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Good to Bad or Bad to Bad? What is the relationship between valence and the trait content of the Big Two?

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Abstract

In this article we directly assessed the relationship between valence and relevant traits of the Big Two dimensions (i.e., communion and agency). Drawing on previous research, we expected that the relationship with valence would be less monotonous and more variable in direction across agency-related traits, compared to communion-related traits. In three repeated measures studies we assessed the perceived valence of each trait dimension on a continuum of seven points. Studies 1 and 2 defined each continuum verbally. In Study 3 each continuum was defined by facial features. Results across these studies show that valence is linearly and more consistently related with communion-related traits than with agency-related traits. Within agency, however, competence established a positive linear relationship with valence, whereas dominance showed a target-sensitive relationship with valence: quadratic in evaluation of trait concepts, and negative and linear in face evaluation. We discuss the implications of these data for Big Two-related research.

KEYWORDS

Big Two, communion and agency, competence and dominance, face perception, person perception, valence

1 | INTRODUCTION

Traits such as competence, warmth, honesty, dominance, and trustworthiness play a highly relevant role in how we perceive each other (for reviews see Abele & Wojciszke, 2014; Cuddy, Fiske, & Glick, 2008). This was shown to be the case for inferences about people's behavior (Hastie & Kumar, 1979; Wojciszke, 1994, 2005), trait concepts (Rosenberg, Nelson, & Vivekananthan, 1968; Rosenberg & Sedlak, 1972), groups (Fiske, Cuddy, & Glick, 2007), or people's facial appearance (Oosterhof & Todorov, 2008). These traits were identified as highly representative of the content of two primary and relatively independent dimensions consistently found to underlie social judgments: *communion* and *agency*, or the *Big Two* of social perception (Abele, Cuddy, Judd, & Yzerbyt, 2008; Abele & Wojciszke, 2007). Because all of these traits are inherently imbued with an evaluative meaning (i.e., positive or negative connotation; Kim & Rosenberg, 1980; Peabody, 1970), they are tightly intertwined with interpersonal attitudes (Wojciszke, Abele, & Baryla, 2009). As a result, these trait inferences influence how much we like a person (Anderson, 1968; Wortman & Wood, 2011) or how desirable her personality is (e.g., Hampson, Goldberg, & John, 1987; Rosenberg et al., 1968; Wortman & Wood, 2011). But how traits inform our interpersonal attitudes depends on the nature of their relationship with valence (i.e., positive or negative evaluation attached to an entity; Fiske & Taylor, 2017).

In this article, we review current knowledge on this relationship and offer empirical data that can demonstrate the nature of this relationship within the domains of person perception (Studies 1 and 2) and social face perception (Study 3).

1.1 | Traits and their relationship with valence

The Big Two dimensions underlying social perception have been repeatedly found across time, cultures, and different lines of research

(for reviews see Abele & Wojciszke, 2014; Cuddy et al., 2008). From a functional perspective, communion encapsulates traits related with the appraisal of intentions and social connection (e.g., trustworthiness, honesty, warmth, sociability), whereas agency captures traits related with perceived ability and motivation for goal achievement (e.g., competence, dominance, confidence).

Given the pervasiveness of valence in personality impressions, it should not be surprising that valence is correlated with both of the Big Two (e.g., Abele & Wojciszke, 2007; Kim & Rosenberg, 1980; Suitner & Maass, 2008). However, previous research has consistently shown that communion overlaps with valence to a greater extent than agency does. The high positive correlations of valence with communion (Kervyn, Fiske, & Yzerbyt, 2013; Rosenberg et al., 1968; Suitner & Maass, 2008) strongly suggest that communion-related traits and valence express the same underlying evaluative dimension (i.e., social evaluation in terms of perceived positivity). This would suggest that the task of evaluating someone's trustworthiness or warmth is practically indistinguishable from expressing how positive or negative is our global evaluation of the person. This is further substantiated by the fact that valence and trustworthiness are interchangeably used as interpretations of the same primary dimension of face impressions (Oosterhof & Todorov, 2008). Overall, these findings support the prediction that, although agency traits are not independent of valence, valence is strongly and positively related with communion traits.

Furthermore, research suggests that the Big Two are further branched into two facets each (Abele et al., 2016; Brambilla & Leach, 2014; Carrier, Louvet, Chauvin, & Rohmer, 2014). Communion encapsulates a warmth (e.g., warmth, sociability, friendliness) and a morality facet (e.g., trustworthiness, honesty, benevolence). In turn, agency encapsulates a competence (e.g., competence, intelligence) and an assertiveness facet (e.g., dominance, confidence). Two dimensions analogous to the Big Two have also emerged in social face perception. But here, they seem to be less multifaceted, and best represented by trustworthiness (communion morality) and dominance (agency assertiveness) (Oosterhof & Todorov, 2008). This branching suggests that the Big Two may be concealing a more complex relationship with valence, given that their facets vary in their relationship with valence. For instance, previous research has shown that the valence of personality impressions is more strongly determined by morality rather than warmth (e.g., Brambilla & Leach, 2014; Goodwin, 2015): Whereas morality-related traits reveal whether someone's intentions are good or bad, warmth-related traits reveal someone's proficiency in recruiting social support for their intentions (Landy, Piazza, & Goodwin, 2016). Moreover, competence and dominance diverge in their relationship with valence, despite their common association with agency. Competence-related traits (e.g., competence, intelligence) are perceived as highly positive and likeable, whereas dominance is perceived as slightly negative (close to neutral) and highly unlikeable (Abele, Uchronski, Suitner, & Wojciszke, 2008; Anderson, 1968). Similar findings emerged in social face perception showing that whereas competence is positively correlated with valence, dominance is (slightly) negatively correlated with trustworthiness and valence (Chen, Jing, & Lee, 2014; Oliveira, Garcia-Marques, Dotsch, & Garcia-Marques, 2019; Oosterhof & Todorov, 2008). This opposite relationship with valence is in agreement with what evolutionary theories of status attainment (Chapais, 2015; Henrich & Gil-White, 2001) would predict: Dominant individuals act in ways that inflict costs on others to benefit themselves, whereas competent individuals act in ways that are beneficial to them through helping others.

A clarification of the relationship between traits and valence is highly relevant for a more complete understanding of the person perception space. Any assumption regarding the independence between the Big Two (e.g., Cislak & Wojciszke, 2008) is challenged at the evaluative level, given the common variance that the Big Two share with valence (Suitner & Maass, 2008). Like communion-related traits, agency-related traits are polarized in valence (e.g., *intelligent* is more likeable than *unintelligent*; Anderson, 1968). However, unlike communion-related traits, the literature suggests that agency-related traits exhibit inconsistent relationships with valence. And within agency, two traits stand out as potential promoters of such inconsistency: competence and dominance.

Although the research reviewed so far documents the basic dimensions underlying personality impressions, it does not address the nature of the relationship that these dimensions establish with valence.

1.2 | Nature of the relationship between valence and the dimensions of personality impressions

Although a few studies have addressed the nature of the relationship between the Big Two (e.g., Imhoff & Koch, 2017), none, to the best of our knowledge, have explicitly focused on the nature of the relationship between the Big Two and valence. It is relevant to understand if the absent or weak linear relationships with valence found in previous research are indirectly expressing the presence of curvilinearity in the data. Lemann and Solomon (1952) provided early evidence about how we perceive the relationship between valence and traits. Their work acknowledged that the nature of that relationship may be either linear or quadratic. To take this into account in the assessment of trait perceptions they proposed two types of scales: *alpha-trait* and *beta-trait* scales. Alpha-trait scales are used when the trait is assumed to exhibit a linear relationship with valence, such that the increased (or decreased) presence of the trait in a target reflects an increase (or decrease) in perceived positivity (i.e., valence). In turn, beta-trait scales are used when the trait is assumed to establish a curvilinear relationship with valence. These are the traits exhibiting an inverted U-shaped relationship with valence. Specifically, the perceived positivity of a beta-trait increases from one extreme to the mid-point of its dimension continuum, where it reaches a positivity peak, and then starts decreasing toward the other extreme.

The strong positive relationship that communion-related traits establish with valence suggests they fit well with the definition of alpha-traits. However, the nature of agency-related traits such as competence or dominance is less clear. The divergence between

competence and dominance regarding their relationship with valence may be signaling that these two diverge in the type of trait (alpha or beta) they best fit with. Several reasons lead us to expect that dominance has a beta nature (i.e., curvilinear relationship). First, the linear relationship between dominance and valence, although negative, tends to be close to neutral (e.g., Oosterhof & Todorov, 2008). Second, the two extremes of dominance seem to be much more similar in valence than a linear relationship would lead us to expect. Submissiveness may be undesirable for being associated with vulnerability (e.g., invites exploitation; Richards, Rollerson, & Phillips, 1991), whereas high dominance conveys a threatening image (e.g., Chen et al., 2014). The same argument may apply to other agency-related traits such as assertiveness or confidence. Too little assertiveness results in passiveness, while too much of it may project aggressiveness (Ames, Lee, & Wazlawek, 2017). And low-to-moderate confidence (cf. self-enhancement) is more socially attractive than overconfidence (Dufner et al., 2013). These considerations agree with the Aristotelian idea that virtue results from a balance between excess and deficiency (e.g., Grant & Schwartz, 2011; Imhoff & Koch, 2017).

Previous work by Imhoff and Koch (2017) offered empirical support for the idea that agency-related traits are more desirable in moderate amounts. At least if we take into account that likeability, warmth, and trustworthiness (communion-related traits) can serve as proxies of valence given their strong positive correlation (e.g., Abele, Uchronski, et al., 2008; Anderson, 1968). In their work, Imhoff and Koch (2017) found that social targets are perceived as more likable and warm at average levels of status, power, and dominance; and as less likeable or warm at extreme levels of agency. That is, they found an inverted U-shaped relationship between communion and agency.

However, the generalizability of that finding across the trait content of agency is put into question by the fact that those studies did not include competence traits. As noted earlier, competence dissociates from dominance with regard to their relationship with valence. Competent individuals are perceived as substantially more positive than incompetent ones (Rosenberg et al., 1968). Therefore, we would expect, not an inverted U-shaped, but a linear relationship between competence and valence. Competence may be beneficial not only to the trait holder—who gains prestige and admiration by others—but also to others who benefit from collaborations with competent individuals (Henrich & Gil-White, 2001). It may be argued, nevertheless, that competence is a beta-trait. This is suggested by historical records revealing that intellectual giftedness used to be perceived as leading to morally deviant behavior (Hegarty, 2011), or by the existence of the "nerd" stereotype, which blends task-oriented competence with social inability.

1.3 | Present research

Our goal is to clarify Imhoff and Koch's (2017) data regarding the alpha and beta nature of communion- and agency-related traits, by directly relating them with perceived valence (instead of relating the Big Two with each other). We also aim to extend those data by clarifying whether competence and dominance are both beta-traits due to their common association with agency, or if competence is instead an alpha-trait, as suggested by previous research.

The three studies presented here focused on how the perceived variability in the expression of a trait along its continuum is related with perceived valence. Our approach relies on a new experimental task. Methods traditionally used in person perception research are purely correlational and do not assess valence independently of the traits themselves. The detection of the relationship requires a method that ensures the capture of the variability of the traits themselves, by directly assessing the perceived valence of the different levels spanning their respective continuum. If this variability is not captured, the result may truncate the "true" relationship or disguise a quadratic relationship as a weak linear one (see Imhoff & Koch, 2017, p. 124). Taking this into account, we developed a new paradigm that allowed us to directly assess the relationship. We used the degree of expression of a trait—semantically defined in Studies 1 and 2, and defined by faces in Study 3—along its dimension continuum points as our independent variable and valence as the dependent variable.

Our target sample included representative traits of the Big Two and their respective facets (i.e., agency assertiveness, agency competence, communion morality, and communion warmth; Abele et al., 2016). Taking into account the high overlap between communion and valence, we expected (a) to offer new data supporting a consistent linear relationship with valence across communion-related traits and (b) to conceptually replicate Imhoff and Koch's (2017) work by finding an inverted U-shaped relationship between agency-related traits and valence (instead of communion). However, unlike what Imhoff and Koch's (2017) findings would seem to suggest, we do not expect the curvilinearity to be consistent across different agency-related traits. Specifically, we expect competence-related and assertiveness-related traits to exhibit distinct relationships with valence.

Although it is still an empirical question whether the same relationships with valence are found when traits are inferred from faces, here we expected the same pattern to emerge regardless of whether the target stimuli were trait words or face stimuli. Of the two independent dimensions hypothesized to underlie social face perception—trustworthiness and dominance (Oosterhof & Todorov, 2008)—only trustworthiness overlaps highly with valence. But also in this domain, competence and dominance were found to dissociate, although by establishing opposite linear relationships with valence (Oliveira et al., 2019). Here, we expected to clarify all these relationships by integrating them in the same study using a new experimental paradigm that directly assesses the relationship of these traits with valence. In Study 3, we directly explore this relationship, expecting a linear relationship for competence and a curvilinear relationship for dominance.

2 | STUDY 1

2.1 | Participants and design

Forty native English speakers (95% male, 5% female; M_{age} = 33 years, SD_{age} = 10.29) were recruited online via Prolific Academic and

participated in the study in exchange for payment (£2.50). Forty-two participants had been initially recruited, but two participants were excluded before the analyses for showing signs of rushing through the task (i.e., invariant responses across blocks). The study was defined by a 12 (Trait dimension) × 7 (Target persons representing trait continuum levels) within-participants design with a valence-score, based on three different ratings (desirability for self, likeability, and valence), as the dependent measure.

2.1.1 | Power considerations

Without a basis for effect size estimation, sample size was calculated for a within repeated measures GLM, to estimate a linear and a quadratic contrast of medium size for the 7-point continuum (f = 0.25; G*Power; Faul, Erdfelder, Lang, & Buchner, 2007), for the total of traits analyzed (12 measurements), with an error probability of α = .05 and 99% power. The calculation suggested N = 28 as the optimal sample size, which was increased on the basis of available resources.

2.2 | Trait selection and trait continuum design

Our trait sample included trait scales previously used to calculate aggregated scores of communion and agency in Imhoff and Koch (2017), or found to best represent the dimensions and sub-dimensions/facets of person and group perception (see Abele et al., 2016; Brambilla, Rusconi, Sacchi, & Cherubini, 2011; Fiske, Cuddy, Glick, & Xu, 2002; Rosenberg et al., 1968). Following these criteria, the selected communion-related traits were: warm–cold (*warmth*), sociable–unsociable (*sociability*), trustworthy–untrustworthy (*trustworthiness*), honest–dishonest (*honesty*), sincere–insincere (*sincerity*), and benevolent–malevolent (*benevolence*). The selected agency-related traits were: dominant–submissive (*dominance*), confident–unconfident (*confidence*), competent–incompetent (*competence*), intelligent–unintelligent (*intelligence*), powerful–unpowerful (perceived *power*), and high status–low status (perceived *status*). Status and power may not be traits per se, but they are thought to overlap with competence and dominance (Fiske et al., 2007; Oosterhof & Todorov, 2008) and were previously used in agency-scores (e.g., Imhoff & Koch, 2017).

We created hypothetical target persons to represent the different levels of a trait continuum (see Figure 1). Each trait continuum was composed of seven points (i.e., levels), corresponding to seven target persons. Each point of the continuum corresponded to an explicit quantification of a trait by means of an adverb (e.g., "Somewhat"; "Extremely"; see Cliff, 1959) or a verbal quantification (e.g., Much more [trait] than average). For the mid-point we used the label "About average" (in the target dimension). The continuum was bipolar. The points below the mid-point used the low-pole trait of its dimension (e.g., submissive), and the points above the mid-point used the high-pole trait (e.g., dominant).

2.3 | Dependent measures

Valence is our main dependent measure. In seeking validity and reliability for our measure, we attended to the fact that in person perception research valence is often measured as perceived likeability (e.g., Anderson, 1968; Wortman & Wood, 2011), goodness/badness or desirability of a trait under particular circumstances (Rosenberg et al., 1968), or positivity associated with the target (i.e., pure valence; Abele, Uchronski, et al., 2008). Assuming that a more general evaluative dimension (i.e., valence) underlies these constructs, each of these three dimensions was assessed on a 7-point rating scale. The valence and likeability scales ranged from 1 (Very bad/unlikeable) to 4 (Neutral or Neither good/likeable nor bad/unlikeable) to 7 (Very good/likeable). The "desirability for self" scale ranged from 1 (Very undesirable in myself/I wouldn't want to be this person) to 4 (Neither desirable nor undesirable/Indifferent) to 7 (Very desirable in myself/I would definitely want to be this person). Each dependent measure had its own specific instruction. All task instructions are available in our online repository. Because the target trait continuum

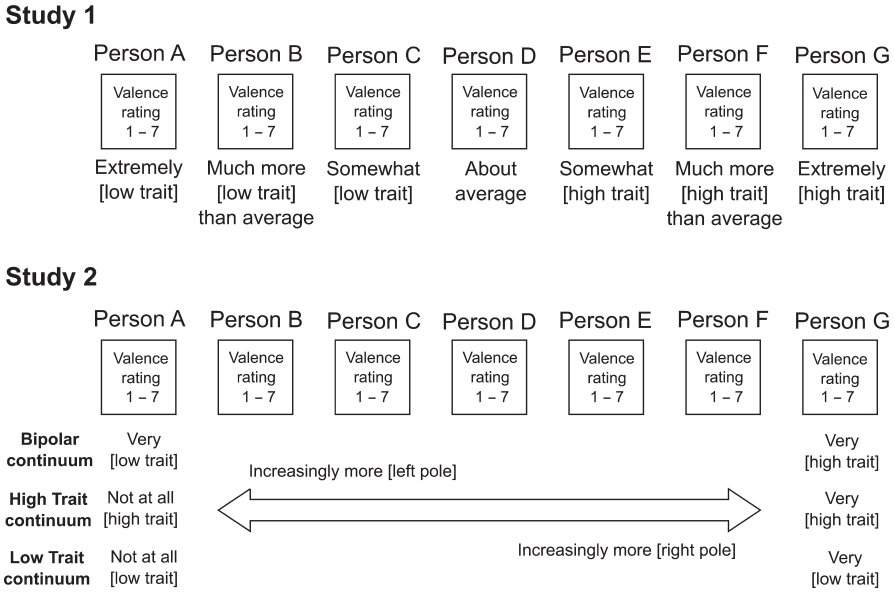

FIGURE 1 Structure of the trait continua used in Studies 1 and 2. Each continuum point was operationalized as a hypothetical target person to be judged in a valence measure (each target was rated on desirability for self, likeability, and valence). In Study 1, all continuum points were labeled. In Study 2, only the continuum endpoints were labeled, and task instructions emphasized that the degree of expression of the trait increased (in Bipolar and High Trait continuum types), or decreased (in Low Trait continuum type), at each step from the left endpoint to the right endpoint of the continuum

points were operationalized as "Person [A to G]", we adjusted the instruction of the "desirability for the self" block so that the participants had to indicate how much they would desire to be that "particular hypothetical person".

2.4 | Procedure

The task was programmed using Qualtrics software. Participants were invited to participate in an online study aimed at "understanding how people evaluate several personality characteristics of other people". The task was composed of three blocks, each for a dependent measure (i.e., valence, likeability, desirability for self), presented in randomized order. Trait continua were randomly presented one-by-one within each block. In each trial, participants were shown verbal descriptions (quantifications of the target trait) for each of the seven different persons varying in the degree to which they expressed a given trait. Each target person corresponded to one of the seven continuum points (see Figure 1). To ensure adequate comprehension of the task, a practice trial was first presented using the trait "extraversion" as an example (data not analyzed). In this example, participants were asked to indicate how much they would like: an "Extremely Introverted" person "A"; a "Much Less Introverted Than Average" person "B"; a "Somewhat Introverted" person "C"; a person "D" who is "About Average" in extraversion; a "Somewhat Extraverted" person "E"; a "Much More Extraverted Than Average" person "F"; and finally, an "Extremely Extraverted" Person "G". In the main task, trials were identical to the practice trials, except for the target trait.

To prevent participants from directly mapping, in a linear fashion, the seven points of the rating scale onto the seven continuum points, we emphasized that they should focus their evaluation on what they thought about each target in isolation. At the end of the task, we asked participants whether they were aware that they "could use the same number for two or more people differing in the amount of the same trait?" Together with an inspection of each participant's data, this check served as a criterion to exclude participants who failed to understand the instructions and simply mapped one dimension onto the other. After finishing the task, participants were thanked, debriefed, and compensated.

2.5 | Results and Discussion

2.5.1 | Valence-score

We submitted all three ratings to a principal component analysis (PCA) to ascertain that a single component optimally accounted for their variance. The data points corresponded to the raw response values of each rating for each of the points within a trait continuum. An oblimin rotation was applied to allow for non-zero correlations between the components, and a parallel analysis (Horn, 1965) revealed that one component was sufficient to account for 84% of the variability in the data. As expected, all three ratings loaded highly on that component (desirability for self, likeability, and valence yielded loadings of .91, .92, and .93, respectively), which we interpreted as "general valence". On the basis of these results, we computed a valence-score by averaging the responses of the three measures for every continuum point of every trait dimension.

2.5.2 | Inter-rater agreement

Inter-rater agreement for the valence-score was assessed with two indexes: intra-class correlation coefficients (ICCs; see Shrout & Fleiss, 1979) and average inter-rater correlations (AICs; see Brand & Bradley, 2012). Because ICCs are inflated by sample size, we additionally computed the AICs to complement the ICCs and obtain more nuanced and conservative results. Results are listed in Table 1. Both indexes indicate that the lowest agreement occurred for agency assertiveness-related traits. This low agreement is also apparent in the wider dispersion of the valence peak distributions obtained for these traits (see Table 1 and Figure 2).

2.5.3 | Linear and quadratic fits

To examine whether a linear or a quadratic trend better predicted the valence-score on a given trait dimension, we used a linear mixed-effects models approach (LMM; Pinheiro & Bates, 2000). These analyses were conducted in R (version 3.3.2) using the *lme4* and *lmerTest* packages (Bates, Mächler, Bolker, & Walker, 2015; Kuznetsova, Brockhoff, & Christensen, 2017). We ran separate LMMs for each trait with valence-score as the outcome variable. To correct for multiple testing we applied a false discovery rate (FDR) correction to all estimates' *p*-values (Benjamini & Hochberg, 1995). In all models, we entered the continuum points as fixed-effect predictors in a quadratic polynomial form, where the first term corresponded to the linear predictor (i.e., *continuum points*) and the squared term (*squared continuum points*) corresponded to the quadratic predictor (curvilinear trend predictor). The seven levels of the continuum points' factor were set to range from −3 to +3 (and squared values of this range for the quadratic predictor) in the analysis. Additionally, we entered participants as a random-intercept effect, to obtain estimates of the variability of the mean valence-score across participants. Results are listed in Table 1 and plotted in Figure 2. Additionally, we examined where the valence judgments peaked for each trait. For each trait, we performed a local polynomial regression fit on the valence-scores (by participant) and used the fitted model to estimate the location of the valence peaks in the continuum. The density distributions of the estimated valence peaks per trait are plotted in Figure 2. Means of valence peak locations are listed in Table 1. This analysis complements the LMM results by providing a more nuanced description of the relationships established with valence.

Results showed that all the relationships between traits and valence were significantly predicted by the linear component. However, they differed in both the strength of the linear component and whether the relationship exhibited a (significant) quadratic component. Only two communion traits—honesty and sincerity—were not significantly predicted by the quadratic

TABLE 1 Study 1 results including linear and quadratic unstandardized regression coefficients, mean peak locations, and inter-rater agreement for the valence-score by trait dimension

Big Two	Trait	Mean peak (*SD*)	Intercept (*SD*)	Linear *b*	Quadratic *b*	ICC (2, *k*)	AIC
Communion	Benevolence	2.30 (1.18)	3.77 (0.37)	**.85** ***	**−.04** **	.994***	.948
	Honesty	2.65 (0.58)	3.55 (0.31)	**.96** ***	.01	.997***	.960
	Sincerity	2.71 (0.59)	3.69 (0.29)	**.91** ***	.00	.997***	.961
	Trustw.	2.95 (0.22)	3.37 (0.38)	**1.01** ***	**.05** ***	.997***	.974
	Sociability	1.52 (1.16)	4.30 (0.40)	**.61** ***	**−.14** ***	.986***	.827
	Warmth	2.35 (0.77)	3.93 (0.24)	**.83** ***	**−.05** ***	.996***	.937
Agency	Confidence	1.80 (0.97)	4.36 (0.24)	**.54** ***	**−.13** ***	.986***	.809
	Dominance	0.32 (1.25)	4.25 (0.46)	**.14** ***	**−.22** ***	.966***	.627
	Power[a]	1.40 (1.17)	4.16 (0.33)	**.35** ***	**−.13** ***	.967***	.651
	Status[a]	1.45 (1.22)	4.22 (0.32)	**.35** ***	**−.11** ***	.971***	.658
	Competence	2.85 (0.43)	3.74 (0.35)	**.90** ***	.02	.996***	.961
	Intelligence	2.50 (0.64)	3.99 (0.21)	**.78** ***	−.02	.995***	.929

Note: Valence-score values range from 1 to 7. Mean peak locations for the valence-score range from −3 to 3 (i.e., continuum point values). Significant unstandardized regression coefficients are in bold, and correspond to the fixed effect predictors (Linear *b* = continuum points; Quadratic *b* = squared continuum points). Intercept and its standard deviation refer to the random-intercept by participant effect and represent the between-participant variability of the mean valence-score per trait. ICCs indicate inter-rater agreement for the target judgments (*k* = 40, i.e., number of raters). AIC = Average inter-rater correlation (i.e., zero-order correlation of all possible raters within trait).

[a]Power and Status are not traits per se, but have been used to measure agency in previous research (see Study 1 Method section). A Benjamini-Hochberg (*FDR*) correction was applied to all *p*-values of linear and quadratic estimates.

α = .05; **p < .01; ***p < .001.

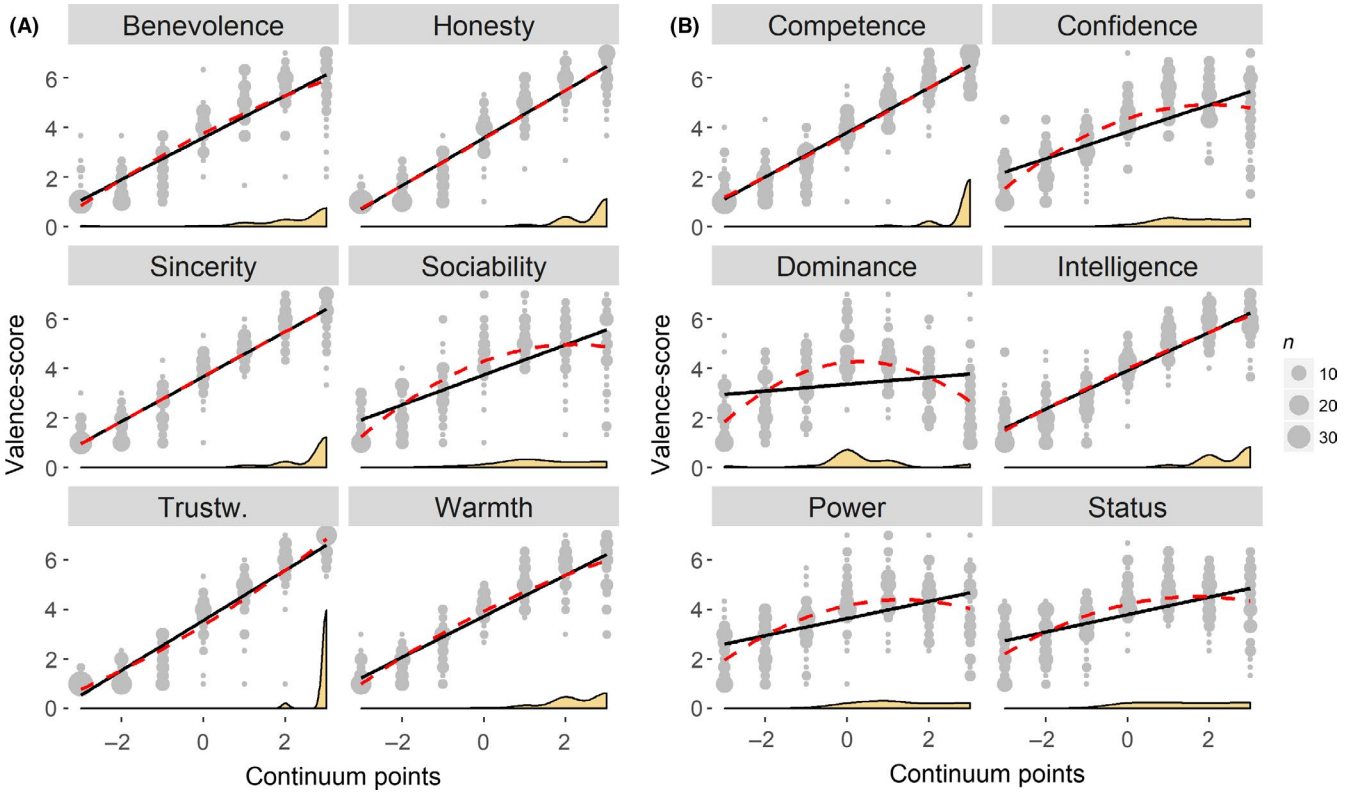

FIGURE 2 Linear and quadratic regression lines fitted to the valence judgments of (panel a) Communion-related trait dimensions and (panel b) Agency-related trait dimensions, in Study 1. Black lines represent the linear fit. Red dashed lines represent the quadratic fit. The gray dots represent the number of observed ratings (*n*) and their density along the valence-score scale, for every continuum point (ranging from −3 to +3) of a trait dimension. The density distributions of valence-score peaks across the seven continuum points of a trait dimension are shown at the bottom of each plot (in yellow)

component. This suggests that these traits fit better with the definition of alpha-traits than other traits such as warmth, benevolence, trustworthiness, and sociability. Our review of the literature did not lead us to expect that warmth-related traits such as sociability would exhibit a strong quadratic component. Yet, our results suggest that moderate-to-high sociability is generally preferred to very high sociability. Nevertheless, these data seem to support a distinction between warmth- and morality-related traits previously endorsed in the literature (e.g., Brambilla et al., 2011).

In agreement with previous research, we found that two agency traits—competence and intelligence—are better defined as alpha-traits, as suggested by their non-significant quadratic components. Dominance, in turn, exhibited the expected inverted U-shaped relationship with valence. Importantly, dominance was the only trait for which the quadratic coefficient was higher than its linear counterpart, and the one exhibiting the lowest linear and highest quadratic coefficients of all traits. This strongly suggests that dominance is the only agency-related beta-trait of our sample. Despite exhibiting higher quadratic coefficients than most communion-related traits, power, status, and confidence showed clear linear relationships with valence, accompanied by weaker curvilinear trends.

Our data suggest that, as expected, not all agency-related traits share the same relationship with valence. The stark contrast between the dominance and the competence-related plots suggests that, despite being related with the same agency dimension, dominance is a beta-trait, whereas competence is an alpha-trait. Finally, against our prediction, not all communion-related traits exhibited a pure alpha nature.

2.5.4 | Correlation between traits' valence

To better understand how the relationship between traits and valence may be interfering with the relationship between the fundamental dimensions, we computed the correlations between all traits' raw valence ratings (including all three measures). As expected, alpha-traits exhibited stronger correlations between them than beta-traits (see Table 2). Overall, the correlational pattern between communion-related traits supports the inference that their common variance should be expected if they share an underlying dimension (except for sociability). The same occurred for all agency-related traits, with the exception of competence and intelligence. Competence and intelligence exhibited a strong positive correlation between themselves and, remarkably, with other communion-related alpha-traits. This suggests that valence promotes the association between competence and communion. This interferes with the assumption of their independence (as claimed in the literature), which may only emerge when this relationship with valence is partialled out (but see Suitner & Maass, 2008, who found a negative relationship between communion and agency after partialling out valence).

3 | STUDY 2

Study 2 addresses three limitations of Study 1. One caveat of Study 1 relates to the presentation style and specific properties of the continuum. An over-specification of continuum point labels, the bipolar nature of the continuum, or the linguistic properties of traits selected to represent opposite poles of a continuum could have induced the observed evaluations. In Study 2, we addressed this possibility by manipulating the presentation style of continua. A second limitation of Study 1 is the unbalanced number of traits across Big Two facets. In this study, we counterbalanced the number of traits per facet. This allowed us to conduct additional exploratory analyses at the facet level. Finally, we now counterbalanced participant gender to overcome a possible gender bias in Study 1.

3.1 | Participants and design

Sixty native English speakers (50% female, 50% male, M_{Age} = 34.02 years, SD_{Age} = 11.25) were recruited via Prolific Academic to

TABLE 2 Pearson correlations between all trait dimensions' valence ratings

	1	2	3	4	5	6	7	8	9	10	11
1. Benevolence											
2. Honesty	.83										
3. Sincerity	.82	.89									
4. Trustworthiness	.82	.91	.89								
5. Sociability	.65	.67	.67	.64							
6. Warmth	.81	.85	.85	.85	.71						
7. Competence	.79	.85	.88	.88	.66	.83					
8. Intelligence	.75	.78	.82	.79	.63	.79	.86				
9. Confidence	.64	.64	.65	.59	.68	.64	.67	.72			
10. Dominance	.29	.24	.25	.20	.43	.31	.27	.35	.53		
11. Power	.51	.46	.48	.42	.61	.52	.50	.56	.70	.61	
12. Status	.51	.47	.50	.43	.61	.52	.51	.59	.70	.57	.75

Note: Communion-related traits numbered from 1 to 6. Agency-related traits numbered from 7 to 12. All correlations' *p*s < .001, α = .05.

participate in the study in exchange for payment (£4.16). All 60 participants were included in the analyses. The study was defined by a 3 (Continuum type) × 8 (Trait) × 7 (Continuum points) within-participants design with a valence-score, identical to Study 1's, as the dependent measure.

3.1.1 | Power considerations

A use of G*Power similar to the procedure described in Study 1, now with 8 traits and with the addition of the within-participants manipulation of the three continuum types (24 measurements), suggests a sample size of 21 participants. We additionally conducted a statistical power simulation using the R package *simr* (see Brysbaert & Stevens, 2018; Green & MacLeod, 2016). This analysis, informed by the 95% confidence intervals obtained for agency assertiveness-related traits in Study 1, suggests a sample size of $N = 60$ for a well-powered study. This sample size allowed us to detect whether unstandardized regression coefficients as small as ± 0.10 were significantly different from zero ($\alpha = .05$), with a statistical power of 99%, for either the linear or quadratic predictors.

3.2 | Continuum manipulation

To assess the influence of continuum presentation style on the valence ratings, we created three different types of trait continua: a bipolar continuum (BC), a high-pole trait continuum (HTC), and a low-pole trait continuum (LTC). The structure of these three types of continuum is illustrated in Figure 1. Unlike Study 1, all three continuum types only exhibited labels for their two extreme endpoints. Like the bipolar continuum in Study 1, the BC uses two trait words (e.g., submissive for low pole, dominant for high pole). The other two unipolar types used only one target trait each. In the HTC, the trait represented the high pole of its dimension (e.g., dominant). In the LTC, the trait represented the low pole of its dimension (e.g., submissive).

3.3 | Dependent measures

Valence measures were identical to Study 1's.

3.4 | Procedure

The procedure was in every way identical to Study 1's, with some exceptions. This time there were three blocks defined by trait continuum type (BC, HTC, and LTC). Block order was counterbalanced between-participants. Between blocks, participants were instructed to pay attention to the upcoming changes regarding the target trait and valence rating. Because there were no labels for intermediate continuum points, the instructions additionally clarified that the degree of expression of a trait increased (BC and HTC), or decreased (LTC), step-by-step from the left endpoint to the right endpoint of the continuum. All task instructions are available in our online repository. After finishing the task, participants were thanked, debriefed, and compensated.

3.5 | Results and Discussion

The continuum points of the LTC were reverse-scored to match the direction rationale of the other two continuum types (e.g., *Very Submissive* as −3 and *Not at all Submissive* as +3). We closely followed the analytical procedure in Study 1, but adapted it to this study's goals. Again, a PCA revealed one component accounting for 84% of the variability in ratings (desirability for self, likeability, and valence loadings were .91, .91, and .93, respectively). Thus, we computed a valence-score exactly as in Study 1.

3.5.1 | Continuum type and participant gender analyses

To examine the effect of continuum type and participant gender on the perceived valence of traits we conducted a 3 (Continuum Type) × 8 (Trait) × 2 (Participant Gender) mixed ANOVA with the last factor between-participants and valence-score as the dependent variable. All effects are reported with Greenhouse-Geisser corrections. The three-way interaction between all factors was non-significant, $F(8.8, 511.3) = 1.35$, $p = .21$. No effects involving Participant Gender were significant, suggesting it had no influence on the results. The significant interaction between Continuum Type and Trait, $F(8.8, 511.3) = 2.29$, $p = .017$, $\eta^2_G = .007$, indicates that the perceived valence of traits differed across continuum types. Bonferroni post-hoc comparisons clarified that only ratings of dominance differed across continuum types ($p < .001$), and specifically between the BC and LTC. To understand the impact of the Continuum Type × Trait interaction on the linear and quadratic components, we conducted LMM analyses by trait as in Study 1, separately for each continuum type. An inspection of the LMM results clarified that the linear component of dominance was stronger than its quadratic counterpart but only for the LTC ($b_{\text{linear}} = 0.30$, $p_{FDR} < .001$; $b_{\text{quadratic}} = -0.14$, $p_{FDR} < .001$). Nevertheless, even in this continuum the quadratic (linear) component of dominance remained the highest (lowest) of all traits. Overall, and independently of continuum type, the results replicated those obtained in Study 1 and clarify that they cannot be entirely explained by continuum presentation style. LMM results and plots for the BC type are shown in Table 3, and Figures 3 and 4 (but see next section). Additional results for all continuum types, and plots by participant gender, can be found in our online repository (in Supporting Information).

3.5.2 | Bipolar continua analyses

To better understand how people mapped their evaluations onto a continuum, and to facilitate the comparison of results across continuum type and across studies, we converted the HTC and LTC into a Composite Bipolar Continuum (CBC), by averaging the valence-scores of each continuum point for each trait across these two continuum types (note that we found no significant differences between these types). The CBC can be understood as a

TABLE 3 Study 2 linear and quadratic unstandardized regression coefficients for the valence-score by type of bipolar continuum, Big Two facet and trait dimension

		Bipolar continuum			Composite bipolar continuum		
Facet	**Trait**	**Intercept (*SD*)**	**Linear *b***	**Quadratic *b***	**Intercept (*SD*)**	**Linear *b***	**Quadratic *b***
CM	Honesty	3.71 (0.32)	**.96** ***	.00	3.75 (0.28)	**.89** ***	.00
	Trustw.	3.53 (0.42)	**1.00** ***	**.04** ***	3.70 (0.30)	**.93** ***	**.02** *
CW	Friendliness	4.19 (0.34)	**.92** ***	**−.05** ***	4.14 (0.15)	**.84** ***	**−.04** ***
	Sociability	4.45 (0.39)	**.69** ***	**−.09** ***	4.43 (0.13)	**.63** ***	**−.08** ***
AA	Confidence	4.47 (0.32)	**.64** ***	**−.10** ***	4.47 (0.19)	**.57** ***	**−.09** ***
	Dominance	4.60 (0.45)	**.22** ***	**−.22** ***	4.60 (0.26)	**.17** ***	**−.17** ***
AC	Competence	3.86 (0.11)	**.91** ***	.02	4.02 (0.15)	**.79** ***	.00
	Intelligence	4.14 (0.23)	**.80** ***	**−.02** *	4.22 (0.29)	**.73** ***	**−.03** *
CM	–	3.62 (0.40)	**.98** ***	**.02** **	3.73 (0.35)	**.91** ***	.01
CW	–	4.32 (0.37)	**.81** ***	**−.07** ***	4.28 (0.21)	**.73** ***	**−.06** ***
AA	–	4.53 (0.38)	**.43** ***	**−.16** ***	4.53 (0.24)	**.37** ***	**−.13** ***
AC	–	4.00 (0.20)	**.86** ***	.00	4.12 (0.27)	**.76** ***	−.01

Note: Abbreviations:
AA, Agency Assertiveness; AC, Agency Competence; CM, Communion Morality; CW, Communion Warmth.
Valence-score values range from 1 to 7. Significant unstandardized regression coefficients are in bold, and correspond to the fixed effect predictors (Linear *b* = continuum points; Quadratic *b* = squared continuum points). Intercept and its standard deviation refer to the random-intercept by participant effect and represent the between-participant variability of the mean valence-score per trait. A Benjamini-Hochberg (*FDR*) correction was applied to all *p*-values of linear and quadratic estimates.
α = .05; *p < .05; **p < .01; ***p < .001.

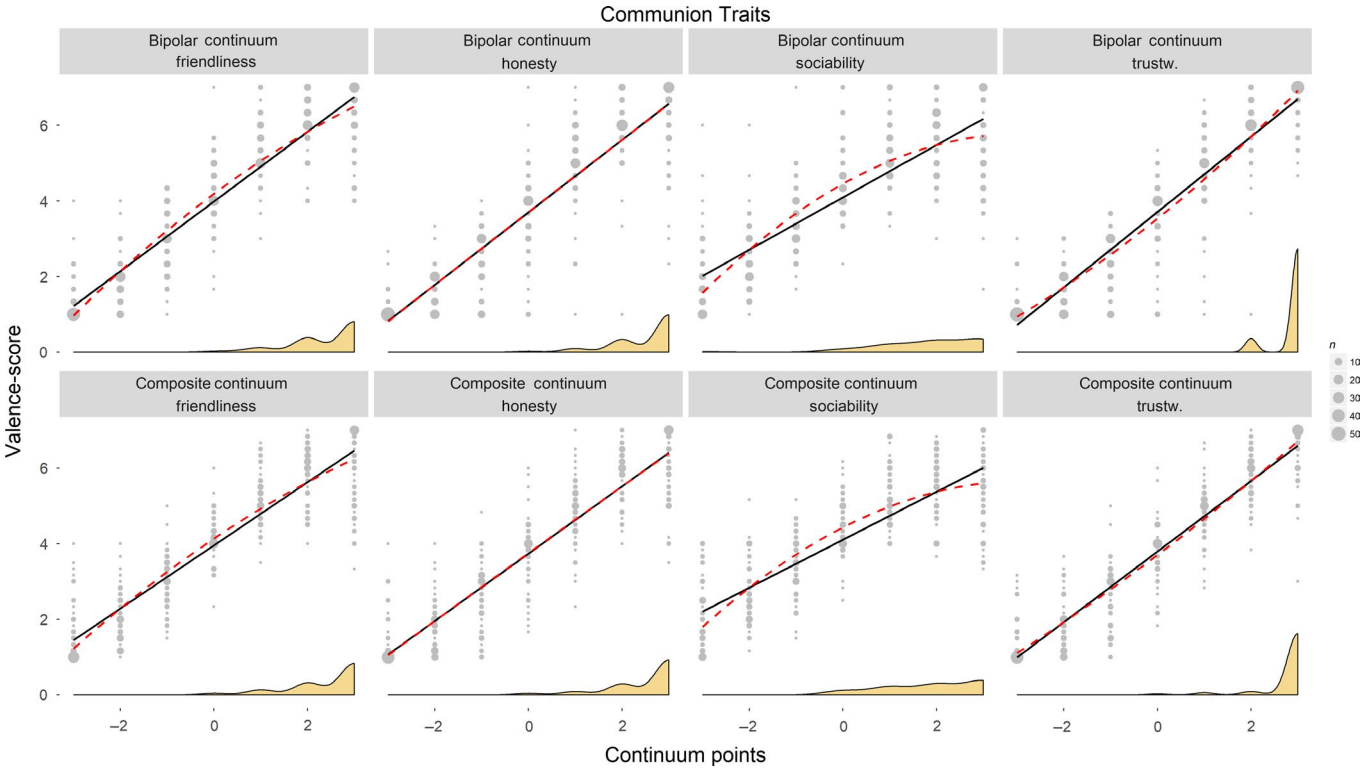

FIGURE 3 Linear and quadratic regression lines for each communion-related trait dimension for the Bipolar and Composite Bipolar Continuum types. Black lines represent the linear fit. Red dashed lines represent the quadratic fit. The gray dots represent the number of observed ratings (*n*) and their density along the valence-score scale, for every continuum point (ranging from −3 to +3) of a trait dimension. The density distributions of valence-score peaks across the seven continuum points of a trait dimension are shown at the bottom of each plot (in yellow)

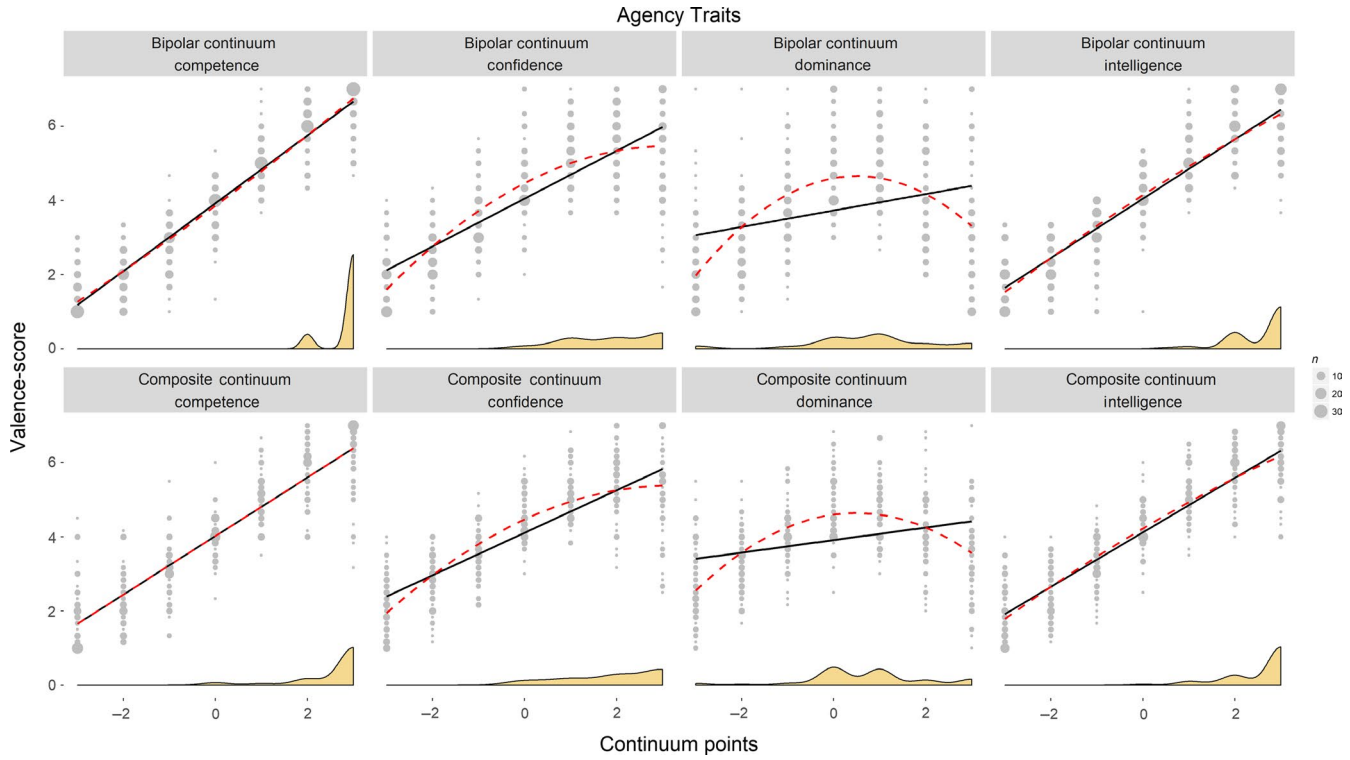

FIGURE 4 Linear and quadratic regression lines for each agency-related trait dimension for the Bipolar and Composite Bipolar Continuum types. Black lines represent the linear fit. Red dashed lines represent the quadratic fit. The gray dots represent the number of observed ratings (*n*) and their density along the valence-score scale, for every continuum point (ranging from −3 to +3) of a trait dimension. The density distributions of valence-score peaks across the seven continuum points of a trait dimension are shown at the bottom of each plot (in yellow)

synthetic bipolar continuum that circumvents some of the methodological issues discussed earlier. For instance, there is no contrast between traits representing opposite poles, nor between their linguistic features, underlying the CBC data. Any impact of continuum design on the ratings should thus be observable by comparison with the BC.

We obtained linear and quadratic estimates per trait for the CBC using separate LMMs exactly as we did earlier for the BC. Additionally, we conducted four additional exploratory LMMs at the level of Big Two facet for the BC and CBC types. LMM results for the BC and CBC are listed in Table 3. Plots of the results for both bipolar continuum types are shown in Figures 3 and 4.

Table 3 shows that the overall pattern of results was identical across bipolar continuum types. These results replicated the pattern observed in Study 1, with the exception that, this time, the linear component for dominance was stronger, and practically identical[1] to the quadratic component. Nevertheless, the quadratic (linear) component of dominance remained the highest (lowest) across all traits. In contrast, competence and honesty were the only traits for which only the linear component was significant.

3.5.3 | Facet analyses

The analysis at the facet level further showed a divergence between the two facets of agency. Although the linear components were stronger across all facets, the quadratic component of assertiveness remained the highest of its class, and competence was the only facet with a purely linear component (additional Big Two facet plots available in online repository). To test if the relationship valence-assertiveness facet is significantly less linear and more inverted U-shaped than the relationship valence-competence facet, we ran additional exploratory LMMs including two interaction terms, each specifying an interaction between facet (e.g., assertiveness and competence) and either a linear or an inverted-U trend predictor (i.e., −3, −2, −1, 0, −1, −2, −3), with intercepts and slopes by participant as random effects. For simplicity, LMMs were computed separately for each pair of agency- and communion-related facets, and each bipolar continuum type. Significant interactions in the following analyses indicate a significant difference between the (linear or inverted-U) slopes of any two facets. We expected the difference between linear slopes to be positive (and negative for inverted-U slopes) for competence compared to assertiveness (reference facet level). And indeed, for

[1]A reviewer raised a concern about the effect of including desirability ratings in our valence-score, given Study 3's results with faces. That does not seem to be the case. When desirability ratings were analyzed separately from a valence-score aggregating likeability and valence (as in Study 3), results led to the same conclusions. Nevertheless, our procedure may have inflated the linear component of dominance (and other agency-related traits). When desirability was dropped, its linear component became lower than its quadratic component, while remaining the lowest across all traits. This analysis is available in our online repository.

TABLE 4 Study 2 mean peak locations and inter-rater agreement results for the valence-score by type of bipolar continuum, big two facet, and trait dimension

		Bipolar continuum			Composite bipolar continuum		
Facet	Trait	Mean peak (*SD*)	ICC (2, *k*)	AIC	Mean peak (*SD*)	ICC (2, *k*)	AIC
CM	Honesty	2.58 (0.70)	.997***	.978	2.55 (0.77)	.997***	.963
	Trustw.	2.88 (0.32)	.998***	.994*	2.83 (0.56)	.998***	.983*
CW	Friendliness	2.46 (0.77)	.998***	.979	2.46 (0.81)	.997***	.968
	Sociability	1.90 (1.16)	.994***	.925	1.93 (1.04)	.994***	.912
AA	Confidence	2.00 (0.97)	.993***	.863	2.00 (1.05)	.993***	.884
	Dominance	0.74 (1.47)	.972***	.593	0.70 (1.31)	.973***	.581
AC	Competence	2.87 (0.34)	.998***	.984*	2.65 (0.78)	.997***	.969
	Intelligence	2.62 (0.61)	.997***	.961	2.61 (0.70)	.996***	.964
CM	–	2.65 (0.66)	.997***	.933**	2.73 (0.60)	.997***	.950**
CW	–	2.30 (0.82)	.996***	.888**	2.37 (0.76)	.996***	.903**
AA	–	1.29 (1.13)	.986***	.666*	1.41 (1.03)	.987***	.699*
AC	–	2.73 (0.52)	.998***	.936**	2.75 (0.60)	.996***	.933**

Note: Abbreviations: AA, Agency Assertiveness; AC, Agency Competence; CM, Communion Morality; CW, Communion Warmth.
Mean peak locations for the valence-score range from −3 to 3 (i.e., continuum point values). ICCs indicate inter-rater agreement for the target judgments (*k* = 60, i.e., number of raters). AIC = Average inter-rater correlation (i.e., zero-order correlation of all possible raters within trait/facet). A Benjamini-Hochberg (*FDR*) correction was applied to all *p*-values of linear and quadratic estimates.
α = .05; *p < .05, **p < .01; ***p < .001.

both bipolar continuum types, we found the expected interactions involving the linear predictor (BC: b = .42; CBC: b = .39; both ps_{FDR} < .001) and the inverted-U predictor (BC: b = −.53; CBC: b = −.40; both ps_{FDR} < .001). The same pattern of results was found for the slope difference between the warmth (reference facet level) and morality facets, for both the linear (BC: b = .17; CBC: b = .18; both ps_{FDR} < .001) and inverted-U predictors (BC: b = −.31; CBC: b = −.24; both ps_{FDR} < .001). These results provide stronger support for our hypothesis that the nature of the relationship with valence differs across facets within agency, and additionally suggest a similar, though unexpected, difference within communion.

3.5.4 | Inter-rater agreement and valence peaks

Inter-rater agreement and valence peaks were computed for both bipolar continuum types (see Table 4). The overall pattern of results at the trait level replicated the one observed in Study 1. At the facet level, inter-rater agreement was lower for the assertiveness and warmth facets. These were also the facets for which valence peaked closer to the continuum's mid-point. In contrast, the competence and morality facets both exhibited the highest inter-rater agreement and valence peaks at their high poles. Overall, this supports the interpretation that extreme expressions of assertiveness- or warmth-related traits are less positively evaluated, whereas the more competence or morality one expresses the better, at least when no specific context is provided.

Altogether, these data replicate Study 1's while circumventing some of its methodological limitations.

4 | STUDY 3

In Study 3, we adapted the paradigm developed in Studies 1–2 to social face perception. This study is, thus, a conceptual replication of Studies 1–2 using face stimuli in place of verbal stimuli: The independent variable was defined by a continuum of faces known to vary in the target trait, rather than by verbal descriptions of the trait continuum. By exposing participants to sets of seven faces representing a continuum of a trait dimension, we expected the evaluation of these faces to represent the evaluation of the trait continuum itself. To minimize the influence of gender stereotypes, we balanced participant and target gender.

4.1 | Participants

Forty native English speakers[2] (50% female, 50% male, M_{age} = 30.50 years, SD_{age} = 7.02) were recruited via Prolific Academic to participate in the study in exchange for payment (£1.70). All 40 participants were included in the analyses.

4.1.1 | Power considerations

The same power considerations discussed in Study 1 apply to this study. For consistency, we pre-specified a participant sample size identical to Study 1's.

[2]In total we recruited 49 participants, but nine were excluded from the analyses as a result of using mobile devices with small screens incapable of displaying an entire face continuum, which we considered a crucial requirement in our study. These participants were subsequently replaced to achieve the intended sample size.

4.2 | Face continua

In this study we focused on a shorter range of trait dimensions due to difficulties[3] in obtaining stimuli that would entirely correspond to the traits used in Studies 1–2. Thus, we focused on the basic dimensions of social face perception (i.e., trustworthiness and dominance), and an equal number of Big Two-related dimensions for which we found previously validated face continua (competence and warmth). We generated a set of seven face images per continuum, where faces varied along a given trait dimension. Each set was bounded by two faces whose features conveyed the low and high poles of the dimension. Materials were created from two types of face stimuli sets: a widely known face photograph database (Karolinska face database; Lundqvist, Flykt, & Ohman, 1998), and continua of synthetic "FaceGen" faces previously generated and validated by Todorov et al. (2013). The inclusion of FaceGen faces served the purpose of validating our custom photograph-based continua, which were expected to convey the same traits. Using both materials allowed us to assess influential trait labels used in Big Two research such as competence (Fiske et al., 2007), as we were only able to manipulate intelligence using photographs.

4.2.1 | Face photograph-based continua

These continua were generated using stimuli from the Karolinska database and its correspondent ratings collected by Oosterhof and Todorov (2008). These ratings included traits such as dominance, trustworthiness, intelligence (competence-related), and caring (warmth-related). For each trait, we generated a male and female version of the continuum. First, we used PsychoMorph (Version 5; Tiddeman, Burt, & Perrett, 2001) to generate two average-faces representing the high and low poles of a continuum. Each average-face was derived from the 10 face photographs with the highest (or lowest) trait ratings. Next, we used Webmorph (Version 0.0.0.9001; DeBruine, 2017) to generate continua with seven face images each, to match the seven-point continua used in Studies 1–2. Along each continuum, the features of the low-pole average-face (e.g., submissive) gradually shifted toward the features of the high-pole average-face (e.g., dominant) at each step (for details see Sutherland, Rhodes, & Young, 2017). The resulting face continua are shown in Figure 5. These materials are available in our online repository.

4.2.2 | FaceGen continua

Todorov et al. (2013) generated, validated, and made available several sets of face continua composed of FaceGen stimuli that partially corresponded to our target dimensions. From these sets, we selected the dominance, trustworthiness, competence, and likeability face continua. The likeability continuum was the only one available to serve as a proxy for the warmth/communion dimension, as likeability and warmth/communion are highly positively correlated (e.g., Oliveira et al., 2019; Wojciszke et al., 2009). However, please note that this continuum matches our likeability measure (aggregated in the valence-score), and constitutes yet another example of how valence and communion-related traits are highly conflated. To control for gender, we slightly modified the face continua by dropping the most distant faces from the continuum's mid-point (e.g., +3 *SD* and −3 *SD* faces, or others closer to the continuum's mid-point as deemed necessary), at which point the faces started to clearly convey a gender transformation. These modifications were only necessary for the dominance and trustworthiness continua. Using Webmorph (DeBruine, 2017), we generated a replacement for any image dropped from the original continuum. Specifically, we generated a 3-face continuum using the two faces that bounded the removed image, and subsequently extracted the mid-point face to use as the replacement image. These continua are shown in Figure 5.

4.3 | Dependent measures

As in Studies 1–2 we used valence, likeability, and desirability ratings to measure perceived valence. To forestall the possible interaction between participant and target gender, the desirability (for self) ratings block only included face stimuli that matched the participant's gender. Consequently, only half of the targets (male or female faces) were rated on desirability, which resulted in half the observations for this measure compared with any of the others. Therefore, we had two separate measures: valence-score (aggregating likeability and valence) and desirability for self.

4.4 | Procedure

The task was programmed using Qualtrics software. Participants were invited to participate in a study about "how people perceive and evaluate faces". Participant gender was filtered via the Prolific Academic website to randomly assign the participants to their appropriate condition. All participants rated the perceived likeability and valence of all the faces of the continua presented in their assigned condition. Only continua matching the participant's gender were rated on desirability for self (excluding the masculine-looking FaceGen continua). Blocks of trials with different targets (detailed in Figure 5) were defined by the target rating, target gender, and stimulus type (photograph-based vs. FaceGen). Trial order was randomized within each block. The task structure was such that the participants always started by evaluating the female and male face target blocks before the FaceGen targets' blocks. The order of target gender blocks was counterbalanced, but varied with participants' gender. Male (female) participants started with either: two blocks of female

[3]Except for Todorov, Dotsch, Porter, Oosterhof, and Falvello's (2013) materials, the best face materials we found— among the ones publicly available or requested to different authors (i.e., Sutherland, Young, Mootz, & Oldmeadow, 2015; Sutherland et al., 2013; Walker, Schönborn, Greifeneder, & Vetter, 2018)—suffered from some limitations (e.g., missing target trait dimensions, naturally occurring overlaps between traits and gender). For this reason, we decided to create our own stimuli. Because we relied on Todorov et al.'s (2013) materials to validate our custom continua, we were also limited by the number of Big Two-related dimensions available in their set.

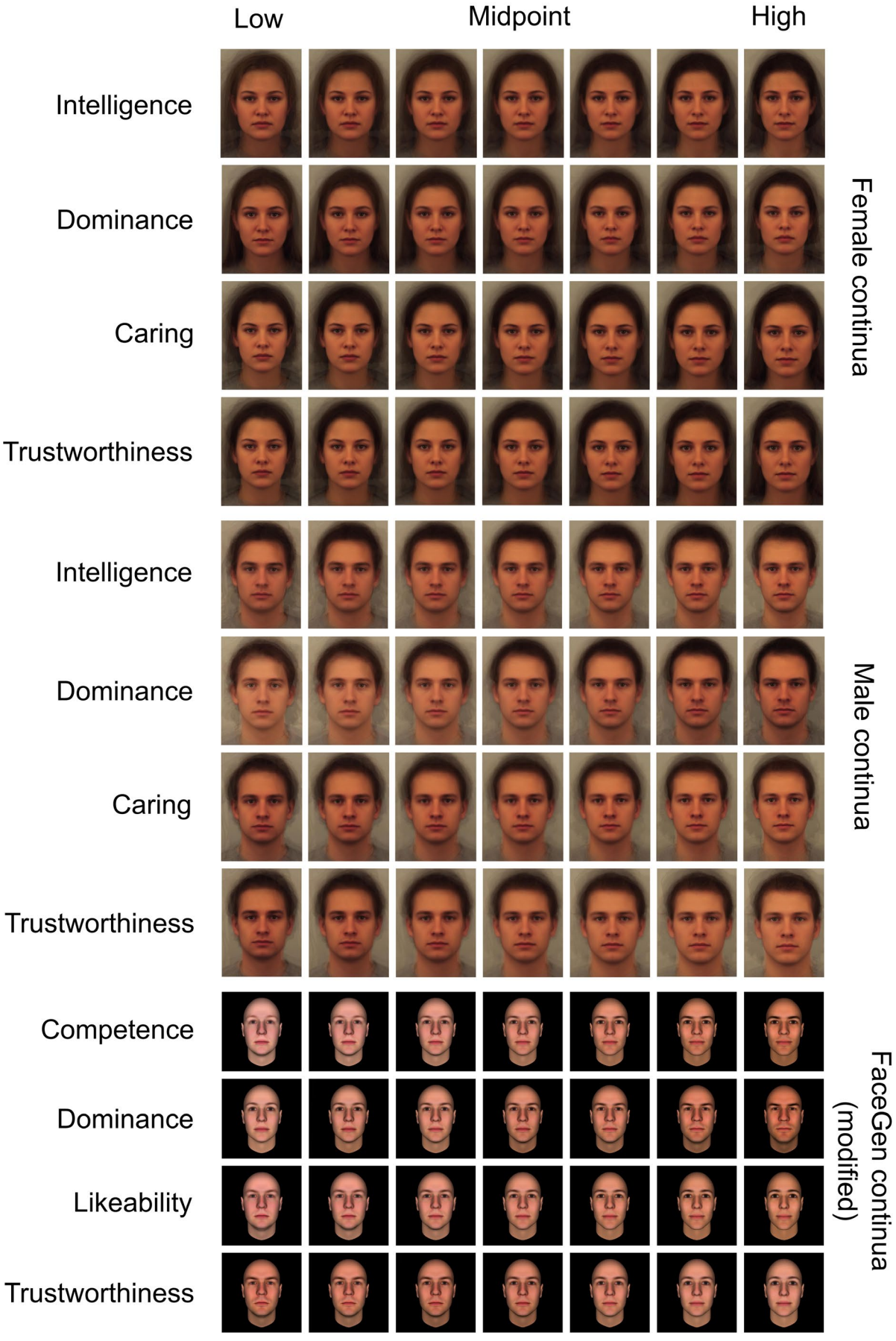
Low
Midpoint
High
Intelligence
Dominance
Caring
Trustworthiness
Female continua
Intelligence
Dominance
Caring
Trustworthiness
Male continua
Competence
Dominance
Likeability
Trustworthiness
FaceGen continua (modified)

FIGURE 5 Face continua used in Study 3. The bottom set of FaceGen faces correspond to a slightly modified version of the original face continua generated by Todorov et al. (2013). Specifically, only the trustworthiness and dominance FaceGen continua were modified. All stimuli were made available in our online repository

(male) faces, one for likeability and another for valence ratings; or, three blocks of male (female) faces, each for one of the three different ratings. In each trial, the whole face continuum was displayed in the center of the screen along with instructions tailored to the specific rating of the block (all instructions available in our online repository). In the valence rating blocks, participants were asked, "How Good or Bad in general is the impression you get from each face?" In the likeability rating blocks, participants were asked, "How Likeable does each face seem to you?" In the "desirability for self" blocks, participants were asked to "imagine they were going to be a character in a Virtual Reality setting" and indicate "how likely you would be to choose each face to represent you in the virtual world, in order to create the best impression". Responses were given on a 7-point rating scale, ranging between 1 (Very Bad/Very Unlikeable/Would never choose) to 7 (Very Good/Very Likeable/Would definitely choose; for valence, likeability and desirability, respectively). Each of the seven faces in each continuum was associated with a response box where participants entered their response using numerical keys. After completing the task, participants were thanked, debriefed, and compensated.

4.5 | Results and Discussion

4.5.1 | Valence measures

Because the desirability ratings were only assessed in half of the data points comparatively to the other ratings, we analyzed them separately. Note that PCA requires an equal amount of observations per measure. Therefore, we submitted only the likeability and valence ratings to a PCA using the same criteria as in Studies 1–2. The PCA yielded one component, interpreted as general valence that accounted for 77% of the variance in the ratings. Loadings for likeability and valence were both .88. We then calculated a valence-score by aggregating the ratings of likeability and valence for each point of each face continuum.

4.5.2 | Inter-rater agreement

We calculated ICCs and AICs for the valence-score (see Table 5) and desirability (see Table 6) ratings, using the values of each point of each face continuum. Like Studies 1–2, high agreement was not observed for all traits. The overall pattern suggests that participants agreed less on the perceived valence of agency-related male face continua. In contrast, agency-related female continua exhibited high inter-rater agreement for both the valence-score and desirability ratings. Thus, unlike the Studies 1–2, the low agreement was now also observed for competence, and exclusively for male targets.

4.5.3 | Linear and quadratic fits

Valence-score

Again, we ran separate LMMs (same fixed and random effects as in Studies 1–2) by face continuum with valence-score as the outcome variable. All estimates' *p*-values were FDR-corrected. Face continua were defined by stimulus type (photograph-based vs. FaceGen), target gender (photograph-based continua only), and trait dimension (see Figure 5). Results are listed in Table 5, and data are plotted in Figure 6. As in Studies 1–2, the valence-scores of all traits were significantly predicted by the linear component. Regarding communion-related traits, as expected, we found stronger linear components for all the trustworthiness and warmth-related continua, regardless of stimulus type.

The results obtained in Studies 1–2 for agency-related traits were, however, not entirely replicated. Instead of a stronger quadratic component for dominance, we found that the linear component was the strongest predictor for all agency-related continua, especially for female continua. The relationship of valence with female facial dominance was more clearly linear, and stronger, than the observed for male facial dominance. Nevertheless, only the dominance-related continua established a negative relationship with valence, and especially the female one. As expected, the FaceGen competence continuum showed a purely linear relationship with valence. However, the same did not occur for the photograph-based intelligence continua, which exhibited a small but significant quadratic component. It remains unclear, however, whether this resulted from higher noise in our custom continua, or from actual differences between facial features across competence and intelligence.

Desirability for self

Linear mixed-effects models were run separately by participant gender with desirability ratings as the outcome variable. Results are listed in Table 6, and plotted in Figure 7. Regardless of participant gender, communion-related continua showed a stronger linear relationship with desirability. Results for the agency-related continua were less consistent across traits and suggest sensitivity to participant gender. Only the results for male faces replicated the findings of Studies 1–2: a stronger quadratic component for dominance and a stronger linear component for intelligence. For female faces, the linear components of intelligence and dominance were both stronger than their quadratic counterparts and exhibited a clear opposite relationship with valence. These results must, however, be read with caution given the lower sample size. Nevertheless, they may be informative to future research focusing on actor–observer differences in face perception.

5 | GENERAL DISCUSSION

In three studies we assessed the relationship between valence and traits that have been identified as central in person perception and

TABLE 5 Study 3 results including linear and quadratic unstandardized regression coefficients, mean peak locations, and inter-rater agreement for the valence-score by face continuum

Stimuli	Face continuum	Mean peak (*SD*)	Intercept (*SD*)	Linear *b*	Quadratic *b*	ICC (2, *k*)	AIC
Photograph-based	Female caring	2.31 (1.02)	4.19 (0.62)	**.52*****	−0.03	.977***	.815
	Male caring	2.42 (1.17)	3.94 (0.56)	**.46*****	0.02	.972***	.754
	Female trustw.	1.91 (1.59)	4.27 (0.50)	**.40*****	**-.04***	.961***	.656
	Male trustw.	2.15 (1.42)	4.18 (0.52)	**.41*****	**.00***	.962***	.679
	Female dominance	−1.68 (1.61)	4.22 (0.65)	**-.46*****	-.03	.966***	.700
	Male dominance	−0.26 (2.13)	4.29 (0.44)	**-.16****	**-.06****	.811***	.163
	Female intelligence	1.90 (1.19)	4.34 (0.64)	**.47*****	**-.07*****	.972***	.763
	Male intelligence	1.10 (1.63)	4.37 (0.52)	**.21****	**-.05****	.892***	.396
FaceGen	Likeability	1.90 (1.65)	3.91 (0.80)	**.33*****	-.01	.925***	.532
	Trustw.	1.85 (1.67)	3.72 (0.94)	**.34*****	-.01	.916***	.586
	Competence	1.10 (1.93)	3.94 (0.83)	**.17*****	-.03	.740***	.247
	Dominance	−0.47 (2.11)	4.00 (0.85)	**-.17*****	**-.07*****	.809***	.272

Note: Valence-score values range from 1 to 7. Mean peak locations for the valence-score range from −3 to 3 (i.e., continuum point values). Significant unstandardized regression coefficients are in bold, and correspond to the fixed effect predictors (Linear *b* = continuum points; Quadratic *b* = squared continuum points). Intercept and its standard deviation refer to the random-intercept by participant effect and represent the between-participant variability of the mean valence-score per trait. ICCs indicate inter-rater agreement in the target trait judgments (k = 40, i.e., number of raters). AIC = Average inter-rater correlation (i.e., zero-order correlation of all possible raters within face continuum). A Benjamini-Hochberg (*FDR*) correction was applied to all *p*-values of linear and quadratic estimates. $\alpha = .05$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

social face perception. Studies 1 and 2 focused on the conceptual knowledge about the traits themselves. Study 3 focused on how these traits were (likely to be) inferred from faces. Results from Studies 1–2 show that the relationship established with valence is less stable in nature across agency-related traits comparatively to communion-related traits, a phenomenon that was particularly noticeable when comparing dominance and competence. Study 3 assessed the same relationships using face stimuli instead of verbal trait labels and found that the curvilinearity between dominance and valence observed in Studies 1–2 shifted to a negative linear relationship, whereas all the other relationships replicated the pattern of results obtained with trait words. Moreover, the desirability ratings in Study 3 suggest that the nature of the relationship between dominance and valence is sensitive to perceivers' gender. Our results are thus informative regarding how core traits of the Big Two dimensions relate with valence and additionally raise questions that are relevant to the field. We summarize them below.

A piece of information directly offered by these results is that one chief difference between the communion and agency dimensions is the extent to which their traits are homogeneous in the relationship established with valence: Whereas communion-related traits (except for sociability) overlapped extensively with valence, agency-related traits exhibited a more heterogeneous and context-dependent relationship with valence (see also Bruckmüller & Abele, 2013). All agency-related traits, except for dominance, consistently exhibited an alpha nature (i.e., linearity with valence). Dominance was the only trait more clearly exhibiting a beta-trait nature (i.e., curvilinearity with valence), although only in the evaluation of verbally described targets. Moreover, all agency-related traits, except for competence, exhibited a quadratic component. The curvilinear trend (unexpectedly) found for the communion-related trait of sociability suggests that high sociability can be negatively evaluated (for a similar finding see Landy et al., 2016). Future research should seek to understand why sociability shares this feature with dominance, as both show strong inverted-U relationships with valence. For instance, future studies could investigate whether the curvilinearity observed for these two traits is related to social perspective. The impact of social perspective (having a trait myself vs. interacting with someone who expresses that trait) on trait evaluations may be more crucial for agency-related traits, and more relevant for sociability than for other communion-related traits. Although our studies were not optimally designed to examine social perspective, we must note that our PCA results speak against that hypothesis given the high correlation found between desirability for self and likeability (of others).

Our data also clarify and add to Imhoff and Koch's (2017) data regarding the relationship between the Big Two. With a new paradigm where traits themselves are defined as independent variables, we show that not all agency-related traits exhibit a curvilinear relationship with valence. For instance, competence-related traits showed a purely linear relationship with valence. Our results additionally clarify that although other agency-related traits (and power and status dimensions) exhibited significant quadratic relationships with valence,

TABLE 6 Study 3 results including linear and quadratic unstandardized regression coefficients, mean peak locations, and inter-rater agreement for the desirability for self-ratings by face continuum and participant gender

Face continuum	Participant gender	Mean peak (*SD*)	Intercept (*SD*)	Linear *b*	Quadratic *b*	ICC (2, *k*)	AIC
Caring	Female	1.35 (1.76)	4.51 (0.56)	**.43** ***	−.07	.881 ***	.421
	Male	1.82 (1.94)	3.79 (0.61)	**.48** ***	.01	.923 ***	.670
Trustw.	Female	1.60 (1.24)	4.22 (0.91)	**.41** ***	**−.07** *	.875 ***	.604
	Male	2.02 (1.44)	4.15 (0.36)	**.59** ***	−.05	.953 ***	.651
Dominance	Female	−1.20 (1.91)	4.22 (0.71)	**−.35** ***	−.05	.788 ***	.212
	Male	0.37 (1.91)	4.46 (0.53)	.06	**−.11** **	.491	.129
Intelligence	Female	1.42 (1.16)	4.57 (0.63)	**.45** ***	**−.11** **	.924 ***	.534
	Male	1.12 (2.18)	4.10 (0.51)	**.24** ***	−.03	.652 **	.201

Note: Desirability ratings range from 1 to 7. Mean peak locations for the desirability ratings range from −3 to 3 (i.e., continuum point values). Significant unstandardized regression coefficients are in bold, and correspond to the fixed effect predictors (Linear *b* = continuum points; Quadratic *b* = squared continuum points). Intercept and its standard deviation refer to the random-intercept by participant effect and represent the between-participant variability of the mean valence-score per trait. ICCs indicate inter-rater agreement in the target trait judgments (*k* = 20, i.e., number of raters). AIC = Average inter-rater correlation (i.e., zero-order correlation of all possible raters within face continuum). A Benjamini-Hochberg (*FDR*) correction was applied to all *p*-values of linear and quadratic estimates.
α = .05; *p < .05; **p < .01; ***p < .001.

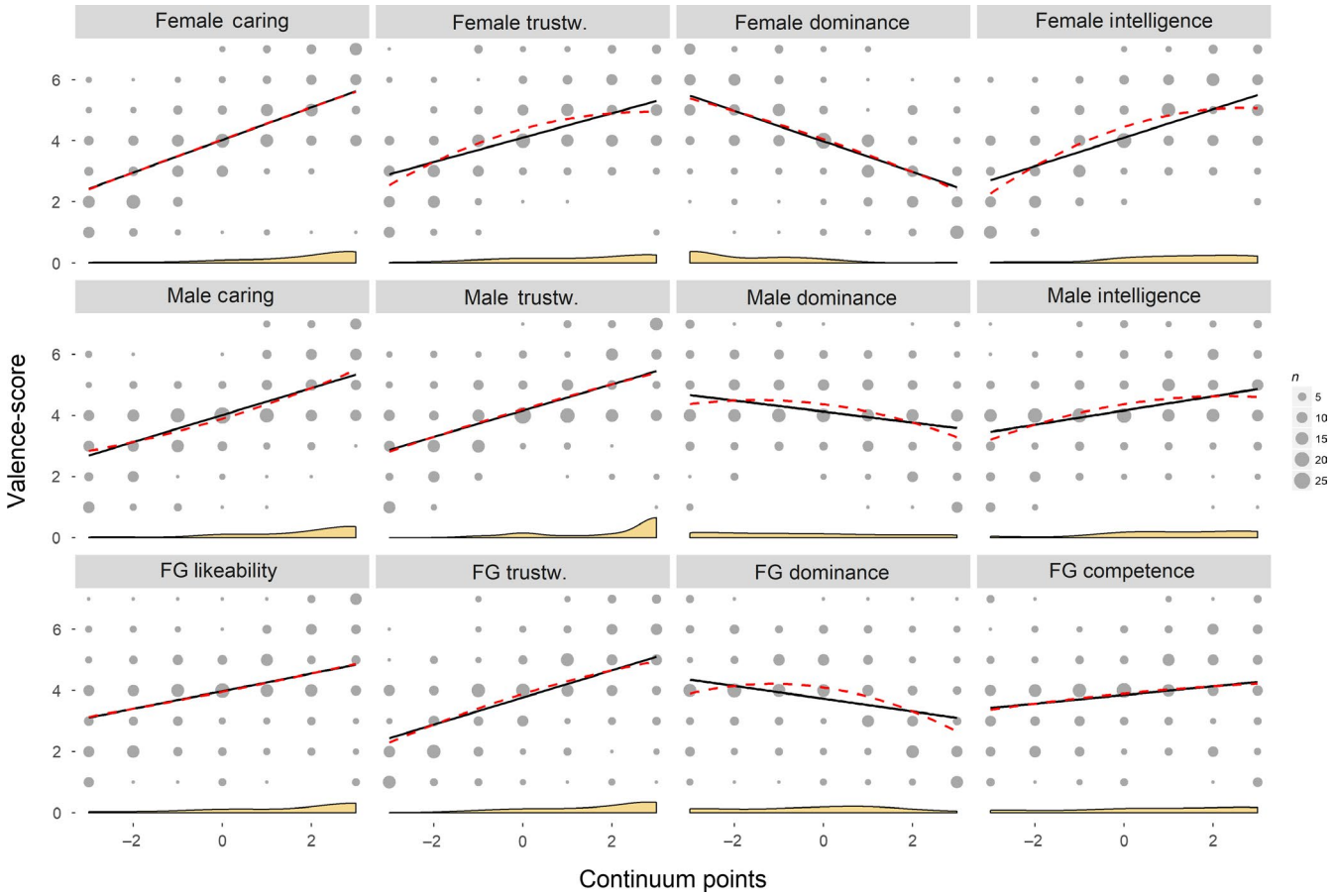

FIGURE 6 Linear and quadratic regression lines fitted to the valence-scores of each face continua (by target gender and trait dimension) for the valence-score, in Study 3. Black lines represent the linear fit. Red dashed lines represent the quadratic fit. The gray dots represent the number of observed ratings (*n*) and their density along the valence-score scale, for every continuum point (ranging from −3 to +3) of a trait dimension. The density distributions of valence-score peaks across the seven continuum points of a trait dimension are shown at the bottom of each plot (in yellow). FG, FaceGen face continua

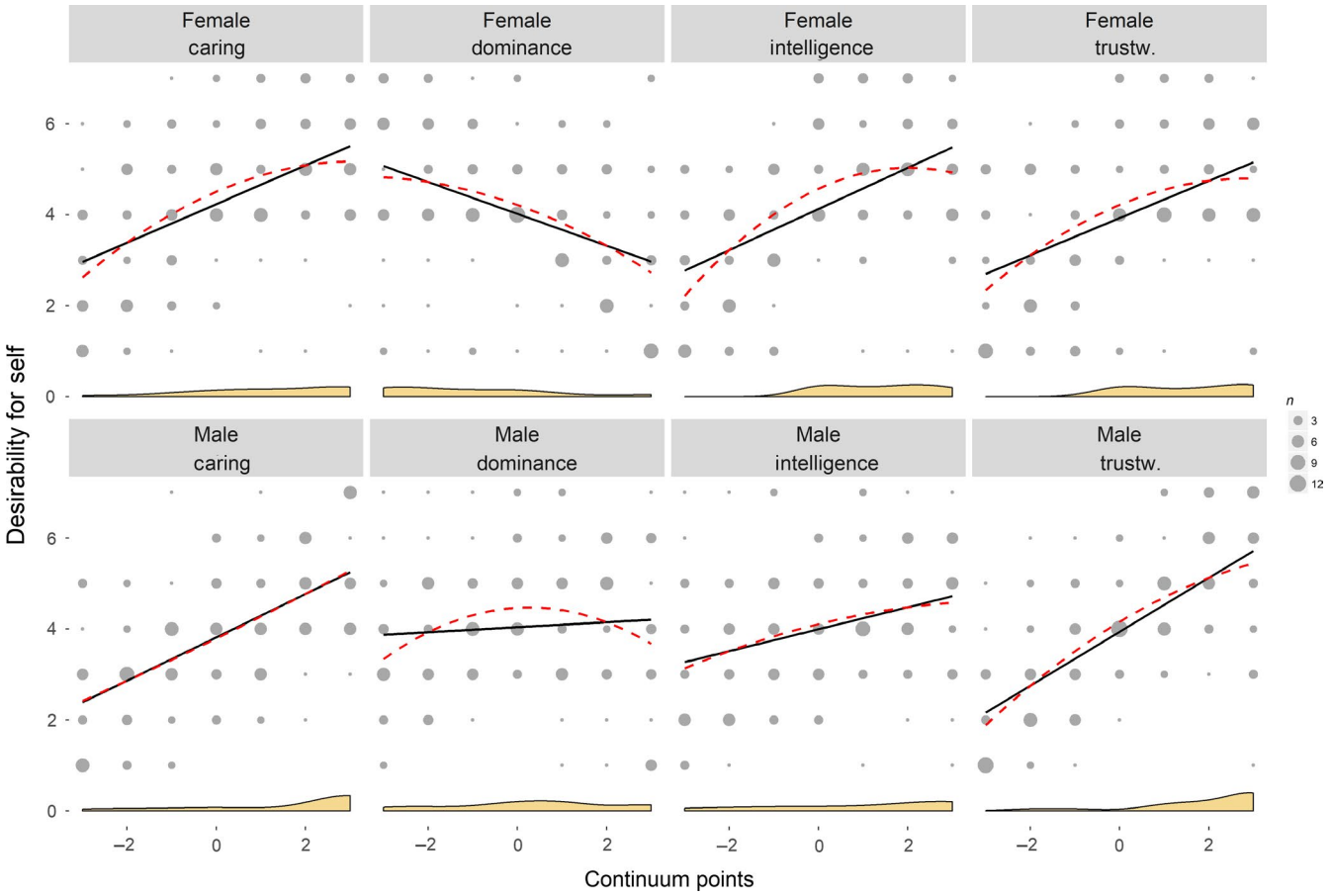

FIGURE 7 Linear and quadratic regression lines for each trait dimension by participant gender for the "desirability for the self" ratings (ranging from low (1) to high desirability (7)), in Study 3. Black lines represent the linear fit. Red dashed lines represent the quadratic fit. The gray dots represent the number of observed ratings (*n*) and their density along the valence-score scale, for every continuum point (ranging from −3 to +3) of a trait dimension. The density distributions of valence-score peaks across the seven continuum points of a trait dimension are shown at the bottom of each plot (in yellow)

these were a weaker feature of that relationship (except for dominance). It is conceivable that any differences between Imhoff and Koch's (2017) results and ours may have derived from their definition of agency in terms of assertiveness- but not competence-related traits (e.g., Koch, Imhoff, Dotsch, Unkelbach, & Alves, 2016), coupled with examining social entities other than traits and faces per se.

The divergence between traits regarding their relationship with valence may also constitute a reason to branch the Big Two into facets. In light of the results obtained in Study 2, one may notice that the facets within each Big Two dimension can be characterized as diverging in the nature of the relationship that their traits establish with valence. Whereas competence-related traits tend to exhibit an alpha nature more strongly, assertiveness-related traits tend to exhibit a beta nature more strongly. Moreover, the beta nature trend observed for sociability (warmth-related) is also supportive of the branching of communion into the morality and warmth facets (see Brambilla & Leach, 2014; Goodwin, 2015). This, however, remains a hypothesis to be rigorously tested in the future, since the present studies focused primarily on relationships at the trait level, and our analyses at the facet level were exploratory in nature.

It is important to stress that our results do not allow us to state that one specific trait is immutably alpha or beta. Our results only suggest that, by default, some traits are more likely to show the quadratic component relatively to others. Thus, although we consistently found a positive linear relationship between competence and valence, it is conceivable that a curvilinear or even negative relationship may emerge under different circumstances. For instance, in a competitive environment, highly intelligent individuals may be perceived as "bad" (e.g., Carrier, Dompnier, & Yzerbyt, 2019). Further studies may clarify how changes in the meaning of a trait modulate its perceived valence across different contexts. This hypothesis of flexibility in valence perception emerges as a possibility in light of our results showing that, although dominance was perceived as a beta-trait, it also exhibited low inter-rater agreement. This suggests that some perceivers may perceive dominance as an alpha trait more than others—an individual differences hypothesis worth pursuing in the future (see also Stolier, Hehman, Keller, Walker, & Freeman, 2018, for a similar idea regarding trait interrelationships).

We find our face evaluation data from Study 3 to be highly relevant. First, because they clarify that the conceptual variability perceived in a trait dimension does not necessarily map onto the variability perceived

in a face. And second, because they suggest that these perceptions are modulated by participant gender and type of judgment. Evaluations of face continua did not exhibit the beta patterns previously observed in Studies 1–2. All relationships between valence and face-trait dimensions tended to be linear. And the curvilinearity between dominance and valence was only found under circumstances where male perceivers evaluated the desirability of male faces. Moreover, the nature of that relationship was more inconsistent across agency- than across communion-related faces. Why this is so, is still an empirical question, but once more, this suggests that the valence of a trait is flexible and context-dependent. For instance, competence- and dominant-looking faces match positive and negative emotional expressions, respectively (Said, Sebe, & Todorov, 2009). This may constitute one reason why they exhibited an opposite linear relationship with valence.

Our results also suggest that participant gender interfered with the perceived valence of targets. Females preferred more submissive-looking faces compared with males, who instead preferred a low-to-moderate dominance appearance. This may have occurred because counter-stereotypical facial features (e.g., masculine-looking female faces) lead to amplified negative evaluations (Oh, Dotsch, Porter, & Todorov, 2019; Sutherland et al., 2015). These results concerning participant gender raise the possibility that self-perception may have modulated the perceived valence of traits—another interesting hypothesis to be addressed in future studies.

Another source of variability in our data may have been the standard used to support each trait rating. One possibility was that participants were making self-reference ratings (O'Mahony, 1984). This may have been more likely in Studies 1–2 than in Study 3, where targets were faces of "others". The actor–observer differences predicted by the Dual Perspective model proposed by Abele and Wojciszke (2014), according to which agency-related traits are more desirable for oneself (actor perspective), whereas communion-related traits are more desirable in others (observer perspective), could be underlying the divergent results found with faces (Study 3). This hypothesis should also be further explored.

5.1 | Considerations regarding the relationship between dimensions

Two traits that are clearly and linearly related should establish similar linear relationships with a third dimension (e.g., valence). Our results clearly indicate that not all of the traits encapsulated by the same Big Two dimension establish the same relationship with valence, as one would expect. Our findings would suggest that results regarding the relationship between agency and communion may critically depend upon the trait(s) selected in a study to represent the agency dimension. This is consistent with the stimulus-sampling explanation proposed by Imhoff and Koch (2017, p. 124) to account for the inconsistent relationship between the fundamental dimensions reported in the extant literature (Judd, James-Hawkins, Yzerbyt, & Kashima, 2005; Kervyn, Yzerbyt, & Judd, 2010; Rosenberg et al., 1968). Although Imhoff and Koch (2017) provide an example for societal groups, the same can be applied to traits. If alpha-traits (e.g., competence-related) are oversampled in a composite-score of agency, the resulting relationship with communion should be more linear than it would be if the trait set suffered from an oversampling of beta-traits (e.g., assertiveness-related) (but see also Judd, Garcia-Marques, & Yzerbyt, 2019). Regarding face evaluations, the distinct relationship that dominance and trustworthiness established with valence in Study 1 (Table 2) may be contributing to the orthogonality found between these two dimensions (Oosterhof & Todorov, 2008). If the independence between dominance and trustworthiness is an artifact resulting from a non-linear relationship, results will be contingent on how well a face set represents all the levels of dominance. Targets biased toward the lower (higher) levels of the dimension could promote a positive (negative) correlation between the dimensions. This could also explain why we did not detect a curvilinear, but instead a negative relationship between dominance and valence in Study 3.

5.2 | Limitations

Although the paradigm used in the present work adds to the correlational data in the literature, its methodology is not free of limitations and confounds. Our results could have been affected by the psychological tendency to dislike extremes of either type (Grant & Schwartz, 2011), which suggests that a non-linear relationship would be found by default in all relationships where extremity is represented. Even if this explains the results we obtained for dominance, it would not explain why extreme competence did not suffer from the same tendency. In addition, our procedure may lack the natural variability of a trait, truncating it at some level. This could lead us to believe that some traits are alpha traits when in fact they are beta. This problem is likely to be greater in Study 3 where no clear curvilinear relationships were found. Perhaps more extreme submissive faces, along with more differentiated intermediate stimuli, would increase sensitivity to any existent curvilinearity. Still, when we attend to Studies 1–2, we may conclude that when trait variability was described by the same labels, curvilinearity emerged more clearly for dominance than for competence. While we believe that our paradigm offers more compelling data than pure correlation measures for inferring the relationship between traits and valence, we also think that more data should be collected using different materials and labels than those used in our studies.

Other limitations of our approach include the possibility that our participants' features are moderating the effects, and the fact that our sample is far from being representative in terms of all relevant variables that can affect trait perception on the perceiver side such as, for instance, political ideology (Olivola, Sussman, Tsetsos, Kang, & Todorov, 2012) and self-perception (Srivastava, Guglielmo, & Beer, 2010).

6 | CONCLUSION

The present research examined the relationship between valence and core traits involved in personality impressions based on

conceptual knowledge and facial appearance. We found that: (a) the majority of core agency- and communion-related traits exhibited a linear relationship with valence and (b) dominance was the only trait establishing a clear quadratic relationship with valence, although this pattern was more evident in assessments of conceptual knowledge than in face evaluation. Our findings add to the current literature by clarifying the relationships between valence and the trait content of the Big Two using two different modalities of social stimuli (i.e., verbal and visual). Importantly, the present findings caution against assuming only linearity or curvilinearity in studies concerned with the relationship between the Big Two.

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CONFLICT OF INTEREST

The authors declared no conflicts of interest with respect to the authorship or the publication of this article.

ETHICAL STATEMENT

All of the reported studies in the manuscript were approved by the ethics committee of the ISPA—Instituto Universitário. This manuscript adheres to ethical guidelines described in the APA Code of Conduct, Declaration of Helsinki, Declaration of Geneva, Convention of Oviedo, and the Universal Declaration of Human Rights.

TRANSPARENCY STATEMENT

All the data, materials, and supporting information associated with this work are publicly available online at: https://osf.io/gc4d8/.

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SUPPORTING INFORMATION

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