2008; van der Linden, Te Nijenhuis, et al., 2010), which has also been linked to leadership ability in previous studies (e.g., Pelt, van der Linden, Dunkel, & Born, 2017).

The GFP refers to the shared variance among personality dimensions. Although many of the most common personality models assume multiple independent personality dimensions, such as the Big Five (Lewis R. Goldberg, 1990), it has now been clearly established that, empirically, most of these dimensions are intercorrelated in such a way that a general factor emerges that explains somewhere between 20 to 60% of the variance in the underlying traits (Musek, 2007; Rushton & Irwing, 2011; van der Linden, Te Nijenhuis, et al., 2010). The GFP reflects the socially desirable ends of the personality dimensions. Thus, from the perspective of the well-known Big Five personality model, a person scoring high on the GFP would, on average, be relatively high in openness to new ideas and experiences, diligent (i.e., conscientious), sociable (extraversion), friendly (agreeableness), and emotionally stable (Musek, 2007).

Since the inception of the GFP in the recent literature (Figueredo et al. 2004; Musek, 2007), there has been an ongoing debate about the nature of the construct. Several scholars suggested that the GFP may simply reflect methodological or statistical artifacts and thus has little relevance to understanding personality (Bäckström et al., 2009; Revelle & Wilt, 2013). For example, it has been suggested that individual differences in providing socially desirable answers on personality surveys are causing a GFP to emerge (Bäckström & Björklund, 2016).

Other scholars, however, have suggested that even though socially desirability bias may play some role -as it does in almost every measure in social science-, the GFP may predominately reflect a substantive factor (e.g., Dunkel, van der Linden, Brown, & Mathes, 2016). In this substantive explanation, the GFP is assumed to mainly reflect general social effectiveness (Loehlin, 2012a; van der Linden, Dunkel, et al., 2016). In other words, high GFP individuals would have the motivation, knowledge, and skills to truly behave in socially desirable ways and, in that way, are better able to achieve their goals, such as finding a partner, making friends, or acquiring high social status. To the point, a recent meta-analysis showed a strong overlap ($r \approx .85$) between the GFP and trait emotional intelligence (trait EI, van der Linden, et al., 2017). Similar to the GFP, trait EI seems to reflect emotional and social effectiveness (Petrides et al., 2007). This idea has been supported by the studies showing that trait EI correlated with a range of other-rated or objective outcomes, such as job performance (O'Boyle, Humphrey, Pollack, Hawver, & Story, 2011) and health (Martins et al., 2010). Therefore, the strong correlation between the GFP and trait EI can be considered as additional support for the notion that the GFP indicates social effectiveness.

Chapter 3

The social effectiveness explanation was the basis of the present study in which we tested whether people with high GFP scores tend to be selected as group leaders or representatives more often. The presumed link between the GFP and leadership was coined in evolutionary theories stating that during human history, individuals with a higher GFP would have had a reproductive (e.g., general fitness) advantage (Figueredo & Rushton, 2009; Rushton, Bons, & Hur, 2008; van der Linden et al., 2018). Because of their social effectiveness, they would have been selected as mates, friends, or leaders more often, thereby contributing to acquiring status and resources and leaving more, or more surviving progeny. The difficulty with these types of evolutionary reasoning is that one cannot go back in time and directly test those hypotheses. However, one thing we can test is whether the GFP indeed plays a role in who will emerge, or who will be selected as a group leader/representative. Although there are now several studies that have revealed that there is indeed a relation between the GFP and leadership (e.g., Pelt et al. 2017), to our knowledge, these studies, without exception, have been cross-sectional, and thus do not allow causal interpretations. The current study, therefore, would be the first to examine the predictive validity of the GFP for leadership emergence. In order to be able to link such a study to previous evolutionary statements, and before explaining the details of the study, we first have to discuss previous findings suggesting a link between the GFP and leadership, and the evidence indicating that the GFP indeed has been shaped by evolutionarily selective pressures.

Personality and leadership: A role of the GFP?

The literature on leadership and personality has now established that personality traits such as the Big Five are related to leadership emergence and effectiveness. In a comprehensive meta-analysis using 222 correlations from 73 samples, Judge, Bono, Ilies, & Gerhardt (2002) reported leadership emergence correlations of .24, .28, .31, .08, and -.24, for openness (O), conscientiousness (C), extraversion (E), agreeableness (A), and neuroticism (N), respectively. They also reported that the Big Five showed multiple correlations of .48 with leadership. Although studies such as the one of Judge et al. (2002) and also of Antonakis (2004) confirmed that each of the Big Five might relate to leadership emergence, the typical pattern of associations seems to indicate the role of the GFP. That is, the pattern of O+, C+, E+, A+, and N- is in line with what one would expect if the general factor was (partially) driving those associations. This was directly tested in a study by Pelt et al. (2017). Based on the meta-analytic data of Judge et al. (2002), Pelt et al. constructed a GFP from the Big Five measures that they related to various leadership outcomes. Those analyses yielded substantial meta-analytic correlations of the GFP with

leadership emergence (ρ = .49) and leadership effectiveness (ρ = .40). Importantly, the leadership criteria were based on objective outcomes and other ratings, which is in contrast to the idea that the GFP would merely reflect the socially desirable bias in self-report measures.

To test the relative role the GFP may play in the associations between the Big Five and leadership, Pelt et al. (2017) also included correlations between the Big Five in which their shared variance, i.e., the GFP, was taken out of the equation. Those analyses revealed that once the GFP was taken out of the Big Five, their correlations with the leadership criteria were strongly diminished or even reversed in sign. They became, .09, .03, .11, -.27, and .03, for O, C, E, A, and N, respectively. Thus, from such findings, it can be concluded that the GFP does relate to leadership. Yet, as mentioned above, such meta-analytic findings plus a few studies that directly linked GFP scores to leadership positions or qualities after that, do not allow causal interpretations. An alternative explanation may be that people who acquire leadership or higher social status positions change either in personality or in how they fill in their own personality on self-reports.

GFP and evolutionary processes

A second topic that needs to be discussed before elaborating on the present study is what evidence there is for the role of evolutionarily selective forces on the GFP. To date, the strongest data in support of this notion come from genetically informed studies. Several of those have been conducted and revealed that the GFP has a substantive genetic component of around 50% (Figueredo & Rushton, 2009; Loehlin & Martin, 2011; Schermer & MacDougall, 2013; Veselka, Schermer, Petrides, & Vernon, 2009; Veselka, Schermer, & Vernon, 2011; van der Linden et al., 2018). More importantly, the GFP has a substantial proportion of non-additive genetic variance compared to additive genetic variance (Veselka, Schermer, Petrides, & Vernon, 2009). Given the non-additive genetic variance is considered to indicate the recent evolutionary selective pressure (Veale & Falconer, 1960), we, therefore, could infer that the GFP may have been prone to such selective pressures in recent human history (Figueredo & Rushton, 2009). Although the exact nature of the type of selection processes cannot easily be inferred from such findings, one plausible explanation that has been provided is that, in the past, the higher social effectiveness indicative of the GFP was associated with a general fitness advantage. Specifically, high-GFP individuals were able to better deal with social situations and thereby, on average, were more popular and influential among their peers. As a result, they had more chances to acquire high status or resources. As status and resources are well-

established fitness indicators (Buss, 1991), it would then make sense that the GFP may have been related to having more offspring.

The direct link between the GFP and popularity among peers was confirmed in a previous study that applied network analyses among classmates (van der Linden et al., 2010a). In that study, high-GFP individuals were rated as more popular and more likable by their peers. Support for the direct relation between the GFP and progeny comes from a study among an indigenous population in the Amazon in Bolivia (van der Linden et al., 2018). That study found that higher GFP scores were positively related to the number of offspring, particularly in men. Also relevant in this context is a recent study in 45 countries across the world ($N = 14,478$) that found that, in general, people tend to mate with others of similar levels of social desirability. Subsequently, it was suggested that such a mating pattern might have caused correlations between almost all dimensions of social desirability (Conroy-Beam et al., 2019). This seems to also include the socially desirable aspects of personality that are typically captured in the GFP. All in all, it seems reasonable to assume that those who have higher levels of social effectiveness have a significant fitness advantage.

GFP and leadership: The present study

By definition, it would be difficult, if not impossible, to directly test accounts of the relation between the GFP and its presumed evolutionary advantages. However, several of the more specific assumptions or predictions on which they are built can be tested. One prediction mentioned above is that high-GFP individuals have a higher probability of being selected as a leader.

In the current study, we directly tested this prediction by using a design inspired by the typical Chinese student campaign for leadership positions, which is quite common in most Chinese universities and colleges. The outcome of such a campaign can be thought of as a case of emerging leadership. The student leader/representative election reflects an actual social activity with which Chinese students are very familiar, and it, therefore, has high ecological validity. Moreover, it has very distinct social goals in which social effectiveness plays a role. Hence, we adjusted such a student campaign to a two-step student election. First, before it was decided who would be eligible to campaign for the general leader position, participants had to decide who among the four members of their group would advance to the main campaign stage. Second, in the general campaign, participants had to try to obtain as many votes from their fellow students as possible by providing a short presentation on their suitability as a general group leader/representative. Because, at the start of the study, all participants received the same individual instruction

to try to become the group leader, it can be expected that, on average, the most socially effective and motivated persons would be able to obtain those positions. Under genuinely social conditions, such as in this study, obtaining one's social goal can be achieved in various ways, for example through becoming popular or liked, or by being very convincing and persuasive, or maybe even aggressive (Ferris et al., 2002; van der Linden, Scholte, et al., 2010). Yet, the idea of being socially effective is that given the specifics of the situation (e.g., the setting, the characters of the other people involved in the group) one is able to adjust one's behavior in such a way that the likelihood of obtaining one's social goal is enhanced. Personality was measured at the very beginning of the study, and participants were not aware of others' scores. Therefore, we considered it a more direct test of the presumed GFP-leadership link that allows analyzing the predictive validity of the GFP for leadership emergence. As such, in several ways, the present study goes beyond previous studies on this topic. First, it uses a range of different measures that include self-reports (personality), other ratings (i.e., experimenter ratings on participants' leadership qualities), and objective outcomes, such as who has been appointed as subgroup leader and who received the most votes.

Second, the design allows tests of predictive validity as personality is measured before the elections of leaders. Although, strictly speaking, this design does not allow for direct causal inferences because we, obviously, could not manipulate personality, it did allow us to test whether students with a certain personality profile, are more likely to become selected as leaders.

In sum, two hypotheses were formulated in the present study. First, among their subgroup of four fellow students, participants with higher GFP scores are more likely to be chosen as subgroup leaders, who then advance to the next stage: the general campaign. Second, among those who are involved in the general campaign, the students with higher GFP scores would obtain more votes and also acquire higher ratings (by research assistants) on leadership potential.

Method

Participants

Participants were 136 undergraduate students (58 women and 78 men) from a college in China. Participants ranged in age from 17 to 22 years, with a mean of 18.93 ($SD = 0.86$). Participation in this experiment was a part of a practical course in their psychological curriculum.

Measures

Personality was measured at the beginning of the study using the 40-item Chinese Big Five Personality Inventory, a brief version (CBF-PI-B, Wang, Dai, & Yao, 2011). On a 6-point Likert scale, participants were asked to rate the extent to which a particular adjective applied to them, ranging from *'1' completely disagree, to '6' completely agree*. Reliabilities (Cronbach Alphas) of the CBF-PI-B ranged from 0.76 (agreeableness) to 0.81(neuroticism).

Procedure

At the start of the study, participants were informed that they all would receive a small paper notebook as a reward after the experiment. The selected group leaders would get a higher reward (a pen), and the final campaign winner, the general leader, would get the highest prize, 30 Yuan (about 4.63 dollars). To students, 30 Yuan can be considered a proper amount of money that would facilitate the participants' motivation to try to become a leader.

Considering the total number of participants was too big to be tested simultaneously in one room, the participants were assigned randomly to two test sessions. Every session lasted 2 hours, and no apparent difference occurred between the two sessions. First, participants individually filled in the personality questionnaire, and each participant was unaware of the others' scores. After that, the 68 participants in one session were randomly assigned to 17 groups of 4 members. Thus, in each test session, there were 17 groups of 4 students.

In the first step, the subgroups of 4 students were given 20 minutes to decide who would become their group leader. During these 20 minutes, they were allowed to determine their group leader/representative, based on open discussion. Each group was completely free to determine its strategy in deciding who would become the group leader. During the 20 minutes, there was no interference or involvement of the experimenters. After 20 minutes, all groups had to report whom they had chosen as the group leader.

In the second step, each group leader was allowed to enter a general stage in which they had to give a 3-minute speech to all participants. In the speech, the group leaders tried to explain to all other participants why they were suited to become the general leader. Every subgroup (i.e., the three remaining group members without the leader) only had one vote that could be allocated to one of the 17 candidates for the general leader. However, they were not allowed to vote on the candidate who came from their own subgroup. The number of received votes can be considered an indicator that reflected the degree of leaders'

social effectiveness. The number of votes a candidate got could range from 0 to 17 (the total number of available votes).

In addition to the participants' votes, each of the four research assistants also evaluated the performance of each of the 17 general leader candidates by giving a subjective score ranging from 0 to 25. Thus, the total score a candidate received could range from 0 to 100. The research assistants' rating reflected their general, subjective opinion on how likely a candidate would be qualified as a general leader. This subjective assessment by research assistants was conducted for additional analyses but did not play a role in deciding who would become the general leader. **Figure 1** displayed the core procedure of the campaign.

Figure 1

Procedure of Campaign
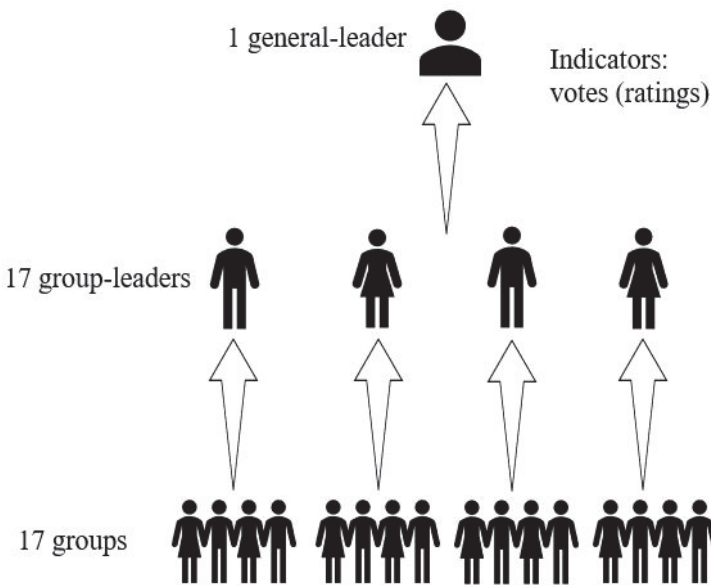
Statistical Analysis

The literature on the GFP shows that there are different ways to extract a general factor from a set of personality measures. One commonly used approach is to extract the first unrotated factor, often with methods such as Principal Axis Factoring or Maximum likelihood (Figueredo et al., 2004; Dunkel et al., 2014). This procedure is identical to how the general factor of cognitive ability, g, is frequently extracted from cognitive ability tests (Jensen, 1998). When using this approach, the participants' scores on the general factor

reflect a weighted (by factor loadings) average or sum of their standardized scores on the specific indicators. The second approach is Confirmatory Factor analysis (CFA), using hierarchical or bi-factor models to extract a latently general factor (Rushton & Irwing, 2011; van der Linden et al., 2017).

Both approaches have their advantages and disadvantages. However, several studies in the personality, as well as in the cognitive domain, showed that the characteristics of general factors are relatively robust for the extraction method. For example, GFPs extracted with EFA, and CFA often tend to correlate to such an extent (around $r = .95$) that they can be considered virtually identical (for reviews see, van der Linden et al. 2016; 2017).

Given that the N in our study was 136 and that the specific guidelines on the use of CFA/SEM state that adequate use of these techniques requires at least 200 participants for simple models, but much larger samples for more complex models (Tomarken & Waller, 2005), we decided to use the first unrotated factor for the main analyses. However, to confirm the robustness of the findings, irrespective of the extraction method, we validated several of the basic analyses by adding parallel CFA/SEM analyses. In the analyses of the second step in the procedure, which included the 34 selected subgroup leaders, we did not use the parallel CFA/SEM method.

Results

Factor analysis

Table 1 shows the intercorrelations between the Big Five. When extracting the first unrotated factor from the Big Five, by means of the Principal Axis Factor (PAF), the GFP explained 31.70% of the Big Five variance (eigenvalue [EV] = 1.59). This was far above the next factor (EV = 0.554) which only explained 11.08% of the variance. The GFP factor loadings were in line with expectations, namely .56 (openness), .66 (conscientiousness), .71 (extraversion), .41 (agreeableness) and -.41 (neuroticism), respectively

In the parallel CFA analysis, we built a model in which a latent GFP was directly extracted from the Big Five traits (as manifest indicators). In this case, we added one covariance between the errors of extraversion and neuroticism ($r = -.27$). This model showed a good fit ($\chi^2 = 7.78$, $df = 4$, CFI = .96, NFI = .92, RSMEA = .08). More importantly, however, it displayed a similar pattern of factor loadings as the PAF, namely .57(O), .76(C), .47(E), .44(A), and.-31(N). To compare the GFPs extracted with

different methods, we imputed the scores of the latent GFP and confirmed that latent GFP (CFA) was nearly identical to the GFP extracted with PAF ($r = .93$).

Table 1

The Big Five Intercorrelations

	1	2	3	4	5
1. Openness	.60				
2. Conscientiousness	.41**	.79			
3. Extraversion	.30**	.39**	.69		
4. Agreeableness	.32**	.35**	.05	.59	
5. Neuroticism	-.18*	-.24**	-.37**	-.11	.76

Note. Cronbach's alpha coefficients are on the diagonal.

$^{*}p < .05$; $^{**}p < .01$.

Table 2

Comparison of the Big Five in Leaders versus Non-leaders

Variable	Non-leaders ($n = 102$)		Leaders ($n = 34$)		$F(4,131)$	η^2_P
	M	SD	M	SD		
Openness	31.61	4.71	34.85	4.97	11.77**	0.08
Conscientiousness	32.43	5.60	37.24	5.55	18.89***	0.12
Extraversion	28.27	5.20	32.91	6.60	17.62***	0.12
Agreeableness	32.18	4.53	34.41	4.45	6.26*	0.04
Neuroticism	27.64	6.22	25.65	7.26	2.40	0.02

Note. η^2_P partial eta-squared

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 3

Comparison of the Big Five Residuals in Leaders versus Non-leaders Taking out of the GFP

Variable	Non-leaders ($n = 102$)		Leaders ($n = 34$)		$F(4,131)$	η^2_P
	M	SD	M	SD		
O residuals	-.01	.99	.02	1.04	0.02	0.00
C residuals	-.02	1.00	.06	1.01	0.17	0.00
E residuals	.01	1.00	-.03	1.01	0.03	0.00
A residuals	-.01	1.00	.02	1.00	0.01	0.00
N residuals	-.04	.94	.13	1.16	0.78	0.01

Note. η^2_P partial eta squared. The O residuals, C residuals, E residuals, A residuals, and N residuals are residuals of openness, conscientiousness, extraversion, agreeableness, and neuroticism, respectively, after taking out the GFP.

Campaigning for the group leader

First, in order to test the possible effect of demographics, we checked whether those who were selected as group leaders among their subgroups differed in terms of sex as well as age from non-group leaders. The results of the Cross-tabulation Analysis showed that the participants who were selected as group leaders did not significantly differ from non-leaders regarding sex (Pearson's $\chi^2 = 0.04$, $p = .84$) or age (Pearson's $\chi^2 = 7.52$, $p = .19$).

Subsequently, we addressed one of our main research questions by testing whether group leaders differed from non-leaders in terms of personality, i.e., their GFP scores. The direct comparison, using t-test showed that participants who were selected as leaders among their groups indeed scored significantly higher on the GFP than non-leaders (M leaders $= .66$ [$SD = .90$]; M non-Leaders $= -.22$ [$SD = .76$]; M difference $= -.88$ [95% CI: -.120; -.57], $t(134) = -5.603$, $p < .001$).

Parallel to the t-test, we examined the group differences using the previously described latent GFP model. Using this model, we first allowed the GFP factor loadings in the two groups to differ from each other. This was the unconstrained model. The fit of this model was good ($\chi^2 = 11.51$, $df = 8$, CFI = .94, NFI = .86, RMSEA = .06). Subsequently, we tested a model in which the GFP factor loadings were set equal in both groups (the constrained model). This model also showed a good fit, which, in an absolute sense, was somewhat better than the unconstrained model ($\chi^2 = 15.04$, $df = 12$, CFI = .95, NFI = .82, RMSEA = .04). A chi-square difference test showed that the two models did not significantly differ ($\Delta\chi^2 = 3.53$, $df = 4$, $p = .47$), which allowed us to assume that the GFP is invariant over the two different groups.

After having established this, we conducted a multiple-group analysis within the constrained model comparing the means of leaders' and non-leaders' GFP scores. This analysis, obviously, confirmed the difference between the two groups ($M_{\text{non-Leaders}}$ = 12.07 [SD = 1.53]; M_{leaders} = 14.38 [SD = 1.68]; $M_{\text{difference}}$ = -2.31 [95% CI: -2.92; -1.70], t (134) = -7.41, p < .001).

Although participants were randomly allocated into subgroups of four persons, the participants in each subgroup were, obviously, not independent from each other. To include the possible group and interdependence effects, we also conducted the following parallel analyses. We compared the group leaders' GFP scores (M = .66), 1) with the mean GFP scores (M = -.22) of the other three members of their own groups, and 2) with the minimum (M = -.81) and 3) with the maximum (M =.39) GFP scores of these three other group members. We did so by using a within-subject approach in which the group-level was the within-subject factor, and we compared the group leaders' GFPs to the GFPs of the remaining group members. These analyses, again, confirmed that the GFP scores of group leaders were significantly higher than the mean GFP scores of the three group members (Wilks' Lambda = .51, F (1, 33) = 32.02, p = .000, η^2_P = .49) as well as their minimum GFP scores (Wilks' Lambda = .30, F (1, 33) = 77.61, p = .000, η^2_P = .70). Regard to maximum GFP scores, the difference did not reach significance (Wilks' Lambda = .91, F (1, 33) = 3.19, p = .083, η^2_P = .09).

 Beyond the GFP, we conducted a multivariate analysis in which we tested whether the leaders differed from non-leaders in the Big Five. Apparently, and in line with the notion of the general influence of the GFP, they did differ in all traits excluding neuroticism (See Table 2).

In order to test the influence of the GFP on the Big Five, we repeated the multivariate analysis as described above, but this time we used the standardized residuals of Big Fives in which the GFP was taken out. Note these Big Five residuals represent the unique effects of the Big Five that are independent of the GFP. The results of this analysis are shown in Table 3 and reveal that none of the initially significant differences in the Big Five remained after taking out the general factor. Thus, this suggests that the personality differences between group leaders and group members may have predominantly been a function of the GFP instead of the unique characteristics of the specific personality traits.

Campaigning for the general leader

In the second step of the election (campaign for the general leader position), the 34 group leaders competed for leadership votes from the subgroups. The votes that the group

leaders received varied from 0 to 5 (M_{vote} = 1.03 [SD = 1.29]) and the rating scores they received from four research assistants varied from 35 to 100 (M_{score} = 74.56 [SD = 19.98]). We noticed that several participants received relatively many votes (5 participants received 3 or more votes) or high scores (5 participants got 99 or 100 points), whereas many candidates did not receive any vote (n = 15) or got less than 70 points (n = 16). This discrepancy indicated that the distributions of the votes and ratings were non-normal. In order to address this, we analyzed the data using Spearman's rank-order correlation. The number of votes group leaders received from voters correlated highly with the rating scores they got from raters ($r_{score-vote}$ = .61 [95% CI: .34; .78]; p < .01).

Besides examining the votes and ratings separately, we also extracted their shared variance that reflected the level of agreement on the subgroup votes and experimenter ratings. The resulting factor extracted with PAF (Eigenvalue [EV] = 1.19) explained 60% of their covariance. Considering this factor was rather closely related to the success of the campaign, we entitled it the Campaign Success factor.

Hereafter, we tested correlations between the GFP and the votes on the one hand, and experimenter ratings, on the other hand, and then found both were significant (See Table 4). In comparison, as a combination of both indicators, the extracted Campaign Success Factor was identically related to the GFP. Regarding separate Big Five traits, Table 4 also showed that nearly all correlations were significant, and the only exception was the association between experimenter ratings and openness. Meanwhile, the Campaign Success Factor was related to all of the Big Five traits.

Table 4

Correlations (Spearman's) between the Big Five, the GFP, Votes, Ratings, and the Campaign Success Factor

	O	C	E	A	N	GFP
Votes	.47**	.34*	.45**	.48**	-.49**	.70**
Ratings	.29	.52**	.39*	.38*	-.54**	.70**
Campaign	.40*	.49**	.36*	.47**	-.49**	.70**

Note. The O, C, E, A, and N are openness, conscientiousness, extraversion, agreeableness, and neuroticism, respectively. The Campaign is the Campaign Success Factor.

$^{*}p$ < .05; $^{**}p$ < .01.

Table 5

Correlations (Spearman's) between the Big Five Residuals, Votes, Ratings, and the Campaign Success Factor

	O residuals	C residuals	E residuals	A residuals	N residuals
Votes	.18	-.24	-.06	.17	-.12
Ratings	.03	.04	-.16	.10	-.29
Campaign	.15	-.01	-.21	.18	-.19

Note. The O $_{residuals}$, C $_{residuals}$, E $_{residuals}$, A $_{residuals}$, and N $_{residuals}$ are residuals of openness, conscientiousness, extraversion, agreeableness, and neuroticism, respectively, after taking out the GFP. The Campaign is the Campaign Success Factor.

In order to further examine the influence of the GFP in the Big Five-leadership emergence associations, we again used standardized residuals of the Big Five with the GFP taken out, and then repeated the analysis. The result demonstrated that (see Table5), without any exception, all correlations involving Big Fives were attenuated steeply, and even none of the Big Five effects remained after taking out the GFP.

<div align="center">

Discussion

</div>

Based on the interpretation that the GFP may reflect general social effectiveness (Dunkel et al., 2014; Loehlin, 2012; van der Linden et al., 2016), the present study tested whether this general factor could predict leadership emergence. To the best of our knowledge, this is the first test of this idea using a simulated student election setting that combines self-reports, other-ratings, and objective outcomes.

In such a test, we first found that the group leaders who emerged out of the subgroups indeed scored significantly higher than non-leaders on the GFPs. This was confirmed regardless of whether we considered the individual-level data (comparing the average GFP scores of leaders to that of non-leaders) or the group-level data (comparing the average GFP scores of leaders to the average or minimum GFP scores of the three non-leader members of their groups). The higher GFP scores of group leaders were irrespective of the extraction methods we used because it was also found in the CFAs. Overall, the use of the different extraction methods confirmed that the GFPs extracted with different methods are highly similar and lead to identical conclusions. When comparing the subgroup leaders to the persons with the highest GFP scores among the three non-leader group members, the

difference did not reach significance (p = .08), although, in an absolute sense, the leaders still scored higher.

In light of the latter findings, it is important to realize that looking at the highest scoring person among the remaining subgroup members, by definition, would lead to a smaller distance between the leaders' GFP scores. In fact, it may be likely that the highest GFP person of the remaining group members, on average, represents those participants who might have been 'second-best' as the subgroup leader. Subsequently, it is not surprising that these second-best scorers did not significantly differ from the actual group leaders. In addition, analyzing at the group level also reduced the N, which in general led to higher effect size thresholds for differences to be significant. Nevertheless, overall, all analyses clearly converged and pointed in the direction that those who became subgroup leaders had the highest GFPs in their groups.

In the analyses at the Big Five level, almost all separate traits (excluding neuroticism) significantly differentiated leaders from non-leaders. However, those differences in the Big Five were strongly attenuated and even were no longer significant after taking out their shared variance as captured by the GFP. This latter finding suggested that it was mainly the GFP that drove the associations between the group leadership emergence and the Big Five (see also Pelt et al., 2017).

In this first step of the procedure, group members had full autonomy in what strategies they used for selecting their leaders. Therefore, it can be expected that in different groups, participants may have used different strategies to win the leader position. In the current study, we did not collect qualitative data on the type of strategies that were used by participants. Nevertheless, it can also be assumed that, regardless of the specific strategy, those who succeeded in becoming the leader would be more socially effective as they apparently were able to reach their goals by convincing others. This notion is in line with previous research by van der Linden et al. (2014), who used a video-based situational test showing that high-GFP individuals were better able to indicate the appropriate social behaviors in various situations. That study also showed that high-GFP individuals were rated higher by others on leadership skills.

Second, at the level of the general campaign, we tested whether the GFP scores could predict who gets the most votes and receives the highest ratings. Again, we found that those who had the highest GFP scores received the most votes and were rated by research assistants as having the highest leadership potential. Considering the non-normal distributions of the votes and ratings, we analyzed the data using Spearman's rank-order

correlation and found the GFP and almost all Big Fives were related to indicators of leadership emergence.

After taking out the GFP, all Big Five correlations with leading indicators were attenuated and did not remain significant. Similar to the first step of the experiment, this finding suggested that it was mainly the GFP that drove the Big Five-leadership emergence correlations.

Overall, the total pattern of results was in line with expectations. That is, the GFP scores, extracted from participants' self-reported Big Fives before the experiment, could predict who would be selected as the leader of the groups and then who would be most successful in the general campaign.

Current findings in light of evolutionary accounts of the GFP

Placing the study's findings in a broader theoretical context, the results are in line with previous claims that, during human history, one of the mechanisms by which the high GFP would have had a fitness advantage is by being more likely to obtain a high status or leadership positions (Rushton et al., 2008). In doing so, they probably could also acquire resources contributing to leaving more (or more surviving) offspring (van der Linden et al., 2018).

At this point in time, we can only speculate on how the link between the GFP and leadership may have developed over time. Yet, it seems probable that this would involve a dynamic and reinforcing process. Specifically, in several evolutionary theories, social desirability is not considered a bias, but a genuine tendency to seek the "approval of one's fellows" (Darwin, 1871; Irwing et al., 2012; Rushton et al., 2008). Darwin, among others, considered such a tendency in line with evolutionary pressures for cooperative and mutualistic behaviors. Thus, individuals who were particularly skillful at displaying such behaviors (i.e., high-GFP individuals) would also be more likely to be selected or accepted as leaders. The possible reinforcing aspect of the GFP-leadership association entails that, once a high-GFP person was able to obtain a leadership position and/or high status, he or she also gained access to more desirable mates. As the recent study by Conroy-Beam et al. (2019) showed, once assortative mating occurs on various traits, then over time, these traits tend to become intercorrelated at the genetic level. In this way, the connection between leadership and generalized socially desirable behaviors as captured in the GFP may become even stronger.

Although the present study provides a novel contribution to insight into the relationship between the GFP and leadership, there are several limitations that need to be taken into account when interpreting the results. One limitation is that the study was conducted among students and in a short time frame (the total study took two hours), and

therefore it may be wise to be somewhat cautious about generalizing the findings to emerging leadership and status in real-life settings that extend over months or years (e.g., who will become the leaders in organizations). On the other hand, such a trade-off between control over the study's setting versus ecological validity is a well-known point of discussion in experimental and social psychology. Another limitation is that the study had been conducted in an Asian population, and in future studies, it would be useful to examine whether the findings replicate in other cultures.

Beyond its limitations, the present study contributes insight into the processes that may have shaped the GFP over time. A point of critique that may be raised is that even when acknowledging that the present study revealed an interesting social finding, it does not necessarily need, or relate to, evolutionary accounts of the GFP. Yet, assuming that the link between general socially effective or desirable behaviors, as captured in the GFP, is consistent over time and cultures, it would be difficult to deny its potential influences from evolutionarily selective pressures. There is abundant empirical and anecdotal evidence that high status is associated with increased reproductive fitness. Thus, the association between the GFP and leadership emergence would logically imply that this is, at least, one of the pathways through which the GFP may have been associated with a fitness advantage. Others are being i) more popular among peers in general (van der Linden et al., 2010a), and ii) having higher mate value (Figueredo & Rushton, 2009).

Unidirectional evolutionary selective pressures on the GFP do not imply that, as it has sometimes been suggested, over time, there would be no individual differences in the construct anymore. Similar to the general factor in cognitive ability, g, selective pressures toward a higher level of the variable can co-occur with other processes that maintain individual variation in the population. Regarding this, it is relevant to note that, using runs of homozygosity, Verweij et al. (2012) found that increased levels of the mutation load by inbreeding were associated with lower scores on the GFP. Overall, combining the literature on the evolutionary origins of the GFP with findings that the GFP is associated with leadership –as also shown in the present study-, supports the notion that leadership may be one of the pathways by which high GFP individuals could acquire resources. In that way, high GFP individuals may have created a fitness advantage.

Chapter 6
Summary and General Discussion

Creativity

GFP

Leadership

The present dissertation addressed two core questions centered around the General Factor of Personality (GFP), namely what is the nature of the GFP (is it a substantive or an artifact factor), and what the GFP means? As the scientific literature suggested, the GFP as the commonly shared variances among personality traits/dimensions (Musek (2007), indicates general social effectiveness (van der Linden et al., 2016; van der Linden et al., 2021). The GFP forms a way to understand humans' personalities from the perspective of evolutionary psychology (Figueredo et al., 2004; J. Philippe Rushton et al., 2009). To enrich knowledge about the GFP, this thesis addressed the following questions: 1) whether the GFP can be found in non-WEIRD samples; 2) whether found correlations between the GFP and leadership effectiveness from WEIRD samples can be replicated in non-WEIRD samples; 3) whether the GFP can be used to predict leadership emergence; 4) whether the GFP correlates with creativity?

In this last chapter, we will summarize the main findings and the relevance of those findings to the literature. Subsequently, the limitations will be discussed. Finally, the remaining topics and possible future directions in the study field will be elaborated on.

Part 1: Summary of main findings

The studies included in this thesis particularly focused on the construct of the GFP and the implication of the GFP for leadership and creativity. First, below summaries are provided of the main findings from each study.

The generalizability of the GFP

A rising number of empirical studies support the existence of the GFP. Yet, it is also clear that the majority of the samples in these studies included so-called WEIRD samples, which refers to Western, Educated, Industrialized, Rich, and Democratic samples (Henrich et al., 2010). Previous studies have tested the GFP in a much smaller number of non-WEIRD samples. The lack of non-WEIRD samples hinders information on the generalizability of the GFP to non-WEIRD samples. Therefore, similar to research on other personality constructs such as the Big Five (Schmitt et al., 2007), we tested whether the findings in WEIRD samples uphold in non-WEIRD samples. The importance of doing so was discussed more generally in psychological science by Thalmayer et al. (2020 p.1;): "*How can psychologists trust that these models and results generalize to all humans if the evidence comes from a small and unrepresentative portion of the global population*?"

Using personality data reported by Chinese scientific publications over the past 20 years. Chapter 2 reported on a meta-analytic study testing the construct of the GFP in the Chinese population. We found that a viable general factor could be extracted from the

Chinese Big Five data ($N = 30863$, $k = 53$). Although we only used samples from mainland China, our findings can be considered a relevant large-scale replication of the GFP in a specific non-Western context. To the best of our knowledge, this is the first meta-analysis testing the construct of the GFP exclusively focusing on non-WEIRD samples.

The stability of the GFP

In study 1, reported in Chapter 2, we also meta-analytically tested whether the structure of the GFP is influenced by potential moderators, the measures of personality, and the type of samples. Sensitivity tests showed that the GFP extracted from Chinese Big Five data was not influenced by the way we analyzed the data. In other words, regardless of the way, the data were corrected for methodological artifacts, or the way the data were weighted, the GFP remained consistent. A comparison between published and unpublished articles included in the meta-analysis showed no difference between each of the Big Five intercorrelations. This finding is an indication of GFP's stability across the publication status of the primary studies. Next, we tested potential moderators, such as the types of measures of the Big Five, the sample's geographical distribution, and the types of tested samples (students vs. managers vs. employees). Again, a stable GFP occurred across all moderators. We also used different approaches to extract the GFP from the Big Five, namely a direct extraction from the Big Five and an indirect extraction from the intermediate Big Two factors which themselves first had been extracted from the Big Five. The latter extraction method was named the hierarchical GFP (Hi-GFP) model. We compared the Hi-GFP model to a typical bi-factor model in which the GFP and the Big two factors were set to be unrelated to each other. As found, those two models with no significant differences in terms of the model fit, supported the existence of the GFP. The bi-factor model, in addition, displayed that the GFP always loaded on the Big Five much higher than the Big Two factors, indicating the GFP as the most fundamental constitute in the personality hierarchy.

The correlational relationship between the GFP and leadership

To test the notion of whether the GFP is indicative of general social effectiveness, we tested the correlation of the GFP with leadership. As Magnusen and Perrewé (2016) suggested, leadership is an effective indicator of social effectiveness. To study leadership, two outcomes are commonly used, namely leadership emergence and leadership effectiveness. The former refers to the process of becoming a leader, while the latter refers to the way in which the leader performs in relation to subordinates. Study 2 of Chapter 2 tested the correlation between the GFP and leadership effectiveness and abusive supervision (Tepper, 2000). Specifically, it was expected that higher GFP scores would be

positively associated with more effective leadership behaviors but negatively associated with disruptive leadership behaviors (abusive supervision). The results showed that the GFP indeed significantly and positively correlated with leadership effectiveness and negatively correlated with abusive supervision. Leadership effectiveness, as well as abusive supervision, were rated by subordinates, which circumvents limitations of using self-reported leadership behavior. In line with the objectives of study 1, in this study, we focused on non-WEIRD samples. To this end, data from two previous Chinese scientific publications were re-analyzed and the results showed that leaders' self-reported GFP positively correlated with their leadership effectiveness as rated by their subordinates, and negatively correlated with the leaders' abusive supervision, as rated by their subordinates. This study is among the first to investigate the GFP-leadership behavior relationship in non-WEIRD samples.

The predictive validity of the GFP for leadership emergence

Compared to the strength of the relationship between the GFP and leadership effectiveness found in study 2 ($r = .17$), higher values were reported in earlier meta-analyses ($\rho = .30$ by Do and Minbashian (2020); $\rho = .40$ by Pelt et al. (2017)). A central finding across these previous meta-analyses and our Study 2 is that the correlation between the GFP and leadership is often higher than between leadership and any Big Five trait. For example, Conscientiousness was found to be correlated with leadership effectiveness ($r = .14$) among the Big Five traits in study 2. This correlation, nevertheless, is lower than the correlation between the GFP and social effectiveness ($r = 17$), although the difference is not significant ($\Delta r = .03$; $n = 210$; $p > .05$). Do and Minbashian (2020) reported similar results, namely that the GFP was higher but not significantly than Conscientiousness ($\rho = .28$) in the correlations with social effectiveness ($\Delta r = .02$; $N = 3032$; $p > .05$). By comparing the effects between the GFP and the Big Five traits in predicting leadership effectiveness, Do and Minbashian conducted regression analyses and found that the GFP contributed to the most effects in predicting social effectiveness ($R^2 = 0.06$). Compared to the GFP, adding all Big Five traits into the regression only produced a little high $R^2 = 0.07$. This result implied that the GFP may be the main reason for the correlation between personality and leadership.

To study leadership, two outcomes are commonly used, namely leadership emergence and leadership effectiveness. The former refers to the process of becoming a leader, while the latter refers to the way in which the leader performs in relation to subordinates. By re-analyzing meta-analytical data, Pelt et al. (2017) reported the correlation of the GFP to be $\rho = .40$ with leadership effectiveness and to be $\rho = .49$ with leadership emergence. Yet,

given the cross-sectional nature of their data, these correlations did not indicate causation. Overcoming this limitation, the study described in Chapter 3 used a design that was able to address questions regarding causality. In this study, 136 student participants were randomly assigned into 17 groups, each consisting of four participants. All participants were asked to campaign for the group leader position (group campaign). The group leaders who emerged from the group campaign would be eligible to campaign for the general leader position. The candidates were asked to give a speech to explain why he/she should be voted as the general leader, in front of all groups (general campaign). All groups voted for their preferred candidate, excluding their own group leader. In the end, the candidate who had received the most votes won the general leader position. During the general campaign, four researchers gave ratings to each candidate in terms of their performance.

Through this stimulated student election, we tested the predive power of the GFP on outcomes of both group and general campaigns, namely leadership emergence. The differences were tested in scores on the GFP between individuals who emerged as subgroup leaders (winners) and the remaining group members in the phase of the group campaign. The results showed that those who emerged as leaders, on average scored higher on the GFP, implying that the GFP plays a relevant role in who will be selected as leader of a small group. Furthermore, related to leader effectiveness, the GFP was found to be highly correlated with two indicators of candidates' success during the overall leadership campaign, namely the number of received votes and ratings of leadership qualities from four experimenters. The GFP was positively related to both leader effectiveness indicators and with a composite variable reflecting overall campaign success. In general, the higher the GFP score one had, the more likely it was that one would win the campaign and get the leader position. The tests we conducted were based on the procedures of selecting student representatives/leaders in Chinese universities. The results, therefore, have ecological validity.

Leaders' GFP and subordinates' motivation and attitudes

Chapter 3 focused on leadership effectiveness and also on subordinate-based outcomes such as job satisfaction, general work motivation, and organizational commitment and how these employee outcomes relate to their leader's GFP. Although numerous factors will influence these outcomes, we assumed that they are also partly under the influence of the social effectiveness of their leaders (Bogler, 2001; Medley & Larochelle, 1995). As the results showed, a higher-GFP score of the leader was indeed associated with subordinates' higher job satisfaction ($r = .28$), work motivation ($r = .25$), and organizational commitment ($r = .38$).

The relationship of the GFP with creativity

Rodriquez et al. (2020) empirically found a relationship between GFP and creativity. These authors used so-called ideation evaluation to reflect creativity. Ideation evaluation has been assumed to be a critical element of creative problem-solving (Guilford, 1967). To directly test the notion of Rodriquez et al., namely the relation between the GFP and creativity, we conducted two studies reported in Chapters 4 and 5. Chapter 4 reports on a study on the relationship between the GFP and creativity in two Chinese samples. Results showed that the findings of Rodriquez et al. (2020) who used a North American sample (*n* = 178) could be generalized to a non-WEIRD sample by showing the correlations between the GFP and creativity in two studies with Chinese samples. In Study 1 of Chapter 4, the GFP-creativity correlation was found based on self-reported data. To overcome the limitation of self-reports, Study 2 included peer-reported measurements of personality and creativity, as well as objective tests of one's creativity. The relationship between the GFP and creativity was found across the self-reported and the peer-reported measures. Furthermore, the relationship remained intact using cross-comparisons by establishing the relationship between self-reported and peer-reported measures of personality and creativity.

In addition, the GFP-creativity relationship was found regardless of using the Remote Association Test (RAT) or the Alternative Uses Test (AUT). Compared to the creativity questionnaire, both RAT and AUT are more objective measures of creativity. Yet the creativity measured by either RAT or AUT showed a lower correlation with the GFP, compared to creativity measured by the self-report questionnaire. One possible explanation for this finding is that the questionnaire and test measure different components of creativity. In particular, the creativity questionnaire seems to mainly assess creative traits whereas both RAT and AUT are assumed to measure creative abilities. Our proposed division of traits versus abilities is similar to the distinction that has been made with regard to other psychological constructs such as emotional intelligence (EI), which has also been divided into trait EI versus ability EI REFERENCE. Although creativity measured by questionnaires and tests showed different correlations with the GFP, all correlations are at least of moderate size, namely from .31 to .86. These correlations support the existence of a relationship between the GFP and creativity.

In addition to the GFP, Chapter 4 tested the existence of a relationship between the Big Two personality factors (Plasticity and Stability) and creativity. Karwowski and Lebuda (2016) already reported that Plasticity was highly correlated with creativity. Our study compared the Big Two factors to the GFP in terms of their correlations with

creativity, using the powerful and more and more commonly used structural equation modeling (SEM) technique. As found in SEM, the GFP model fit data much better than the Big Two model. That indicates the GFP to be a better creativity predictor than the Big Two factors. Next to the Big Two factors, we compared the GFP to each of the Big Five traits in terms of their correlations with creativity. As found, the GFP had a higher correlation with creativity than any Big Five trait. Based on those findings, the GFP can be thought of as the best predictor of creativity in the Big Five context.

In Chapter 5, we further expanded on the relations between the GFP and creativity by adopting a meta-meta-analytic approach. This time, we used the outcomes of three previous meta-analyses on the Big Five and creativity. We included tests of the correlation between the GFP and a) different measures of creativity b) different measures of creative self-beliefs (CSBs), and c) whether the GFP can differentiate three contrast groups that were assumed to differ in creativity. We used the meta-analytic values to test the GFP and the Big Two in their correlations with creativity and CSBs, respectively. Similar to Chapter 4 we found that the GFP was a more stable higher-order personality factor than the Big Two, also displaying higher correlations with both creativity and CSBs than any of the Big Five traits including openness to experiences. In Study 3 of Chapter 5, we found that the GFP remained consistent in the tested correlational models. In comparing the GFP with the Big Two, only the GFP stably and positively correlated with all three divisions of contrast. Other personality constructs such as plasticity or stability showed less consistent results. Hence, we found that only the GFP could reliably distinguish the contrast groups.

Summarizing the pattern of findings from Chapters 4 and 5, it can be concluded that the GFP is a stable and useful predictor of creativity in the personality hierarchy. Due to its versatile information combining all the Big Five and its social effectiveness implication, the GFP can be thought of as an overall and socially useful specific predictor of creativity.

The ego-resiliency explanation for the GFP

Beyond its direct empirical contributions, this thesis also addressed various more theoretical topics regarding the GFP. One relates to the nature of the GFP. In testing the GFP-creativity relationship, we revitalized the ego-resiliency explanation of the GFP as suggested by Block (2010). Block used the concept of ego-resilience to label the first factor in his influential Minnesota Multiphasic Personality Inventory (MMPI). Ego-resilience refers to the ability to adaptively modify the level of self-control to match the circumstances (Dunkel et al, 2021). A reason for our interest in Block's ego-resilience account of the GFP is the notion that such a perspective has the potential to bind personality and social psychology, particularly in relation to creativity (Feist, 1998).

Another reason is that the ego-resiliency explanation fits with the hierarchical nature of the GFP. For example, the intermediate higher-order factors of plasticity and stability seem to correspond to two parts of ego-resiliency, which are personal dispositions, and social situations, respectively. In line with that reasoning, the GFP, as a balance between stability and plasticity, can be considered being embodied the notion of ego-resiliency, drawing the dynamic procedure of how individuals adjusted personal dispositions to adapt to social situations.

Part 2: Theoretical considerations

One of the main aims of the present thesis was to address the theoretical implications of the GFP. It is important to note that the GFP closely links to the discussion about humans' social characters from the perspective of evolutionary psychology. Due to so, the GFP theory can be thought of as providing a way to understand personality by combining knowledge and theories of personality psychology and evolutionary psychology. The contexts in this part below will discuss the theoretical implications of the GFP theory.

Understanding personality from the perspective of evolutionary psychology

Personality is a complicated topic that can be understood and studied from many perspectives. In line with trait theory, personality can be understood by dividing it into several distinct traits, such as those distinguished in the Big Five.

During its initial stages of research, however, the Big Five model was criticized by Block (1995), who stated that the Big Five model is atheoretical (i.e., "it is not based on the evolutionary theory"; Dunkel et al., 2021). In contrast, the GFP model is grounded in evolutionary theory (Figueredo et al., 2004; Rushton and Irwing., 2008), implying that the GFP can be seen as reflecting a social-related disposition, or a reflection of humans being 'social animals' (Whyte & Marshall, 1970). The rise of the GFP theory in the field of personality linked modern personality theory, such as the Big Five (McCrae & Costa, 1999) to evolutionary psychology without needing the notion that personality is grounded in language as an explanatory mechanism (Rushton et al., 2008). In other words, regardless of how many dimensions modern personality theory assumes, a general factor is consistently and universally found. GFP theory explains how natural selection may have driven humans towards increasing levels of socially desirable behavior. As Darwin (1871) stated, humans are more cooperative and less contentious than other primates such as apes. It can be reasoned that without support from others or groups, a single human being would have more difficulty surviving. Therefore, being socially adept can be thought of as an advantage for an individual. It can be speculated that humans gradually formed a need for

the approval of other members and society, which played a more important role in humans' life in comparison to other primates. The presumed evolved social effectiveness, shaped by evolutionary social pressures, is believed to be reflected by the GFP. One solid proof for that presuming can be seen from van der Linden et al. (2018). As the authors found, in indigenous people in Bolivia, Tsimane males with a higher GFP score indeed showed higher social effectiveness as they have more or more live offspring. This finding fits with the notion that social effectiveness, as indicated by the GFP, posed a 'fitness' advantage.

Understanding personality as a whole

While diverse taxonomies of personality provided many ways to describe personalities, such as the Big Five, Eysenck's PEN model, or the more recent HEXACO, the GFP provides a way to better understand the hierarchical structure of personality. At this point, the GFP plays a somewhat similar role as the general factor of intelligence in the cognitive domain. It may be conceivable why the GFP would exist in the structure of personality. Regardless of how many meta-factors (the Big Two), traits, and facets are supposed, a general factor would always occupy the highest position in the hierarchy of personality. We can assume those meta-factors, traits, or facets as branches of personality and assume the GFP as the root of personality (the most fundamental constituent of the personality hierarchy; Wu et al., 2021). Accordingly, if one renders traits/factors independent of other factors by statistically taking out the commonly shared variances (say the GFP), one will also take out the common core of those traits/facets. As a result of taking out the GFP, the Big Five traits almost lost all significant correlations with leadership emergence (Wu et al., 2022) and leadership (Pelt et al., 2017). Based on those empirical findings, the GFP can be thought of as at least partially substantive (Davies et al., 2015), indicating social effectiveness (van der Linden et al., 2021; van der Linden et al., 2021). By assembling many social characters across traits/facets to a single GFP, we are able to understand the *social* nature of personality as a whole.

Part 3: Practical implications

The effective predictors of leadership and job performance

The studies listed in this thesis support the social effectiveness account of the GFP, interpreting the GFP as general social effectiveness (Dunkel & van der Linden, 2014; van der Linden et al., 2016). Empirical supports for this view on the GFP are the correlations of the GFP with leadership (Pelt et al., 2017) and job performance (van der Linden et al., 2010). To leaders and employees, more effective leadership and better job performance imply more chances to reach their own social goals such as the next step in one's career. In the other words, leadership and job performance indicate to which extent leaders and

employees are socially effective in doing their job. Therefore, the GFP by showing its effects on leadership and job performance indicates social effectiveness.

The GFP is a versatile personality trait

One of the most important advantages of the GFP is that the GFP was found to correlate with an extensively wide range of variables, such as popularity and likeability (van der Linden et al., 2010a), well-being (Musek, 2007), creativity (Rodriguez et al., 2020), leadership (Do & Minbashian, 2020; Wu et al., 2022; Wu et al., 2021), job performance (Pelt et al., 2017; van der Linden et al., 2010), number of offspring/live offspring (van der Linden et al., 2018), physical attractiveness (Dunkel et al., 2017); emotional intelligence (van der Linden et al., 2017; van der Linden et al., 2017) and intelligence (Dunkel, 2013b; Dunkel et al., 2014), social effectiveness (Dunkel & van der Linden, 2014; van der Linden et al., 2016), competence (Bäckström et al., 2020), and early life experience (Chua et al., 2021). Taking these findings together, the GFP can be interpreted as a versatile personality trait, which can be used to predict many social behaviors.

Practical implications for personnel selection

Based on the notion that the GFP is indicative of general social effectiveness (Dunkel & van der Linden, 2014; van der Linden et al., 2021; van der Linden, Dunkel, et al., 2016). intrapersonal/social behaviors or sociability can be expected to be relevantly correlated with the GFP. Given these findings, the GFP can be used as an estimation for individuals' overall sociability in personnel selection or/and assessment. A candidate with higher scores on the GFP can be expected to have better sociability and hence can be expected to perform more adequately in social contexts. The more sociability a job requires, the higher GFP scores the worker should have. Recruiters can pay attention to the GFP when they are trying to assess a candidate's sociability. For jobs that do not need a high level of sociability, assessment of one's GFP is also relevant, because many works need employees to have at least moderate sociability, such as salesmen communicating with customers, nurses taking care of patients, teachers guiding students, et al. All in all, recruiters can consider using the GFP as an estimate of employees' sociability.

Limitations and direction for future research

Although there now is a large number of studies (over one hundred) confirming the GFP as a substantive trait, several scholars remain highly skeptical of the substantive trait interpretation of the GFP (Ashton et al., 2009). Therefore, more convincing proof of the existence of the GFP is still needed.

A second limitation is that to extract the GFP, most studies must base on other personality measures, e.g., the Big Five and the HEXACO, using the EFA/CFA technics. Although one study created a GFP-specific questionnaire, the so-called GFPQ (Amigó et al., 2010), and tested this questionnaire among Spanish samples, research is needed to confirm the psychometric properties of the GFPQ in other cultures or to develop a GFP-specific scale for use in different cultures.

A third limitation is that the structure of the GFP so far can only be tested by factoring analytical technics. For some researchers, the results of factoring analysis are not sufficient. Therefore, future studies can consider using other analytical technics to test the GFP.

Conclusion

The present dissertation confirmed the positive relationships between the GFP and both leadership and creativity. A person who scores higher on the GFP can be expected to have a correspondingly higher perceived level of leadership and creativity. Based on the social effectiveness interpretation of the GFP, such persons are regarded as more socially effective in implementing their leadership and creativity.

Chapter 6

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Nederlandse Samenvatting
(Summary in Dutch)

Dit proefschrift behandelde twee algemene onderzoeksvragen met betrekking tot de algemene persoonlijkheidsfactor, die in het Engels wordt aangeduid als de *General Factor of Personality*, oftewel de GFP. De vragen zijn: 1) Wat is de aard van de GFP (inhoudelijk of artefact), en 2) wat impliceert de GFP? Uit de wetenschappelijke literatuur blijkt dat de GFP vaak wordt geoperationaliseerd als de gedeelde variantie tussen persoonlijkheidstrekken /dimensies (Musek,2007) en wordt verondersteld algemene sociale effectiviteit (Van der Linden et al., 2016; Van der Linden et al., 2021) of emotionele intelligentie (Van der Linden et al., 2017) te weerspiegelen. De GFP is nuttig gebleken om de persoonlijkheid van mensen te begrijpen vanuit het perspectief van de evolutionaire psychologie (Figueredo et al., 2004; Rushton et al., 2009). Om bij te dragen aan de kennis over de GFP zijn in dit proefschrift de volgende deelvragen aan de orde gekomen: 1) of de GFP en zijn correlaties met andere constructen gerepliceerd kan worden in niet-WEIRD (*Western, Educated, Industrialized, Rich, and Democratic*) steekproeven; 2) of de GFP kan voorspellen wie er zal worden gekozen als leider; en 3) of de GFP correleert met creativiteit.

Samenvatting van de belangrijkste bevindingen

De universaliteit van de GLM

In de wetenschappelijke literatuur bevestigt een toenemend aantal empirische studies het bestaan van de GFP (Figueredo et al., 2004; Musek, 2017; Van der Linden, Te Nijenhuis, et al., 2010). Toch is het ook duidelijk dat de meerderheid van de steekproeven in deze studies, zogenaamde, WEIRD-steekproeven omvatte, wat verwijst naar Westerse, Opgeleide, Geïndustrialiseerde, Rijke en Democratische steekproeven (Henrich et al., 2010). Het gebrek aan niet-WEIRD steekproeven is zonder twijfel een beperking voor het generaliseren van de GFP. Daarom vonden wij het, net als bij onderzoek naar andere persoonlijkheidsconstructen zoals de Big Five (Schmitt et al., 2007), relevant om te testen of de GFP-bevindingen in WEIRD-steekproeven standhouden in niet-WEIRD-steekproeven. Het belang om dit te doen werd besproken door Thalmayer et al. (2020 p.1;) *"Hoe kunnen psychologen erop vertrouwen dat deze modellen en resultaten generaliseren naar alle mensen als het bewijsmateriaal afkomstig is van een klein en niet-representatief deel van de wereldbevolking?"*.

Daarom hebben wij persoonlijkheidsgegevens verzameld die in de afgelopen 20 jaar in Chinese wetenschappelijke publicaties zijn gerapporteerd. Aan de hand van die gegevens werd in **hoofdstuk 2** de GFP getest in de Chinese steekproeven. We vonden dat een algemene factor kon worden geëxtraheerd uit de Chinese Big Five gegevens ($N = 30863$, $K = 53$). Hoewel wij, strikt genomen, het construct van de GFP alleen in

steekproeven van het vasteland van China hebben gevonden, kunnen onze bevindingen worden beschouwd als een relevante grootschalige replicatie van de GFP in een specifieke niet-westerse context. Voor zover wij weten, is dit de eerste meta-analyse waarin het GFP-construct uitsluitend is getest in niet-WEIRD-steekproeven.

De stabiliteit van de GFP

In studie 1, gerapporteerd in **hoofdstuk 2**, hebben we getest of de structuur van de GFP beïnvloed wordt door factoren, zoals de manier waarop met data wordt omgegaan (originele vs. gewogen vs. gecorrigeerde data), het type persoonlijkheidsmeting, en het type steekproeven. Gevoeligheidstests toonden aan dat de GFP in de Chinese Big Five niet werd beïnvloed door specifieke datapunten of door welke statistiek we gebruikten. Met andere woorden, tussen de gecorrigeerde, gewogen en originele gegevens bleef de GFP consistent. Een vergelijking tussen de gepubliceerde artikelen en de ongepubliceerde artikelen in de meta-analyses toonde geen verschil in de Big Five intercorrelaties. De GFP lijkt dus vrij stabiel. Vervolgens testten we mogelijke moderatoren, zoals de types van metingen van de Big Five, de geografische spreiding van de steekproef, en het type steekproef (studenten vs. leiders vs. werknemers) dat getest werd. Opnieuw was er een stabiele GFP voor alle moderatoren. Wij gebruikten verschillende benaderingen om de GFP uit de Big Five te extraheren, namelijk a) een directe extractie uit de Big Five en b) een indirecte extractie uit de tussenliggende Big Two factoren die zelf eerst uit de Big Five werden geëxtraheerd. Dit laatste model werd het hiërarchische GFP (Hi-GFP) model genoemd. Wij vergeleken het Hi-GFP model met een bi-factor model waarin de GFP en de Big two factoren ongerelateerd aan elkaar waren. Door die vergelijking vonden wij dat de GFP inderdaad de meest fundamentele factor in de persoonlijkheidshiërarchie lijkt te zijn.

De correlationele relatie tussen de GFP en leiderschap

Om te testen of de GFP indicatief is voor algemene sociale effectiviteit, hebben we een aanvullende studie uitgevoerd die in **hoofdstuk 2** wordt beschreven. In die studie testten we de correlatie tussen de GFP en leiderschap - een effectieve indicator van sociale effectiviteit (Do & Minbashian, 2020). Specifiek werd verwacht dat hogere GFP-scores positief geassocieerd zouden zijn met meer effectief leiderschapsgedrag, maar negatief geassocieerd zouden zijn met negatief leiderschapsgedrag (e.g., machtsmisbruik). De GFP bleek inderdaad significant en positief gecorreleerd te zijn met leiderschapseffectiviteit en negatief gecorreleerd met misbruik van leiderschap. Leiderschapseffectiviteit en misbruik werden beoordeeld door ondergeschikten, wat de beperkingen van zelfrapportage omzeilt. In lijn met de doelstellingen die we vermeldden met betrekking tot studie 1, richtten we

ons in deze studie op de niet-WEIRD steekproeven. In studie 2 analyseerden we gegevens van twee eerdere Chinese wetenschappelijke publicaties opnieuw en ontdekten we dat de zelfgerapporteerde GFP van leiders positief correleerde met hun leiderschapseffectiviteit zoals beoordeeld door hun ondergeschikten, en negatief correleerde met het misbruik van supervisie door de leiders, zoals beoordeeld door hun ondergeschikten. Ook deze studie is een van de eerste die de relatie tussen GFP en leiderschap onderzoekt in niet-WEIRD steekproeven.

De GFP als voorspeller voor leiderschap

Vergeleken met de waarde van de GFP-leiderschap correlatie tussen die we vonden in Studie 2 ($r = .17$), werden hogere waarden gerapporteerd in eerdere meta-analyses, namelijk $\rho = .30$ van Do & Minbashian (2020), $r = .40$ van Pelt et al. (2017). Toch is een centrale bevinding uit deze eerdere meta-analyses, evenals in onze tweede studie, dat de correlatie tussen de GFP en leiderschap vaak hoger is dan tussen leiderschap en welke Big Five eigenschap dan ook. Bijvoorbeeld, Consciëntieusheid bleek te correleren ($r = .14$) met leiderschapseffectiviteit. Dit was de hoogste Big Five correlatie met leiderschap in Studie 2. Toch was die correlatie, in absolute zin, lager dan de correlatie tussen de GFP en leiderschap, hoewel het verschil niet significant was ($\Delta r = .03$; $n = 210$; $p > .05$). Do en Minbashian (2020) rapporteerden soortgelijke resultaten dat de GFP hoger maar niet significant hoger was dan Consciëntieusheid ($\rho = 0.28$) ($\Delta r = .02$; $N = 3032$; $p > .05$). Om de GFP en de Big Five te vergelijken bij hetvoorspellen van leiderschapseffectiviteit, voerden Do en Minbashian regressieanalyses uit. De GFP droeg bij aan de meeste effecten in het voorspellen van leiderschapseffectiviteit ($R^2 = .06$). Vergeleken met de GFP, leverde het toevoegen van de overige Big Five eigenschappen aan de regressie slechts een iets hogere verklaarde variantie ($R^2 = .07$) op. Dit suggereert dat de GFP één van de belangrijkste constructen is die grotendeels verantwoordelijk is voor correlatie tussen persoonlijkheid en leiderschap.

In leiderschapsstudies worden gewoonlijk twee uitkomsten gebruikt, namelijk leiderschapsontplooiing en leiderschapseffectiviteit. De eerste verwijst naar het proces om leider te worden, terwijl de tweede verwijst naar de manier waarop de leider presteert in relatie tot ondergeschikten. Door meta-analytische gegevens opnieuw te analyseren, rapporteerden Pelt et al. (2017) dat de correlatie van de GFP $\rho = .40$ is met leiderschapseffectiviteit en $\rho = .49$ met leiderschapsontplooiing. Toch konden deze correlaties, gezien het cross-sectionele karakter van de gegevens, niet direct de voorspellende waarde van de GFP op leiderschap toetsen. Om deze beperking te ondervangen, was in de studie in **Hoofdstuk 3**, gebruik gemaakt van een onderzoeksopzet

waarin voorspellende validiteit kon worden getoetst . In die studie werden 136 studenten willekeurig ingedeeld in 17 groepen. Elke groep bestond uit vier deelnemers. Alle deelnemers werd gevraagd campagne te voeren voor de positie van groepsleider (groepscampagne). De groepsleiders die uit de groepscampagne naar voren kwamen, waren de kandidaten voor de rol van algemene leider. Deze kandidaten werd gevraagd om in een toespraak voor alle groepen uit te leggen waarom hij/zij tot algemeen leider zou moeten worden verkozen (algemene campagne). Alle groepen konden stemmen op de kandidaat van hun voorkeur, met uitzondering van hun eigen groepsleider. Uiteindelijk won de kandidaat die de meeste stemmen kreeg de positie van algemeen leider. Tijdens de algemene campagne gaven tevens vier experimentatoren aan elke kandidaat een beoordeling van zijn prestaties.

Door gebruik te maken van een dergelijk opzet testten we de voorspellende waarde van de GFP op het verkrijgen van een leiderschapsrol. We testten de verschillen in scores op de GFP tussen individuen die in de fase van de groepscampagne als leiders (winnaars) uit de subgroep naar voren kwamen en de overige groepsleden (verliezers). De resultaten toonden aan dat degenen die als leiders naar voren kwamen, gemiddeld hoger scoorden op de GFP, wat impliceert dat de GFP een relevante rol speelde in wie als leider van een kleine groep zal worden geselecteerd. Ten tweede, gerelateerd aan de effectiviteit van leiders, bleek de GFP sterk gecorreleerd te zijn met twee indicatoren van het succes van de kandidaten tijdens de algemene leiderschapscampagne, namelijk het aantal ontvangen stemmen en de beoordeling van leiderschapskwaliteiten door vier experimentatoren. De GFP was positief gerelateerd aan beide indicatoren voor leiderschapseffectiviteit en aan een samengestelde variabele die het algemene campagnesucces weerspiegelde. Hoe hoger iemands GFP-score, hoe groter de kans dat die persoon de campagne zou winnen en de leiderspositie zou krijgen. Het onderzoek dat wij uitvoerden was gebaseerd op de procedures voor de selectie van studentenvertegenwoordigers/-leiders aan Chinese universiteiten. De resultaten hebben dus een duidelijke ecologische validiteit.

De relatie van de GFP met creativiteit

Rodriquez et al. (2020) suggereerden een correlatie tussen de GFP en creativiteit. In die studie gebruikten de auteurs idee-evaluatie om creativiteit weer te geven. Idee-evaluatie is gerelateerd aan creativiteit maar is niet hetzelfde als creativiteit. Om de correlatie tussen de GFP en creativiteit rechtstreeks te testen, hebben wij daarom twee studies uitgevoerd die in **hoofdstuk 4 en 5** worden beschreven.

In **hoofdstuk 4** onderzochten wij de relatie tussen de GFP en creativiteit in twee Chinese steekproeven. We waren in staat om de bevindingen van Rodriquez et al. (2020),

die een Noord-Amerikaanse steekproef (*n* = 178) gebruikten, te repliceren door de correlaties tussen de GFP en creativiteit in twee studies met Chinese steekproeven te laten zien. In studie 1 van **hoofdstuk 4** is een sterke GFP-creativiteit correlatie gevonden op basis van alleen zelfrapportages. Om de beperking van zelfrapportages te ondervangen, werden in studie 2 beoordelingen van persoonlijkheid en creativiteit door leeftijdsgenoten en objectieve creativiteitstesten gebruikt. De relatie tussen de GFP en creativiteit werd gevonden in de zelfrapportage maar ook in de beoordeling door anderen. Bovendien bleef de relatie intact wanneer kruisvergelijkingen werden gemaakt, dat wil zeggen wanneer de relatie tussen zelfgerapporteerde en ander-gerapporteerde metingen van persoonlijkheid en creativiteit werd vastgesteld.

Bovendien werd de GFP-creativiteitsrelatie gevonden ongeacht of de *Remote Association Test* (RAT) of de *Alternative Uses Test* (AUT) als maat voor creativiteit werd gebruikt. Maar de creativiteit gemeten door de RAT of de AUT vertoonde een veel lagere correlatie met de GFP, vergeleken met de creativiteit gemeten door vragenlijsten. Een mogelijke verklaring voor die bevinding kan zijn dat de vragenlijst en de test verschillende componenten van creativiteit meten. In het bijzonder leek de creativiteitsvragenlijst vooral creatieve eigenschappen te meten, terwijl de RAT verondersteld wordt creatieve vermogens te meten. Het voorgestelde onderscheid tussen eigenschappen en vaardigheden is vergelijkbaar met het onderscheid dat is gemaakt met betrekking tot een ander psychologisch construct zoals emotionele intelligentie (EI), dat ook over het algemeen is onderverdeeld in eigenschap EI versus vaardigheid EI. Hoewel de door vragenlijsten en tests gemeten creativiteit verschillende correlaties met de GFP vertoonden, zijn al die correlaties ten minste van een gemiddeld niveau, van .31 tot .86. Die correlaties convergeerden niettemin en steunde het idee dat er een relatie is tussen de GFP en creativiteit.

Naast de GFP werden in **hoofdstuk 4** de *Big Two* persoonlijkheidsfactoren (Plasticiteit en Stabiliteit) getest in hun correlaties met creativiteit. Zoals Karwowski en Lebuda (2016) rapporteerden, was Plasticiteit sterk gecorreleerd met creativiteit. In onze studie hebben we de Big Two factoren vergeleken met de GFP in hun correlaties met creativiteit met behulp van *structural equation modelling* (SEM). Door vergelijking vonden we dat het GFP-model veel beter bij de gegevens paste dan het Big Two-model. In sommige gevallen stuitte het Big Two model zelfs op een colineariteitsprobleem: twee factoren overlapten extreem veel (r > .90). Om die redenen kan de GFP beschouwd worden als een betere creativiteitsvoorspeller dan de *Big Two* factoren. Naast de *Big Two* factoren hebben we de GFP vergeleken met elk van de Big Five kenmerken wat betreft

hun correlaties met creativiteit. Geen enkele eigenschap is vergelijkbaar met de GFP wat betreft de correlatie met creativiteit. De GFP kan daarom beschouwd worden als de beste voorspeller van creativiteit in de context van de Big Five.

In hoofdstuk 5 hebben we de relaties tussen de GFP en creativiteit verder uitgediept door een meta-meta-analytische benadering te gebruiken. Dit keer gebruikten we de uitkomsten van drie eerdere meta-analyses over de Big Five en creativiteit. We onderzochten de correlatie tussen de GFP en a) verschillende maten van creativiteit, b) verschillende maten van creatieve zelfovertuigingen (CSBs), en c) of de GFP drie contrastgroepen kan onderscheiden waarvan werd aangenomen dat ze verschillen in creativiteit. We gebruikten de meta-analytische waarden om de GFP en de Big Two te testen in de correlatie met creativiteit en CSBs. Net als in **hoofdstuk 4** vonden we dat de GFP een stabielere hogere-orde persoonlijkheidsfactor was dan de Big Two, en ook hogere correlaties vertoonde met zowel creativiteit als CSBs dan welke van de Big Five eigenschappen dan ook, inclusief openheid voor ervaringen. In Studie 3 van Hoofdstuk 5 vonden we dat de GFP consistent bleef in de geteste correlatiemodellen. Bij het vergelijken van de GFP met de Big Two, correleerde alleen de GFP stabiel en positief met alle drie de indelingen van contrast. Andere persoonlijkheidsconstructen zoals plasticiteit of stabiliteit vertoonden minder consistente resultaten. Daarom vonden we dat alleen de GFP de contrastgroepen op een betrouwbare manier kon onderscheiden.

Als we het patroon van bevindingen uit **hoofdstuk 4 en 5** samenvatten, kunnen we concluderen dat de GFP een stabiele en bruikbare voorspeller is van creativiteit in de persoonlijkheidshiërarchie. Vanwege zijn veelzijdige informatie die alle Big Five combineert en zijn implicatie voor sociale effectiviteit, kan de GFP worden beschouwd als een algemene en sociaal nuttige specifieke voorspeller van creativiteit.

De ego-veerkracht verklaring voor de GFP

Naast de directe empirische bijdragen, werden in dit proefschrift ook verschillende theoretische onderwerpen met betrekking tot de GFP behandeld. Eén daarvan heeft betrekking op de aard van de GFP. Bij het testen van de GFP-creativiteitsrelatie hebben we de *ego-reslience* of ego-veerkracht verklaring van de GFP, zoals voorgesteld door Block (2010), nieuw leven ingeblazen. Block gebruikte het concept van ego-veerkracht om de eerste niet-geroteerde (algemene) factor in zijn invloedrijke Minnesota Multiphasic Personality Inventory (MMPI) te verklaren. Een reden voor onze interesse in Block's ego-veerkracht verklaring van de GFP is de notie dat een dergelijk perspectief het potentieel heeft om persoonlijkheid en sociale psychologie te verbinden (Feist, 1998), in het bijzonder in relatie tot creativiteit. Een andere reden is dat de ego-veerkracht verklaring

past bij de hiërarchische aard van de GFP. Zo lijken de tussenliggende hogere-orde factoren: plasticiteit en stabiliteit te corresponderen met twee onderdelen van ego-veerkracht, respectievelijk persoonlijke disposities en sociale situaties. In lijn met die redenering belichaamt de GFP, als een evenwicht tussen stabiliteit en plasticiteit, het begrip ego-veerkracht, en tekent het de dynamische procedure van hoe individuen persoonlijke disposities aanpasten om zich aan te passen aan sociale situaties. Omdat ego-veerkracht een kernkenmerk deelt met creativiteit, namelijk veelzijdigheid, is de GP-creativiteit correlatie in overeenstemming met de ego-veerkracht verklaring van de GFP.

Conclusie

Het huidige proefschrift ondersteunde positieve de relaties tussen de GFP en zowel leiderschap als creativiteit. Kortom, kan worden verwacht dat degenen die hoger scoren op de GFP gemiddeld genomen een hoger niveau van leiderschap en creativiteit hebben. De reden hiervoor kan verklaard worden als dat de hogere GFP-individuen sociaal effectiever zijn in het uitvoeren van hun leiderschap en creativiteit, gebaseerd op de sociale effectiviteitsverklaring van de GFP (Dunkel et al., 2016; Dunkel & Van der Linden, 2014; Van der Linden et al., 2021).

Portfolio

Curriculum Vitae

Peiqian Wu was born in Yunnan, China, on the 25th of July in 1988. He studied Journalism for his bachelor's degree at China Communication University from 2004 to 2007. During his bachelor's study period, he once was an intern at the Chinese National TV station for months. After graduation, he worked as a journalist as well as producer-director in several media companies in China. From 2014 to 2017, he switched to studying psychology for his master's degree at Shanxi Normal University, China. During the master's study period, he won many prizes including an excellent master's thesis. After his master's study, he went to the Erasmus University Rotterdam (EUR) to study personality and social- and applied-psychology for his Ph.D. degree. During the Ph.D. period, he has actively learned knowledge and skills and done research, guided by his supervisors. Also, he took many courses and training in EUR and participated in many national and international academic conferences to represent his works. Excluding doing research for his Ph.D. with focuses on personality- and evolutionary- psychology, he also cooperated with researchers from developmental and educational psychology. After five years of Ph.D. training, he published several articles and built connections with many researchers all over the world.

Publications

Published

1.   **Wu, P.,** Van der Linden, D., Dunkel, C. S., van Vugt, M., & Han, Q. (2022). Emerging Leadership and the General Factor of   Personality (GFP): A Quasi-Experimental Test of an Evolutionary Prediction. *Evolutionary Behavioral Sciences*, *16*(1), 81–93. https://doi.org/10.1037/ebs0000234 *(in this thesis)*

2.   **Wu, P.,** Van der Linden, D., Dunkel, C.S., Ding, R., Li, J., Li, X., Harmon, A., & Born, M.P. (2021). A meta-analysis on the general factor of personality and its relationship with leadership outcomes: Evidence from mainland China. *Personality and Individual Differences, 179*, 110953. https://doi.org/10.1016/j.paid.2021.110953 *(in this thesis)*

3.   Van der Linden, D., Dunkel, C. S., & **Wu, P.** (2022). The Applied Relevance of the General Factor of Personality: Advancements in the Occupational and Clinical Context. *The Japanese Journal of Personality*, 30(3), 199–211, https://doi.org/10.2132/personality.30.3.13 (invited submission)

4.   Van der Linden, D., Dunkel, C. S., & **Wu, P.** (2021). Is there a Meaningful General Factor of Personality? *The Spanish Journal of Psychology*, 24, e9. https://doi.org/10.1017/SJP.2021.2 (invited submission)

5.   Van der Linden, D., Dunkel, C. S., De Zeeuw, E. J., **Wu, P.**, & Pelt, D. H. M. (2021). The general factor of personality (GFP) and vocational interests: A test of social effectiveness at the behavioral and genetic level. *Journal of Business and Psychology.* Advance online publication. https://doi.org/10.1007/s10869-021-09779-8

6.   Liu S, Cheng C, **Wu P.**, et al. (2021). Phonological Processing, Visuospatial Skills, and Pattern Understanding in Chinese Developmental Dyscalculia. *Journal of Learning Disabilities*. https://doi.org/10.1177/00222194211063650

7.   Ding, R., Han, Q., Li, R., Li, T., Cui, Y., & **Wu, P.** (2019). Unconscious versus conscious thought in creative science problem finding: Unconscious thought showed no advantage! *Consciousness and Cognition*, 71(February), 109–113. https://doi.org/10.1016/j.concog.2019.03.010

Under review

8.   **Wu, P.** et al., The Relationship between Creativity and the General Factor of Personality: A Meta-Meta-Analytic Test. *(in this thesis)*

9. **Wu, P.** et al., Creative Personality or General Personality? Searching for the Best Predictor of Creativity in the Big Five Personality Context. ***(in this thesis)***

10. Liu, S., **Wu, P.**, et al., Put Down Your Phone and Talk with Me – How Parental Phubbing Influences the Problematic Internet Use of Adolescents.

Presentations in academic conferences

1. 2016 Chinese Academic Conference of Creativity, Wuhan, China

2. 2016 Chinese Academic Conference of Psychology, Xi'an, China

3. 2019 Graduate Research Day of DPEC, Rotterdam, the Netherlands

4. 2019 Holland Psychometric Association Conference for Chinese Scholars and Students, Utrecht. Netherlands

5. 2019 International Society for the Study of Individual Differences (ISSID), Florence, Italy.

6. 2019 Annual Conference for Working Community of Researchers in Work & Organizational Psychology (WAOP), Amsterdam, the Netherlands

7. 2020 Graduate Research Day of DPEC, Rotterdam, the Netherlands

8. 2021 Northeastern Evolutionary Psychology Society conference, USA (on line)

9. 2022 European Conference on Positive Psychology, Reykjavík, Iceland (incoming)

Courses/training

Courses

1. Maximize your visibility as a researcher! How to make author profiles and use identifiers

2. Research synthesis and meta-analysis: Session

3. Professionalism and integrity in research

4. Data analysis with R: Session

5. Open interviewing: Session

6. Qualitative Data Analysis: Session

7. English academic writing for Ph.D. candidates

8. Brush up your research design: tips and tricks to achieve your research aim

9. Your personal work-life balance: Session

10. Qualitative coding with ATLAS.ti

11. Multiple criteria analysis (MCA) for complex decision-making

Workshops

1. Open science

2. Experience sampling method

3. Longitudinal study design

4. Development matters: Longitudinal pathways in the brain and behavior

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I thank and cherish all people I met in the Erasmus School of Social and Behavioural Sciences (ESSB), Erasmus University Rotterdam (EUR). It is one of the wisest decisions I have made that I went to ESSB to pursue my Ph.D. degree. I indeed learn much here, not only in doing research but also in handling interpersonal relationships and personal emotions, solving unknown puzzles, etc. Going abroad to the Netherlands and studying at EUR greatly enriched my views of academia. I have seen so many possibilities and diversities from different kinds of people. I have learned and believed that everyone can have his/her unique and special work style although we may do a similar job (publication and teaching) in academia. I have seen that successful professors enjoyed inspiriting their students and young talents enthusiastically talking about their ideas. Their faces ran over with happiness. In contrast, I have also seen that stressful Ph.D. fellows sighed about the endless writing and revision and busy teachers were drained out by heavy teaching tasks. Desperation surrounded them. All those kinds of scenarios depicted the ups and downs in the academic life of researchers and teachers. Whether good or bad, it is just our daily life. I have consciously and unconsciously learned much from all people I met at the EUR.

For my Ph.D. program, I thank all my supervisors. They are prof. dr. Dimitri van der Linden, prof. dr. Marise Ph. Born, and prof. dr. Curtis S. Dunkel. Without their supervision and guidance, I cannot grow so fast. I remembered that when I was drained out by revising the manuscripts for many rounds, Dimitri showed me that he revised one of his papers dozens of times. Another scene I will remember forever is when I underwent rejections from journals many times and reviewers arbitrarily denied the conception of the GFP, I considered renaming the GFP to make it easier to accept by reviewers. I discussed the consideration with Dimitri, and he asked me, "Why don't you insist on what you believe in?" At that moment, I saw a giant with a powerful will inside his body. Thereafter, I had a more firm resolution on my studies. Yes, reviewers with their standpoints can reject me, but they wouldn't change my beliefs unless they can convince me with objective findings. In turn, I would elevate the quality of my studies to prove what I believe in. Let the empirical findings tell us the truth. To make the study more rigorous, Marise made many

Last but not least, I definitely would thank my family for their unconditional care and support. I must thank my girlfriend, Yuhui for her company. I put her name here because she occupies one of the most important places in my heart.

Please forgive me if I forget anyone's name in this acknowledgment section. There are too, too many people I want to thank. Without any of you, I would not have a such good life.

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About the design and for more fun!!!

Do you know___

why did we choose the planets to metaphorically represent the studied variables of the thesis?

why did we make the font and planet colorful? what is the relation between the GFP planet on the back cover and that on the front cover?

why are there many loop wires surrounding the GFP planet, excluding the OCEAN satellites and OCEAN wire?

why did we use Zodiac to represent the framework of the chapters, why choose those six signs from the twelve signs of the zodiac, and why choose the fifth sign of the zodiac, Lion (Latin: Leo) for the last chapter?

You can find **answers** and the **log** for our design via the link https://osf.io/39npd/.

May the GFP be with you!

The General Factor of Personality: Its Relation to Leadership and Creativity

Peiqian Wu