A Framework for Profile Similarity: Integrating Similarity, Normativeness, and Distinctiveness

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ABSTRACT Many questions in personality psychology lend themselves to the analysis of profile similarity. A profile approach to issues such as personality judgment, personality similarity, behavioral consistency, developmental stability, and person-environment fit is intuitively appealing. However, it entails conceptual and statistical challenges arising from the overlap among profile similarity and normativeness, which presents potential confounds and potential opportunities. This article describes the normativeness problem, articulating the need to evaluate profile similarity alongside normativeness and distinctiveness. It presents conceptual and psychometric foundations of a framework differentiating these elements for pairs of profiles. It derives two models from this framework, and it discusses the application of their components to a variety of research domains. Finally, it presents recommendations and implications regarding the use of these components and profile similarity more generally. This approach can reveal and manage potential confounds, and it can provide theoretical insights that might otherwise be overlooked.

The analysis of profiles of psychological variables has an intuitive appeal. From a profile-based approach, an individual is scored on a set of variables obtained at one time, from one person, in one situation, or in response to one set of instructions. The individual's profile is then matched with a second profile of scores on the same set of variables, obtained at a different time, from a different person, in a different situation, or in response to a different set of instructions. The similarity between two profiles can represent many psychological phenomena such as personality similarity, personality judgment, behavioral consistency, developmental stability, clinical diagnosis, or person-environment fit.

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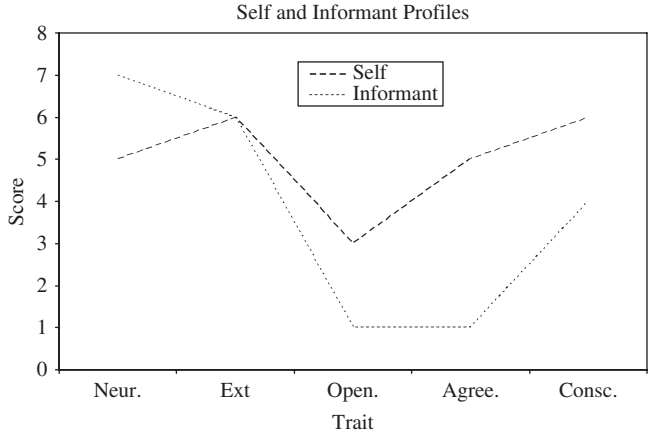

Figure 1
Profiles of self trait ratings and Informant trait ratings.

Figure 1 illustrates two psychological profiles in the context of self-other agreement of personality judgments. One profile represents a target person's self-rated profile of personality trait scores, and the other represents an acquaintance's informant-rated profile of the target's personality. The similarity in the shape of the two profiles reflects the degree to which the target and the informant agree upon the traits that are more and less characteristic of the target's personality. Profile similarity is usually defined in terms of the similarity in the pattern of peaks and valleys common to the two profiles. For example, both profiles in Figure 1 indicate that the target's Extraversion is greater than his or her Openness to Experience, and they both indicate that the target's Conscientiousness is greater than his or her Agreeableness. Although the two profiles do not have identical shapes, the degree of similarity indicates that this target and informant do have some agreement on the target's personality profile.

Despite its intuitive appeal, a profile-similarity approach raises conceptual and statistical problems. These problems largely concern the role of normativeness in creating apparently high levels of similarity between profiles or in obscuring meaningful effects. Although the normativeness problem in profile similarity has been recognized in some domains of research (e.g., Cronbach, 1955), there have been

few, if any, helpfully coherent and flexible frameworks for handling the problem. Furthermore, there have been few, if any, frameworks that are articulated for different domains of social and personality psychology.

The current article presents a solution to the normativeness problem. It presents a conceptual and psychometric framework differentiating normativeness and distinctiveness in the analysis of profile similarity, illustrates the utility of the framework, places the framework within the broader context of profile analysis, and presents recommendations for the use of the framework across many domains of social and personality psychology. The framework affords researchers an opportunity to gauge and potentially account for confounds in the analysis of profile similarity, and it allows researchers to disentangle meaningful effects that might be obscured.

This issue is important because profile similarity is used to examine many fundamental psychological phenomena. A profile approach has a long history in the study of personality judgment, in which interjudge agreement is defined as the degree to which a profile of trait scores as rated by one judge (e.g., the self) matches the profile of trait scores as rated by another judge (e.g., an informant; Baker & Block, 1957; Bernieri, Zuckerman, Koestner, & Rosenthal, 1994; Biesanz & West, 2000; Biesanz, West, & Millevoi, 2007; Blackman & Funder, 1998; Chaplin & Panter, 1993; Colvin, 1993a, 1993b; Cronbach, 1955; Furr, Dougherty, Marsh, & Mathias, 2007; Letzring, Wells, & Funder, 2006; Starzyk, Holden, Fabrigar, & MacDonald, 2006). A profile approach has also been used extensively for phenomena such as husband-wife personality similarity (Gaunt, 2006; Gonzaga, Campos, & Bradbury, 2007; Luo & Klohnen, 2005), cross-situational behavioral consistency (Champagne & Pervin, 1987; Furr & Funder, 2004; Krahé, 1990; Magnusson & Ekehammar, 1978; Ozer, 1986), personality pathology (Carlson & Furr, 2007; Lynam & Widiger, 2001; McCrae et al., 2001; Miller, Lynam, Widiger, & Leukefeld, 2001; Miller, Pilkonis, & Morse, 2004; Miller, Reynolds, & Pilkonis, 2004; Westen & Bradley, 2005; Westen, Shedler, & Bradley, 2006; Widiger, Trull, Clarkin, Sanderson, & Costa, 2002), and the temporal stability of personality (Asendorpf & Van Aken, 1991; Biesanz, West, & Kwok, 2003; Block, 1971; Caspi & Herbener, 1990; Ozer & Gjerde, 1989).

The Normativeness Problem

Profile normativeness creates conceptual and statistical challenges in interpreting profile similarity. The ability to gauge profile normativeness alongside profile similarity provides a way of coping with these challenges, and it represents an opportunity to explore new ideas in domains such as self-other agreement, marital similarity, behavioral consistency, and personality stability.

Profile normativeness is the degree to which a profile reflects an average profile—the similarity between an individual's profile of scores and a group's normative profile of scores. Figure 2 illustrates this, with Figure 2a presenting three targets' self-rated personality profiles. Note the commonality across the three individual profiles; two of the three profiles reflect a higher level of Extraversion than Neuroticism, and all three profiles indicate that the targets see themselves as less Open than Extraverted and Agreeable. Figure 2b presents the three targets' self-rated profiles along with a profile reflecting these normative trends. This Normative self-rated profile represents scores for each trait, as averaged across all targets' self-ratings. As Figure 2b illustrates, each target's self-rated profile is, at least, somewhat similar to the Normative self-rated profile, indicating that each target's profile reflects some normativeness.

There are at least three likely facts about profile normativeness. First, in analyses of trait profiles or behavioral profiles, the normative profile is likely to be "powerful" in that many individual profiles will be somewhat, if not very, normative. That is, normativeness is likely to characterize each individual's profile to some degree, as shown in Figure 2b. Second, two normative profiles are likely to be highly similar to each other. For example, the normative self-rated profile in Figure 2b is likely to be similar to a normative informant-rated profile arising from the informants who rate the targets. For example, Furr et al. (2007, Table 1) report normative trait profiles from adolescents' self-ratings and their mothers' informant ratings; the correlations between these profiles of facet scores were strong: $r = .83$ and $r = .94$ for adolescents with and without Conduct Disorder, respectively. Third, a normative profile likely has psychological meaning, particularly in terms of social desirability, psychological adjustment, or adaptation to one's environment. For example, among the adolescents without Conduct Disorder examined by Furr et al., the normative profile of adolescent self-ratings

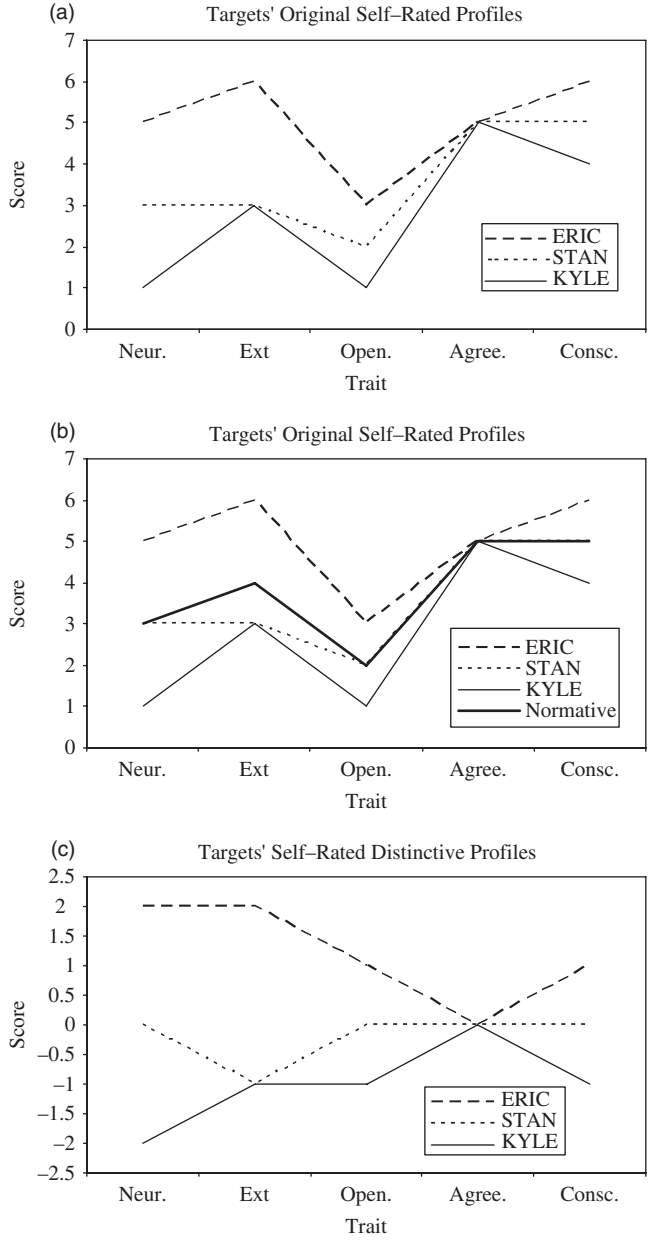

Figure 2
Raw profiles, Normative profile, and Distinctive profiles.

was highly correlated with independent ratings of trait social desirability, $r = .83$ and $r = .88$ (note that these analyses were not reported by Furr et al.). Together, these three likely facts imply that normativeness is a powerful and meaningful component that can affect profile similarity.

These likely facts have implications for the similarity between profiles and for the psychological meaning of similarity. The first two facts imply that any two profiles are likely to be similar, even without an intrinsic connection between the two profiles. For example, one target's self-rated personality profile is likely to be somewhat, if not very, similar to an informant-rated profile of another target. This is likely because (a) each target's self-rated profile is likely to be similar to the normative self-rated profile, (b) each informant-rated profile is likely to be similar to the normative informant-rated profile, and (c) the normative self-rated profile is likely to be similar to the normative informant-rated profile. This implication, along with the likely fact that normativeness has psychological meaning, implies that profile similarity can represent social desirability, adjustment, or adaptiveness. For example, high similarity between a target's self-rated profile and an informant-rated profile indicates high self-other agreement, perhaps suggesting that the informant knows the target well. But it may also, or alternatively, indicate that the target is well adjusted because normativeness is likely to be associated with similarity (as just described) and normativeness may reflect social desirability or psychological well-being.

These implications create at least two forms of the normativeness problem. First, they complicate the interpretation of average levels of profile similarity. We might wish, for example, to interpret a sample's average level self-other agreement (i.e., averaged across all target-informant pairs) as indicating the general depth of understanding between acquaintances. Unfortunately, this interpretation is clouded by the fact that any given target's self-rated profile of trait scores will likely be similar to any given informant's profile of trait scores. Thus, we would likely obtain a positive degree of self-other agreement even if acquaintances understood each other no better than did strangers. Cronbach (1955) and others have recognized this type of complication in the context of personality judgments, but it also has important implications for other applications of profile similarity. For example, any given wife's profile will likely be similar to any given husband's profile, which clouds our ability to evaluate

the general level of personality similarity within married couples. The second problem introduced by the normativeness implications concerns the interpretation of any correlates of profile similarity. For example, we might examine self-other agreement and private self-consciousness, finding a positive correlation between the two. We might interpret this as indicating that self-other agreement arises when targets are attentive to their inner experiences and have good self-insight. But self-other agreement, as a form of profile similarity, may partially reflect psychological adjustment. Therefore, the positive correlation between self-other agreement and private self-consciousness could be interpreted as indicating simply that people who have high private self-consciousness are relatively well-adjusted, with no clear implication for the nature of self-other agreement. This creates ambiguity in interpreting "depth of mutual understanding of a target's personality" versus psychological adjustment as a correlate of private self-consciousness.

Two Possible Analytic Strategies

There are at least two broad strategies for coping with the normativeness problem in profile-based analyses—a sample-level strategy and a pair-level strategy. Although both strategies have been used to account for normativeness, a pair-level strategy offers the potential of greater flexibility and information.

Sample-Level Strategy (Random Dyads)

In a sample-level approach to normativeness, the average similarity between pairs of profiles is compared to a normative level of similarity across the entire sample. That is, similarity is computed between each profile and its true complementary profile (e.g., between each target and his or her informant, or between each wife and her husband) and similarity is computed between random pairs of profiles (e.g., between a given target and another target's informant, or between a wife from one couple and a husband from another couple). The average similarity between "true" pairs is then contrasted with the average similarity between random pairs. In the context of couples, Kenny et al. (2006, pp. 335–337) refer to this approach as "pseudo-couple analysis."

Letzring et al. (2006) present an excellent application of this approach. In this profile-based examination of self-other agreement,

participants interacted with each other in small groups, provided self-reports of their personality, and then provided informant reports of the other group members' personalities. To examine the general level of self-other agreement between two individuals who have interacted with each other, Letzring and her colleagues computed a similarity correlation between each target participant's self-rated profile of trait scores and an informant's profile of trait ratings. A strong positive correlation indicated agreement between the self's profile and the informant's profile. Letzring et al. recognized the complexity that normativeness introduces into this issue, stating that "the baseline correlation between two sets of ratings was not expected to be zero, as some items of the [trait questionnaire] are generally rated higher than others, regardless of the target" (p. 118). Thus, a self-other agreement correlation might be positive, not because the informant knows anything distinctive about the target but because the informant realizes that the typical person has higher levels of some specific traits than of others. Addressing this problem, Letzring et al. created "random pairs" by pairing a profile from one target with a profile from an individual with whom the target had not interacted, and they computed a profile-similarity correlation for each random pair. After repeated pairings, the mean of the random pair correlations was used as a baseline profile correlation reflecting agreement between two unacquainted people. The average similarity between the "real" acquainted self-other pairs was then contrasted with the baseline profile correlation, and the difference was interpreted as the degree to which acquaintance affects self-other agreement. In their experimental examination, Letzring et al. found that "real" self-other agreement was higher than baseline agreement when more than minimal acquaintanceship was attained.

Similarly, Luo and Klohnen (2005) used a sample-level approach in their examination of assortative mating (i.e., the hypothesis that people select mates who are relatively similar to themselves). To explore the similarity between husbands and wives, Luo and Klohnen computed a similarity correlation between each husband's profile of self-reported personality trait scores and his wife's profile of self-reported trait scores. Acknowledging the normativeness problem, Luo and Klohnen stated that "individuals, on average, tend to be more similar than dissimilar" (p. 311). That is, husbands and wives might have similar profiles, but any two adults might have relatively similar profiles. Addressing this facet of the normativeness problem, they

created "random couples" by pairing a profile from a husband in one couple with a profile from a wife in a different couple, and they computed a similarity correlation for each random couple. After many random pairings, the mean correlation was interpreted as "the average similarity between men and women" (p. 311). The average similarity between the "real" couples was then contrasted with the average similarity between randomly paired couples, and the difference was interpreted as the degree to which real couples are more similar than are random pairs of men and women. In their examination of more than 20 domains of personality and attitudes, Luo and Klohnen found that, on average, husbands and wives were indeed similar to each other, but they found that that the average real couple showed significantly higher similarity than would be expected based on the sample normativeness for only 5 domains (particularly in attitude domains).

The sample-level strategy is an effective method of addressing one form of the normativeness problem, allowing researchers to evaluate the average level of similarity in a way that accounts for normativeness. Indeed, given the nature of the questions addressed by Letzring et al. (2006) and given their experimental design, the sample-level approach was reasonable and useful. Similarly, the sample-level approach used by Luo and Klohnen (2005) was sufficient to examine "general level of marital similarity." Although the sample-level strategy can be used to address one form of the normativeness problem, a pair-level strategy can be used to address both forms—the average level of similarity and the correlates of similarity.

Pair-Level Strategy

In a pair-level strategy, the similarity between each pair of profiles is decomposed into elements of normativeness or distinctiveness. For example, in the study of self-other agreement, researchers might wish to evaluate the normativeness of each self-rated profile or to index the degree to which a target-informant pair agrees about the distinctive (i.e., nonnormative) qualities of the target's personality. Similarly, in the study of marital similarity, researchers might wish to evaluate the normativeness of each spouse's trait profile or to index the degree to which each couple shares distinctive personality qualities.

The framework presented in the next section is a pair-level strategy decomposing overall profile similarity into components of distinctiveness and normativeness, and it is intended to accomplish four goals. First, it provides a framework that is internally coherent, in that its components are meaningful and their connections are psychometrically well-defined. Second, it is applicable to a common data structure in profile similarity—data in which each profile is linked to only one other profile (e.g., each self-rating is linked to one informant rating, each wife is linked to one husband). Third, the framework is intended to be meaningfully applicable to any form of profile similarity—self-other agreement, marital similarity, behavioral consistency, personality stability, person-environment fit, and so on. Fourth, it provides flexibility in the components that researchers might examine, thus providing flexibility in the psychological questions that can be addressed. Specifically, the framework to be described allows researchers to examine several ways of conceptualizing and indexing profile normativeness, distinctiveness, and similarity.

Conceptual Basis of the Framework

The current pair-level framework decomposes profile similarity into components of normativeness and distinctiveness. This decomposition of profile similarity begins by decomposing each individual's profile into two specialized profiles.

Decomposition of Individual Profiles

An individual's profile can be seen as arising from two profiles—a normative profile representing a group's average profile and a distinctive profile representing the ways in which the individual is above or below average on each trait. Figure 2c presents three distinctive profiles related to the profiles in Figure 2b. Eric's distinctive self-reported Neuroticism score is 2, reflecting the difference between Eric's original self-reported Neuroticism score (i.e., 5) and the normative self-reported Neuroticism score (i.e., 3). Similarly, his distinctive Agreeableness score is 0, reflecting the fact that his self-reported Agreeableness score (i.e., 5) matches the normative self-reported Agreeableness score (i.e., 5). In sum, an individual's distinctive profile includes deviation scores reflecting the ways in which the individual deviates from the normative profile. Consequently, an individual's raw profile

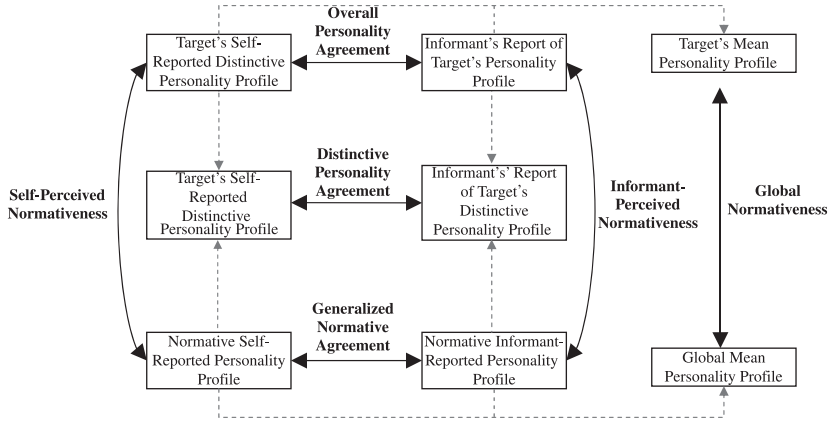

Figure 3
Model 1 applied to self-other agreement in personality judgments.

of scores (e.g., Figure 2a) arises from a normative profile and from his or her distinctive profile. Figures 3 and 4 present the three basic profiles—profiles of raw/unadjusted traits scores, of normative scores, and of distinctive scores.

Overall Similarity

In the current framework, Overall Similarity is the correlation between two raw, unadjusted profiles. This is illustrated in Figure 3, in which the boxed terms represent various personality profiles (e.g., a target's self-reported personality profile, a targets' distinctive profile), and the solid lines and bold text represent the components of self-other agreement, in terms of similarity, normativeness, and distinctiveness. Overall similarity is the typical index of profile similarity, often interpreted as agreement, consistency, stability, fit, correspondence, depending on the relevant research domain. As described above, Overall Similarity is potentially confounded with normativeness, and the current framework decomposes Overall Similarity into three types of components.

Distinctive Similarity

Distinctive Similarity reflects the similarity between the unique aspects of the two profiles within a pair—the degree to which one

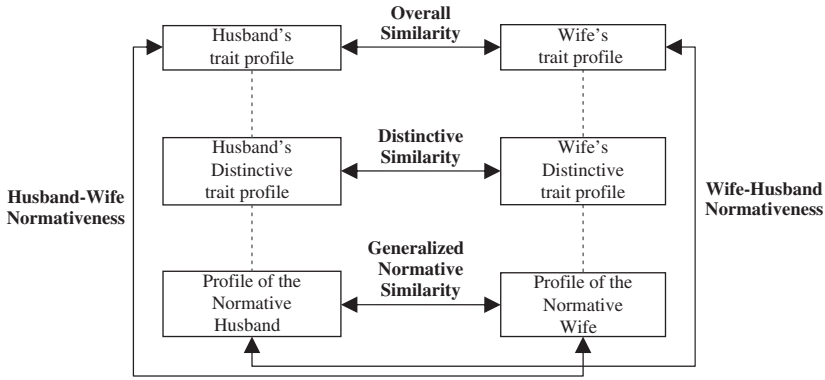

Figure 4
Elements of Model 2 applied to husband-wife similarity.

distinctive profile matches another distinctive profile. In self-other agreement (see Figure 3), Distinctive Agreement is the similarity between the distinctive aspects of a target person's self-perception and the distinctive aspects of an informant's perception. For example, a target might describe himself in a way that reflects above-average Extraversion and below-average Openness as compared to other targets. If his informant also describes him in a way that reflects above-average Extraversion and below-average Openness, then the two profiles have high Distinctive Similarity. In marital similarity (see Figure 4), Distinctive Similarity is the similarity between a wife and husband's distinctive profile—the degree to which the couple shares unusually high and low trait levels.

Generalized Normative Similarity

Generalized Normative Similarity reflects the similarity between two normative profiles. In self-other agreement, for example, this is the similarity between the average self-rating and the average rating provided by informants (i.e., the degree to which the average target's self-perception matches the average informant's perception). As illustrated in Figure 3, this component reflects *Generalized Normative Agreement*. In marital similarity, this component reflects similarity between the average husband and the average wife (see Figure 4). Generalized Normative Similarity is constant across all pairs of profiles—that is, the similarity within each husband-wife pair (i.e., each

pair's Overall Similarity) is partially explained by the similarity between the average husband and the average wife (i.e., the Generalized Normative Similarity within the sample). As mentioned earlier, two normative profiles are likely to be similar to each other (e.g., the average wife will likely be similar to the average husband). Therefore, Generalized Normative Similarity is likely to be large in many applications of profile similarity.

Profile-Level Normativeness

The third type of component reflects the normativeness of each profile or of each pair of profiles. These components can be conceptualized in at least two ways, producing two meaningful models of profile similarity.

In Model 1 (see Figure 3), there are three remaining components. Two of these are Within-Profile Normativeness components reflecting the normativeness of each profile. That is, they reflect the similarity between each profile and the normative profile of its type. In self-other agreement, one Within-Profile Normativeness component reflects the degree to which the target's self-perception is normative—the similarity between a target's self-rated trait profile and the average target's self-rated trait profile. The other Within-Profile Normativeness component reflects the degree to which the informant's perception is normative—the similarity between an informant's profile of trait ratings and the average informant's profile. Complementing the two Within-Profile Normativeness components, Model 1 includes a Global Normativeness component. This component reflects the normativeness of each pair of profiles—the degree to which the average of a pair of profiles matches the average of all profiles. It is the similarity between two new averaged profiles (see Figure 3). The first new profile is a *Pair Mean* profile that includes scores averaged across both profiles in a given pair. In self-other agreement, the Pair Mean profile is the target's personality profile averaged across self-ratings and informant ratings. The second new average profile is a *Global Mean* profile that includes scores averaged across all individuals and all profiles. In self-other agreement, it is the profile of the average person, averaged across all self-ratings and all informant ratings. Based on the two averaged profiles, Global Normativeness represents the similarity between a Pair Mean profile and the Global Mean profile. In self-other agreement (see Figure 3), it reflects the

degree to which a given target (as seen by self and informant) matches the average target (as seen by all selves and all informants).

As presented in Figure 4, Model 2 provides a different conceptualization of the pair-level normativeness components. In Model 2, this includes two *Cross-Profile Normativeness* components reflecting similarity between a profile and the average of the other type of profile. Figure 4 illustrates this in the context of marital similarity. Husband-wife normativeness represents the similarity between a particular husband and the average wife, and wife-husband normativeness represents similarity between a particular wife and the average husband.

Table 1 summarizes the general conceptual framework as reflected in both models. The models provide alternatives in the examination of profile similarity from many domains of research. As detailed later, these alternatives allow researchers to use components most closely fitting their theoretical interests, with the knowledge that they are valid and coherent components of profile similarity.

Table 1 also summarizes the psychometric basis of these models. The next section develops these psychometric foundations, demonstrating that these models are internally coherent. That is, Overall Similarity can be fully decomposed into the components presented in Table 1.

Psychometric Foundations

In a profile approach to phenomena such as self-other agreement and personality similarity, a person's scores in one profile are matched with scores in a second profile. For example, self-other agreement requires an individual's personality to be rated by two sources—the target person's self-ratings of personality comprise one profile and the informant's ratings comprise the second profile. The following notation reflects the general case:

i = any one individual ($i = 1$ to n_i)
v = any one variable in a profile ($v = 1$ to n_v)
p = either of two profiles ($p = 1$ to 2)
x_{ivp} = the score of individual i on variable v in profile p

For example, in the analysis of self-other agreement of personality trait judgments, x_{142} represents individual 1's score on trait 4, as rated by judge 2 (i.e., the informant).

Table 1
Profile Similarity Components Applied to Four Domains of Research

Models and Profile Similarity Components

Model 1

General conceptual framework

Overall Similarity	=	Distinctive Similarity	Generalized Normative Similarity	Within-Profile Normativeness 1	Within-Profile Normativeness 2	Global Normativeness
Covariance terms						
$\sigma_{x_{iv1}x_{iv2}}$	$= \sigma_{x'_{iv1}x'_{iv2}}$		$- \sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}}$	$- \sigma_{\bar{x}_{\bullet v1}x_{iv1}}$	$- \sigma_{\bar{x}_{\bullet v2}x_{iv2}}$	$+ 4\sigma_{\bar{x}_{i\bullet}\bar{x}_{\bullet v\bullet}}$

Correlational terms

$$r_{x_{iv1}x_{iv2}} = \frac{\sigma_{x'_{iv1}}\sigma_{x'_{iv2}}r_{x'_{iv1}x'_{iv2}} - \sigma_{\bar{x}_{\bullet v1}}\sigma_{\bar{x}_{\bullet v2}}r_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} - \sigma_{\bar{x}_{\bullet v1}}\sigma_{x_{iv1}}r_{\bar{x}_{\bullet v1}x_{iv1}} - \sigma_{\bar{x}_{\bullet v2}}\sigma_{x_{iv2}}r_{\bar{x}_{\bullet v2}x_{iv2}} + 4\sigma_{\bar{x}_{i\bullet}}\sigma_{\bar{x}_{\bullet v\bullet}}r_{\bar{x}_{i\bullet}\bar{x}_{\bullet v\bullet}}}{\sigma_{x_{iv1}}\sigma_{x_{iv2}}}$$

Model 2

General conceptual framework

Overall Similarity	=	Distinctive Similarity	Generalized Normative Similarity	Cross-Profile Normativeness 1	Cross-profile Normativeness 2
Covariance terms					
$\sigma_{x_{iv1}x_{iv2}}$	$= \sigma_{x'_{iv1}x'_{iv2}}$		$- \sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}}$	$+ \sigma_{\bar{x}_{\bullet v1}x_{iv2}}$	$+ \sigma_{\bar{x}_{\bullet v2}x_{iv1}}$

Correlational terms

$$r_{x_{iv1}x_{iv2}} = \frac{\sigma_{x'_{iv1}}\sigma_{x'_{iv2}}r_{x'_{iv1}x'_{iv2}} - \sigma_{\bar{x}_{\bullet v1}}\sigma_{\bar{x}_{\bullet v2}}r_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} + \sigma_{\bar{x}_{\bullet v1}}\sigma_{x_{iv2}}r_{\bar{x}_{\bullet v1}x_{iv2}} + \sigma_{\bar{x}_{\bullet v2}}\sigma_{x_{iv1}}r_{\bar{x}_{\bullet v2}x_{iv1}}}{\sigma_{x_{iv1}}\sigma_{x_{iv2}}}$$

Decomposition of Individual Profiles

As described earlier, an individual's profile of scores can be seen as arising from a normative profile and from a distinctive profile. More technically, an individual's observed score on a variable in a profile can be seen as a composite of two elements—a normative element and a distinctive element:

$$x_{ivp} = \bar{x}_{\bullet vp} + x'_{ivp} \qquad \text{Eq.1}$$

where $\bar{x}_{\bullet vp}$ is the mean score on the variable in that profile, averaged over all individuals, and where x'_{ivp} is the degree to which an individual's score on the variable in that profile deviates from the mean score on the variable in that profile (i.e., $x'_{ivp} = x_{ivp} - \bar{x}_{\bullet vp}$). The mean score reflects the group's normative level of that variable in that profile, and the deviation score reflects the degree to which the individual is "distinctive" from the group norm on the variable in the profile. An individual's scores on a variable from two profiles (e.g., a self-profile and an informant profile) are:

$$x_{iv1} = \bar{x}_{\bullet v1} + x'_{iv1} \qquad \text{Eq.2a}$$

$$x_{iv2} = \bar{x}_{\bullet v2} + x'_{iv2} \qquad \text{Eq.2b}$$

Table 2 presents a small example, with three individuals measured on five variables (i.e., traits) by two raters—self and informant (i.e., Profile 1 and 2, respectively). Note, for example, that Kyle's (individual 1) score on Openness trait 3) in his self-rated profile ($x_{131} = 1$) is the sum of the mean score on Openness across all self-ratings situation 1 ($\bar{x}_{\bullet 31} = 2$)and his distinctiveness on Openness within the self-ratings 1 ($x'_{131} = -1$). Thus, Kyle describes himself as distinctively low on Openness.

Initial Decomposition of Profile Similarity

There are several ways to quantify profile similarity (e.g., Cattell 1949; Cohen, 1969; Cronbach & Gleser, 1953; Furr, 2007; McCrae, 1993), and the current framework focuses on the covariance and correlation between profiles. A positive covariance or correlation between profiles indicates that the relative order of variables in one profile is similar to the relative order of variables in the other profile. For example, a target individual's extraversion, agreeableness, and openness might be rated by himself and by an informant, with the

Table 2
Example Data for Computing Components of Similarity, Normativeness, and Distinctiveness

Target = Kyle Trait	Self Rating	Inf. Rating	Distinctive Self Rating	Distinctive Inf. Rating	Kyle's Mean Profile
Neuroticism	1	1	−2	0	1
Extraversion	3	3	−1	0	3
Openness	1	2	−1	−1	1.5
Agreeableness	5	5	0	0	5
Conscientiousness	4	6	−1	0	5
Mean	2.8	3.4	−1	−0.25	5
Std Dev	1.60	1.85	.71	.43	3.42
Target = Stan Trait	Self rating	Inf. rating	Distinctive Self rating	Distinctive Inf. rating	Stan's Mean Profile
Neuroticism	3	1	0	0	2
Extraversion	3	3	−1	0	3
Openness	2	5	0	2	3.5
Agreeableness	5	6	0	1	5.5
Conscientiousness	5	5	0	−1	5
Mean	3.6	4	−0.25	0.75	3.8
Std Dev	1.20	1.79	.43	.83	1.29
Target = Eric Trait	Self rating	Inf. rating	Distinctive Self rating	Distinctive Inf. rating	Eric's Mean Profile
Neuroticism	5	1	2	0	3
Extraversion	6	3	2	0	4.5
Openness	3	2	1	−1	2.5
Agreeableness	5	4	0	−1	4.5
Conscientiousness	6	7	1	1	6.5
Mean	5	3.4	1.25	−0.5	4.2
Std Dev	1.10	2.06	.83	.50	1.40
Norms Trait	Normative Self-rating	Normative Inf. rating			Global Mean Profile
Neuroticism	3	1			2
Extraversion	4	3			3.5
Openness	2	3			2.5
Agreeableness	5	5			5
Conscientiousness	5	6			5.5
Mean	3.5	3			3.25
Std Dev	1.12	1.41			1.15

target's self-ratings indicating high extraversion, moderate agreeableness, and low openness. A positive covariance or correlation between the self-rated profile and an informant-profile indicates that the informant also sees the target as more extraverted than agreeable, and more agreeable than open. Thus, the relative order of the trait ratings in one profile (i.e., self-ratings) is similar to the relative order of the trait ratings in the other profile (i.e., informant-ratings).

Because an individual's observed score on each variable is conceptualized as a composite, the covariance between two profiles of scores can be seen as the covariance between two composites. In this framework, the covariance between two profiles initially can be decomposed into four separate covariances (Nunnally & Bernstein, 1994, p. 171):

$$\sigma_{x_{iv1}x_{iv2}} = \sigma_{x'_{iv1}x'_{iv2}} + \sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} + \sigma_{\bar{x}_{\bullet v1}x'_{iv2}} + \sigma_{\bar{x}_{\bullet v2}x'_{iv1}} \qquad \text{Eq.3}$$

The $\sigma_{x_{iv1}x_{iv2}}$ component is Overall Similarity (i.e., the covariance between individual i's two profiles of observed scores), $\sigma_{x'_{iv1}x'_{iv2}}$ is Distinctive Similarity (i.e., the covariance between the individual's two profiles of distinctiveness scores), and $\sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}}$ is Generalized Normative Similarity (i.e., the covariance between the two group mean profiles). Two additional components emerge from this initial decomposition of overall similarity, although they are less likely to have wide psychological meaning. Specifically, the $\sigma_{\bar{x}_{\bullet v1}x'_{iv2}}$ component is the covariance between the individual's distinctiveness scores for Profile 2 and the group means for Profile 1, and $\sigma_{\bar{x}_{\bullet v2}x'_{iv1}}$ is the covariance between the individual's distinctiveness scores for Profile 1 and the group means for Profile 2. See Appendix A for algebraic details of this derivation, and for terms used in the two substantive models.

This initial decomposition lays the psychometric foundation for Model 1 and Model 2 (see Table 1), which are likely to have broad psychological meaning and utility. Although a variety of models could be derived, Model 1 and Model 2 are likely to be applicable across a wide range of phenomena. The two models are equivalent in terms of producing the same values for Overall Similarity, but they reflect components with meaningfully different psychological implications.

Profile Similarity Model 1

As described earlier, Model 1 includes Distinctive Similarity, Generalized Normative Similarity, and three components of profile-level

normativeness (i.e., two Within-profile normativeness components and a Global Normativeness component). On a covariance metric, the initial decomposition can be re-parameterized (see Appendix B for details) to reflect an individual's Overall Similarity score as:

$$\sigma_{x_{iv1}x_{iv2}} = \sigma_{x'_{iv1}x'_{iv2}} - \sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} - \sigma_{\bar{x}_{\bullet v1}x_{iv1}} - \sigma_{\bar{x}_{\bullet v2}x_{iv2}} + 4\sigma_{\bar{x}_{iv\bullet}\bar{x}_{\bullet v\bullet}} \qquad \text{Eq.4}$$

where the first three components (i.e., $\sigma_{x_{iv1}x_{iv2}}$, $\sigma_{x'_{iv1}x'_{iv2}}$, and $\sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}}$) are defined above—Overall Similarity, Distinctive Similarity, and Generalized Normative Similarity. Model 1 includes three additional components. One Within-Profile Normativeness component reflects the similarity between the individual's scores in Profile 1 and the group norms for Profile 1. Specifically, $\sigma_{\bar{x}_{\bullet v1}x_{iv1}}$ is covariance between individual i's scores in Profile 1 and the group mean scores for Profile 1. A second Within-Profile Normativeness component reflects the similarity between the individual's scores in Profile 2 and the group norms for Profile 2. Specifically, $\sigma_{\bar{x}_{\bullet v2}x_{iv2}}$ is covariance between individual i's scores in Profile 2 and the group mean scores for Profile 2.

The final component of Model 1 is Global Pair-Level Normativeness, reflecting the degree to which the average of a pair of profiles matches the average of all profiles. As discussed earlier (see Figure 1) this component reflects the degree to which a given target (as seen by self and informant) matches the average target (as seen by all selves and all informants). Again, Global Normativeness is the match between two new profiles. The first is a "Pair Mean" profile—a set of scores averaged across both profiles in a given pair, with each score defined as:

$$\bar{x}_{iv\bullet} = (x_{iv1} + x_{iv2})/2 \qquad \text{Eq.5}$$

In self-other agreement, this reflects an individual's profile of average scores across a pair of judges (i.e., self and informant). The second new profile is a "Global Mean" profile—a set of scores averaged across all individuals and across both sets of profiles, with each score defined as:

$$\bar{x}_{\bullet v\bullet} = (\bar{x}_{\bullet v1} + \bar{x}_{\bullet v2})/2 \qquad \text{Eq.6}$$

In self-other agreement, this reflects the average person as rated across both kinds of judges. Based on these two profiles, Global Pair-Level Normativeness is the similarity between a Pair Mean profile and the Global Mean profile. Most generally, this indicates the degree to which the individual on average is similar to the group norm across all profiles. Table 2 presents the two averaged profiles

for the example data. Table 3 presents the Model 1's similarity covariances and correlations for the data in Table 1.

The derivation of the current framework emerges most easily in terms of covariances, but most applications of profile similarity are likely to use a correlations. Thus, Model 1 can be translated onto a correlational metric:

$$r_{x_{iv1}x_{iv2}} = \frac{\sigma_{x'_{iv1}}\sigma_{x'_{iv2}}r_{x'_{iv1}x'_{iv2}} - \sigma_{\bar{x}_{\bullet v1}}\sigma_{\bar{x}_{\bullet v2}}r_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} - \sigma_{\bar{x}_{\bullet v1}}\sigma_{x_{iv1}}r_{\bar{x}_{\bullet v1}x_{iv1}} - \sigma_{\bar{x}_{\bullet v2}}\sigma_{x_{iv2}}r_{\bar{x}_{\bullet v2}x_{iv2}} + 4\sigma_{\bar{x}_{iv\bullet}}\sigma_{\bar{x}_{\bullet v\bullet}}r_{\bar{x}_{iv\bullet}\bar{x}_{\bullet v\bullet}}}{\sigma_{x_{iv1}}\sigma_{x_{iv2}}} \quad \text{Eq.7}$$

Table 1 summarizes Model 1 at the conceptual level, on a covariance metric, and on a correlational metric.

Profile Similarity Model 2

As described earlier, Model 2 includes Distinctive Similarity, Generalized Normative Similarity, and two components of Profile-Level Normativeness (i.e., two Cross-Profile Normativeness components). On a covariance metric, the initial decomposition can be re-parameterized (see Appendix C for details) to reflect an individual's Overall Similarity score as:

$$\sigma_{x_{iv1}x_{iv2}} = \sigma_{x'_{iv1}x'_{iv2}} - \sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} + \sigma_{\bar{x}_{\bullet v1}x_{iv2}} + \sigma_{\bar{x}_{\bullet v2}x_{iv1}} \quad \text{Eq.8}$$

Again, $\sigma_{x_{iv1}x_{iv2}}$, $\sigma_{x'_{iv1}x'_{iv2}}$, and $\sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}}$represent Overall Similarity, Distinctive Similarity, and Generalized Normative Similarity, respectively. The first Cross-Profile Normativeness component is $\sigma_{\bar{x}_{\bullet v1}x_{iv2}}$—the covariance between individual i's scores in Profile 2 and the group mean scores for Profile 1. As discussed earlier in terms of marital similarity, this is the similarity between a particular husband and the average wife. The second Cross-Profile Normativeness component is $\sigma_{\bar{x}_{\bullet v2}x_{iv1}}$—the covariance between individual *i*'s scores in Profile 1 and the group mean scores for Profile 2. In terms of marital similarity, this is the similarity between a particular wife and the average husband.

Again, researchers working with profile similarity will generally prefer a correlational similarity index (e.g., Luo & Klohnen, 2005).

Table 3
Profile Similarity Components for Three Models: Covariances and Correlations

		Models/Profile Similarity Components						
		Both Models		Model 1			Model 2	
Individual	Overall Agreement	Distinctive Agreement	Gen. Norm. Agreement	Self Norm	Other Norm	Global Norm	Other-self Norm	Self-Other Norm
				Covariances				
	$\sigma_{x_{iv1}x_{iv2}}$	$\sigma_{x'_{iv1}x'_{iv2}}$	$\sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}}$	$\sigma_{\bar{x}_{\bullet v1}x_{iv1}}$	$\sigma_{\bar{x}_{\bullet v2}x_{iv2}}$	$\sigma_{\bar{x}_{iv\bullet}\bar{x}_{\bullet v\bullet}}$	$\sigma_{\bar{x}_{\bullet v1}x_{iv2}}$	$\sigma_{\bar{x}_{\bullet v2}x_{iv1}}$
Kyle	2.680	.000	1.520	1.760	3.160	2.280	1.880	2.320
Stan	1.000	.080	1.520	1.320	2.600	1.590	.800	1.640
Eric	1.200	.240	1.520	1.000	3.360	1.710	1.880	.600
				Correlations				
	$r_{x_{iv1}x_{iv2}}$	$r_{x'_{iv1}x'_{iv2}}$	$r_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}}$	$r_{x'_{\bullet v1}x_{iv1}}$	$r_{\bar{x}_{\bullet v2}x_{iv2}}$	$r_{\bar{x}_{iv\bullet}\bar{x}_{\bullet v\bullet}}$	$r_{\bar{x}_{\bullet v1}x_{iv2}}$	$r_{\bar{x}_{\bullet v2}x_{iv1}}$
Kyle	.903	.000	.748	.943	.977	.999	.869	.832
Stan	.466	.196	.748	.943	.834	.899	.383	.784
Eric	.532	.429	.748	.783	.936	.825	.783	.314

On a correlational metric, Model 2 is:

$$r_{x_{iv1}x_{iv2}} = \frac{\sigma_{x'_{iv1}}\sigma_{x'_{iv2}}r_{x'_{iv1}x'_{iv2}} - \sigma_{\bar{x}_{\bullet v1}}\sigma_{\bar{x}_{\bullet v2}}r_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} + \sigma_{\bar{x}_{\bullet v1}}\sigma_{x_{iv2}}r_{\bar{x}_{\bullet v1}x_{iv2}} + \sigma_{\bar{x}_{\bullet v2}}\sigma_{x_{iv1}}r_{\bar{x}_{\bullet v2}x_{iv1}}}{\sigma_{x_{iv1}}\sigma_{x_{iv2}}}$$

Eq.9

Table 1 summarizes Model 2 at the conceptual level, on a covariance metric, and on a correlational metric.

Computations

The previous sections presented conceptual and psychometric foundations of a framework differentiating similarity, normativeness, and distinctiveness. The current section provides computational foundations. Applied to the hypothetical data in Table 2, they produce the values in Table 3.[1]

The computational process can be summarized in three steps, framed here in terms of self-other agreement. The first step is to compute the normative profile for each of the two sets of profiles (i.e., the $\bar{x}_{\bullet v1}$ values and the $\bar{x}_{\bullet v2}$ values for each variable, see the Mean Self-Rating Profile and the Mean Informant-Rating Profile in Table 2). One normative profile is the set of "self" mean scores for each variable averaged across all targets' self-ratings. The other normative profile is the "informant" set of mean scores for each variable, averaged across all informants' ratings. The second step is to compute distinctive profiles, along with other mean profiles related to Model 1 and/or Model 2. These profiles are computed as differences between profiles (i.e., a distinctive profile is computed as $x'_{ivp} = x_{ivp} - \bar{x}_{\bullet vp}$) or as averages across profiles (e.g., Eric's Mean Profile). In the third step, correlations among all profiles are computed for each pair (e.g., $r_{x_{iv1}x_{iv2}}$, $r_{x'_{iv1}x'_{iv2}}$), producing the various components seen Model 1 and 2.

As revealed by the correlations reported in Table 3, all three targets have relatively high self-other agreement. Kyle has the highest Overall Agreement correlation, reflecting the fact that relatively high scores in his self-rated profile of traits tend to be paired with relatively high scores in his informant's profile of ratings (and low scores are paired with low scores). More specifically, Kyle describes himself as more Agreeable and Conscientious than Neurotic, Extraverted,

1. A SAS program written to conduct these analyses is available online at: http://www.wfu.wdu/ ~ furrrm/profile1.sas

and Open, and Kyle's informant describes him in a similar way. Note that, for all three targets, Distinctive Agreement correlations are lower than the Overall Agreement correlations. This pattern of results indicates that, to some degree, Overall Agreement is driven by normativeness. Nevertheless, two of the targets have positive Distinctive Agreement. For example, Eric's level of Distinctive Agreement indicates that the ways in which he described himself distinctively (i.e., different from the normative target's self-rating) are in agreement with the ways in which he was described distinctively by his informant. Note that all three targets have identical values for Generalized Normative Agreement, which is the similarity between the normative self-rating profile and the normative informant-rating profile.

Table 3 also shows the normativeness indices within the two models. For Model 1, Kyle's strong positive "Self-Normativeness" correlation reveals that he sees himself in a highly normative manner. Similarly, Kyle's high level of "Other Normativeness" indicates that his informant sees him as typical, as compared to the way that most informants saw their targets. Finally, the Global Normativeness correlations reflect the degree to which each participant's mean trait profile is similar to the group's mean trait profile across both raters (i.e., the Global Mean Profile in Table 2). For example, Kyle's very strong positive Global Normativeness correlation indicates that he was seen by himself and his informant as nearly identical to the average person. That is, his general trait profile is similar to the average person's general trait profile. For Model 2, there are two Cross-Profile Normativeness correlations For example, Kyle's large "Other-self-normativeness" correlation indicates that his informant described him has having a high level of traits that characterized most self-ratings to a relatively high degree. That is, his informant's description of Kyle closely matches the typical target's self-rating.

Note that the current models produce components that are not necessarily orthogonal across participants. However, by using correlations as the indices of profile similarity (instead of covariances), researchers avoid confounding individual differences in degree of similarity with individual differences in degree of profile variability. The covariances discussed earlier lay the psychometric foundation for the framework, but researchers are most likely to examine the components in terms of correlations.

Applications of the Framework

Thus far, the framework's meaning and its potential application have been articulated within two domains of research: self-other agreement and personality similarity. This section presents a broader perspective on the framework's meaning and utility by discussing (a) insights gained through actual applications of the framework (or of analysis that are conceptually consistent with the framework); (b) applications of the framework in other common uses of profile similarity (i.e., cross-situational behavioral consistency and temporal stability of personality, see Table 4); and (c) the meaning of components that were not discussed in the earlier examples (e.g., the application of Model 2 components to self-other agreement). These applications are intended to (a) illustrate that the current framework is likely interpretable in any examination of profile similarity, (b) provide a language for discussing the components within four very common applications of profile similarity, and (c) provide sufficient background so that the framework can be adapted easily to other applications of profile similarity. As these applications illustrate, the current framework can be used to evaluate the normativeness problem as a potential confound and to allow hypothesis-testing aimed specifically for various components of normativeness and distinctiveness.

Self-Other Agreement

There are at least two studies illustrating the useful application of the current framework to self-other agreement. These studies provide evidence for at least two important issues: (a) the utility of examining Distinctive Similarity alongside Overall Similarity and (b) the utility of examining one or more form of Normativeness to provide deeper insight into self-other agreement processes.

One example is an examination of the hypothesis that self-other agreement is lower among adolescents with personality pathology than among adolescents without personality pathology (Furr et al., 2007). Adolescents—some diagnosed with Conduct Disorder (CD) and others without any disorder—rated themselves and were rated by their mothers on a trait measure, and hypotheses suggested lower agreement among adolescents with CD than among

Table 4
Profile Similarity Components Applied to Common Domains of Profile Research

Profile Similarity Components							
Both Models			Model 1			Model 2	
General Terms							
Overall Similarity	Distinctive Similarity	Generalized Normative Similarity	Within-profile Normativeness 1	Within-profile Normativeness 2	Global Normativeness	Cross-profile Normativeness 1	Cross-profile Normativeness 2
Self-other personality agreement (e.g., Furr et al., 2007)							
Overall Personality Agreement	Distinctive Personality Agreement	Generalized Normative Agreement	Self Perceived Normativeness	Other Perceived Normativeness	Global Personality Normativeness	Self-other Normativeness	Other-self Normativeness
Husband-wife similarity (e.g., Luo & Klohnen, (2005)							
Overall Personality Similarity	Distinctive Personality Similarity	Generalized Normative Similarity	Husband Personality Normativeness	Wife Personality Normativeness	Global Couple Normativeness	Husband-wife Similarity	Wife-husband Similarity
Personality stability (e.g., Ozer & Gjerde, 1989)							
Overall Personality Stability	Distinctive Personality Stability	Generalized Normative Stability	Time 1 Personality Normativeness	Time 2 Personality Normativeness	Global Personality Normativeness	Developmental Hyper-maturity	Developmental Immaturity
Cross-situational behavioral consistency (e.g., Furr & Funder, 2004)							
Overall Behavioral Consistency	Distinctive Behavioral Consistency	Situational Similarity	Situation 1 Behavioral Normativeness	Situation 2 Behavioral Normativeness	Global Behavioral Normativeness	Cross-situational Behavioral Normativeness 1	Cross-situational Behavioral Normativeness 2

control adolescents. For each adolescent, Overall Agreement, Distinctive Agreement, Self-Perceived Normativeness, and Informant-Perceived Normativeness were calculated, reflecting elements of Model 1.[2]

Results revealed[3] the utility of components of Normativeness and Distinctive Similarity. Results indicated that, as expected, Overall Agreement was lower among adolescents with CD than among control adolescents. Results also revealed significantly lower levels of normativeness within the CD group than within the control group, raising the possibility that group difference in Overall Agreement could emerge solely from group differences in normativeness. Evaluating this facet of the normativeness problem, analyses revealed that, despite differences in normativeness, the CD group had a significantly lower level of Distinctive Agreement than the control group. Thus, Furr et al. eliminated the possibility that the group difference in Overall Agreement was an artifact of group differences in normativeness.

A second example of the current framework's application to self-other agreement is an examination of the acquaintanceship effect—Biesanz and his colleagues (2007) hypothesized that high levels of acquaintance between targets and informants enhances self-other agreement. They argued that previous research had produced ambiguous results, because those examinations had not differentiated similarity, normativeness, and distinctiveness. Biesanz et al. used procedures consistent with Model 2, predicting different results for three components.[3] The first component was Overall Personality Agreement, called raw self-acquaintance consensus by Biesanz et al. The second was Other-self Normativeness, which is the correlation

2. To account for the large trait differences between the two groups, the normativeness and distinctiveness scores were computed within each group. That is, the normativeness and distinctiveness scores for a CD adolescent reflect the way he or she compares to the average CD adolescent, and the normativeness and distinctiveness scores for a control adolescent reflect the way he or she compares to the average control adolescent.

3. Although their approach was very consistent with the conceptual and psychometric logic of the current frameworks, Beisanz et al. (2007) quantified distinctive agreement is a way that differs slightly from the framework articulated in this article Specifically, whereas the current framework mean deviates each response from the normative profile, they standardized each response in relation to the normative profile. That is, they mean deviated each response from the normative profile and then adjusted for normative standard deviations.

between an acquaintance's profile of trait ratings and the average profile of self-ratings. Biesanz and his colleagues conceptualized this as stereotype accuracy. The third component was very closely akin to Distinctive Personality Agreement, called differential accuracy. The researchers predicted that increasing acquaintance would produce no stable effect on Overall Agreement, it would decrease Other-self Normativeness, and it would increase Distinctive Agreement.

Results generally confirmed these predictions across two studies. Specifically, Biesanz et al. (2007) found a nonsignificant association between acquaintance and Overall Agreement, a significant negative association between acquaintance and Other-self Normativeness, and a significant positive association between acquaintance and Distinctive Agreement. By differentiating similarity, normativeness, and distinctiveness, Biesanz and his colleagues resolved ambiguities from previous studies. Specifically, they found that increasing acquaintanceship enhances our ability to understand what makes an individual different and unique. Consequently, as our level of acquaintance increases, our impressions rely "less on how people are in general" (p. 132).

Marital Similarity

To my knowledge, previous examinations of marital similarity have not included strategies akin to the current framework. However, as described earlier (see Figure 2), Model 2 could be usefully applied to marital similarity (i.e., Distinctive Personality Agreement, Generalized Personality Similarity, Husband-Wife Normativeness, and Wife-Husband Normativeness, etc). Such an application could produce insights into the antecedents and consequences of similarity between husbands and wives.

As presented in Table 4, two components of Model 1 also might be usefully applied in this domain. Specifically, the two Within-Profile Normativeness components would provide information regarding the normativeness of each spouse's personality, in the context of his or her own sex. Husband Personality Normativeness reflects the degree to which a particular husband is similar to the average husband, and Wife Personality Normativeness reflects the degree to which a particular wife is similar to the average wife. More technically, these components are the correlations between an individual's trait profile and the trait profile of the average husband (for husbands) or wife (for wives).

Personality Stability Across Time

Developmental researchers have examined the stability of personality profiles across time—to what degree is a person's trait profile at one developmental period similar to his or her profile at another developmental period? To my knowledge, profile-based examinations of temporal stability have not included strategies akin to the current framework; the framework, however, offers potential insights in this area (see Table 4). Personality stability can be defined as the degree to which an individual's personality profile remains stable across time. Thus, Overall Personality Stability is the similarity between an individual's trait profile at one time and his or her trait profile at a later time (e.g., Ozer & Gjerde, 1989).

Overall Personality Stability might have multiple sources, introducing ambiguity into its interpretation. An individual might obtain high Overall Stability in at least two ways. First, high Overall Stability could reflect a tendency to retain highly idiosyncratic personality profile in the face of changing age norms. That is, each phase of psychological development may have a normative personality profile, but an individual might be nonnormative in important ways. To the degree that those nonnormative or distinctive qualities are stable across time, the individual will exhibit high Overall Stability. Second, high Overall Stability could reflect a tendency to be consistently normative. In such cases, high Overall Stability emerges if the normative profiles of the time points are similar to each other. That is, if two developmental periods have similar norms and if an individual is normative within each age period, then he or she will exhibit high Overall Stability. Moreover, normative profiles are likely to reflect social desirability or psychological well-being. If so, an Overall Stability that is driven by normativeness reflects both stability and desirability. This presents a potential confound in analyses of Overall Stability.

In personality stability, the components of Model 1 are highly informative. Distinctive Personality Stability is the degree to which an individual retains a no-normative profile across time, and it arises from the individual's two distinctive trait profiles. These profiles reflect the distinctive levels of each trait measured at the two time points (e.g., scores representing the degree to which the individual was distinctively extraverted at both times). Thus, Distinctive Personality Stability is the degree to which an individual's distinctive

trait profile at one time is correlated with his or her distinctive trait profile at the later time. A second component is Generalized Normative Stability, which reflects the degree to which the two age periods have similar normative trait profiles. The third and fourth components are Within-time Normativeness components reflecting the normativeness of an individual's personality within each age period (i.e., the degree to which an individual is like the average person in each age period). Each of these is a correlation between an individual's trait profile at one time and the normative profile for that time point. The fifth component is Global Personality Normativeness, reflecting the normativeness of an individual's general trait profile. More specifically, it is the correlation between the individual's Mean Trait Profile (i.e., his or her trait profile, averaged across both age periods) and the Global Trait Profile (i.e., the trait profile of the average person averaged across both time points).

The two Cross-Profile Normativeness components also reveal interesting concepts in personality stability. One Cross-Profile Normativeness component can be interpreted as Developmental Hypermaturity, reflecting the degree to which an individual's personality at a relatively young age resembles the normative personality of an older age period. The other Cross-Profile Normativeness component might be interpreted as Developmental Immaturity, reflecting the degree to which an individual's personality at a relatively old age resembles the normative personality of a younger age period.

Cross-Situational Behavioral Consistency

From a profile-based approach, cross-situational behavioral consistency can be defined as the degree to which an individual's profile of behaviors in one situation is consistent with his or her profile of behaviors in a second situation (e.g., Furr & Funder, 2004). That is, it is the degree to which the most salient behaviors that a person exhibits in one situation are also the most salient behaviors that he or she exhibits in another situation. The current framework can be applied very usefully to this domain (see Table 4), and Overall Consistency is the correlation between an individual's behavioral profile as measured in one situation and his or her behavioral profile in another situation.

Overall Consistency might have multiple sources, creating ambiguity in its interpretation. An individual might obtain high Overall

Consistency in at least two ways. First, high Overall Consistency could emerge from a highly personality-driven behavioral style. That is, an individual's behavior might be determined strongly by his or her distinctive personality characteristics, rather than situational cues. To the degree that those personality characteristics are stable across situations, the individual will exhibit high behavioral Overall Consistency. Second, an individual's behavior might be determined strongly by situational forces, rather than distinctive personality characteristics. In such cases, high Overall Consistency emerges if the two situations are highly similar to each other. That is, if two situations have highly similar norms or cues, and if an individual behaves solely in response to those cues, then he or she will exhibit high Overall Consistency. Although few, if any, behaviors are either totally immune to situational cues or totally determined by situational cues, a given individual might tend toward one possibility or the other. The current framework affords insight into such potentially important tendencies.

In behavioral consistency, the components of Model 1 are highly informative. Distinctive Consistency reflects the degree to which an individual behaves in a consistently non-normative manner, and it arises from the individual's two distinctive profiles of behavior. These profiles reflect the distinctive levels of each behavior measured in the situations (e.g., scores representing the degree to which the individual was distinctively talkative in Situation 1). Thus, Distinctive Consistency is the degree to which an individual's distinctive profile in one situation is correlated with his or her distinctive profile in the second situation. High Distinctive Consistency emerges only when an individual consistently acts in contrast to situational cues. A second component is Situational Similarity, reflecting the degree to which situations have similar behavioral norms. It arises from normative behavioral profiles in each of two situations—the behavioral profile of the average person in each situation. The third and fourth components are Within-Situation Normativeness components reflecting the normativeness of an individual's behavior in each situation (i.e., the degree to which an individual acts like the average person in each situation). Each is the correlation between an individual's behavioral profile in a situation and the normative profile in that situation. The fifth component is Global Behavioral Normativeness, reflecting the normativeness of an individual's general behavioral style. It is the correlation between

the individual's Mean Behavioral Profile (i.e., his or her behavioral profile, averaged across situations) and the Global behavioral profile (i.e., the behavioral profile of the average person in the average situation).

Although Distinctive Consistency, Situational Similarity, and the other components of Model 1 are informative in any analysis behavioral consistency, Model 2's Cross-Profile Normativeness components may be meaningful only when the situations are highly complementary. For example, a researcher might observe participants in an interaction with a close friend and in an interaction with a stranger. One Cross-Profile Normativeness would reflect the degree to which an individual's behavior with a friend resembles the typical person's behavior with a stranger (i.e., presumably revealing an unusual level of psychosocial distance, or ill at ease with a friend). The other Cross-Profile Normativeness would reflect the degree to which the individual's behavior with a stranger resembles the typical person's behavior with a friend (i.e., presumably revealing an unusual level of familiarity, ease, or closeness to a stranger).

Further illustrating the utility of the framework, components of the framework have been applied to the examination of the link between behavioral consistency and self-monitoring. Researchers have hypothesized that low self-monitors are more behaviorally consistent than high self-monitors (Gangestad & Snyder, 2000; Snyder & Ickes, 1985), but previous research provides mixed support for this prediction (Cheek, 1982; Snyder & Monson, 1975; Wymer & Penner, 1985). Furr and Funder (2005) adopted a profile-similarity approach to examine this prediction. In this research, participants completed the self-monitoring scale, and they engaged in dyadic interactions in two situations. Behavior was measured in each situation, and an Overall Behavioral Consistency correlation was computed for each participant, representing the degree to which he or she exhibited a consistent profile of behavior across the pair of situations. Analyses of Overall Consistency revealed that behavioral consistency was correlated with self-monitoring, but this effect was rather small, only marginally significant, and in the *opposite* direction of predictions ($r = .17$, $p < .10$). These results appear to contradict predictions again: if there is any difference, high self-monitors seem somewhat more consistent than low self-monitors.

Although Furr and Funder's (2005) analysis of Overall Consistency seems to contradict the self-monitoring hypothesis, a consideration of Distinctive Behavioral Consistency offers new insight into the phenomenon. Specifically, high self-monitors might manifest a relatively normative behavioral style—managing their behavior to conform to situational cues and norms. In contrast, low self-monitors might manifest a more distinctive style—basing their behavior on their distinctive personality characteristics more than on situational norms. Since Overall Behavioral Consistency is affected by normativeness, the normativeness of high self-monitors could be "competing" with the distinctiveness of low self-monitors. This produces results that reflect neither clearly. To examine this possibility, components from Model 1 were computed for each participant, and correlations between these components and self-monitoring were examined (Furr & Funder, 2005). As expected, self-monitoring was positively correlated with all indices of normativeness, suggesting that high self-monitors tend to be behave in relatively normative ways. Conversely, self-monitoring was negatively correlated with Distinctive Consistency ($r = -.18$, $p < .05$), as expected. Although this correlation was not large, it was statistically significant and its direction was consistent with the original predictions regarding self-monitoring and consistency.

Thus, the pair-level decomposition of behavioral consistency reveals importantly different facets of behavioral consistency, behavioral normativeness, and their links to self-monitoring. Considering several components together provided deeper insight into the psychological meaning of behavioral consistency, in this case producing results consistent with theory.

Implications and Recommendations

The framework presented in this article allows researchers to examine profile similarity in a way that copes with the normativeness problem. A primary purpose of the current article is to present the conceptual and psychometric foundations of the framework and to articulate its wide applicability and meaning. Several implications and recommendations emerge from these applications.

When Is the Framework Applicable?

The primary implication is that the framework is likely to be applicable to any analysis of the similarity between two profiles of

traits or behaviors. As illustrated in Table 4, the framework provides insights into a variety of domains in which profile similarity is examined.

The normativeness problem must be considered when examining profile similarity, and the current framework offers two opportunities in this regard. First, it allows researchers to gauge and potentially eliminate normativeness as a potential confound. For example, a high level of self-other agreement could arise from (a) an informant's genuine understanding of a target's personality, (b) coincidental normativeness (i.e., any informant's rating is likely to be similar to any target's self-rating), or (c) a psychological characteristic that is associated with normativeness and thereby associated with agreement (e.g., social desirability or psychological adjustment). An analysis in which each target/informant pair's Overall Agreement is decomposed into normative and distinctive components affords the opportunity to understand more fully the processes driving the correlation and to evaluate the potential confounding effects of normativeness.

A second opportunity afforded by the current framework is that it can reveal findings that would otherwise remain hidden. Normativeness should not be seen simply as a nuisance variable or potential confound; instead, normativeness and distinctiveness are potentially important psychological phenomena in their own right, and the current framework can help disentangle their effects (e.g., Biesanz et al., 2007). For example, researchers might find that couples in which the spouses are both normative might have different qualities than couples in which the spouses are nonnormative. Furthermore, these qualities might differ from the qualities of couples in which the spouses share distinctive qualities. Thus, the differentiation of similarity, normativeness, and distinctiveness can expand the scope of psychological questions to be addressed.

Whether the framework is interpreted in terms of gauging potential confounds (e.g., social desirability inherent in the normative profiles) or in terms of gaining insights into important new facets of similarity, distinctiveness and normativeness (e.g., developmental hyper-maturity), researchers are likely to benefit from the information provided by the current framework within in any application of profile similarity.

Which Components Should Be Examined?

The current framework provides a psychometrically coherent perspective that includes a variety of components related to similarity, normativeness, and distinctiveness (see Table 1); however, the components are more important in practice than are the mathematical associations among them. The purpose of the psychometric models outlined in this article is to articulate precisely the formal derivation of overall similarity from a coherent set of components and to demonstrate that the components comprise a meaningful framework integrating similarity, normativeness, and distinctiveness. In practice, the components can be used with little concern for the formal psychometric connections among them.

One's choice of components should fit one's specific research questions. As illustrated earlier, all components are meaningful in most applications of profile similarity. However, some components might be most fundamental to particular questions or hypotheses. For example, in their examination of self-other agreement, Furr et al. (2007) examined Overall Agreement, Distinctive Agreement, and two indexes of Within-Profile Normativeness. Thus, they focused on some, but not all, elements of Model 1. Similarly, Biesanz et al. (2007) examined Overall Agreement, Distinctive Agreement, and one Cross-Profile Agreement index—focusing on some, but not all, elements of Model 2. Finally, Starzyk et al. (2006) focused solely on an index akin to Distinctive Agreement. Although such choices reflect the specific research questions being addressed, they may also reflect the lack of a coherent framework for profile similarity. The availability of a coherent and generally applicable framework may enhance the range of components and questions that researchers consider examining in their analysis.

In addition to their differential relevance to specific psychological questions, some components may have less meaning when applied to particular forms of data. At least two such cases may exist. First, Global Normativeness may be less meaningful when each pair of profiles characterizes two people instead of one. For example, Global Normativeness may not be highly meaningful in analyses of marital similarity. In such cases (i.e., cases in which one profile describes one individual and the second describes another), the Pair Mean profile would describe the "average person in the couple." This component is likely to be more meaningful when each profile

within a pair describes a single person. For example, in the case of self-other personality agreement, both profiles describe a target individual. Therefore, the Pair Mean profile reflects the target person as averaged across two raters, and Global Normativeness reflects the degree to which the target person's average profile fits the average person in the entire sample. The Cross-Profile Normativeness components are a second case in which some components might have less utility. Specifically, in cross-situational behavioral consistency, these components might be interesting only when the two situations are mutually complementary. Recall that, in cross-situational behavioral consistency, the Cross-profile normativeness components reflect the correlation between one's behavior in a situation and the normative behavioral profile in a second situation. If the two situations are not complementary to each other, then the Cross-Profile Normativeness components from Model 2 are probably less interesting than the Within-Profile Normativeness components from Model 1.

Profile distinguishability also has implications for the application of the current models. The current models are highly applicable for profiles that are clearly distinguishable from each other. For example, the personality-rating profiles in Table 1 can be distinguished in terms of the rater who provided them (i.e., self or informant). Likewise, in marital similarity, researchers distinguish husbands' profiles from wives' profiles. But not all profile-oriented research involves distinguishable profiles. For example, analysis of roommate similarity requires two profiles—one for roommate 1 and one for roommate 2— but which roommate should be designated as 1 or 2? When there is no clear way to distinguish one profile from the other, the profiles are nondistinguishable. Furthermore, when working with nondistinguishable profiles, the procedures outlined in this article could produce results that depend partially on the way in which profiles are designated. Models to eliminate such ambiguity could be developed for "nondistinguishable" analytic situations. Until then, researchers could use the current frameworks using a multistage analytic strategy. That is, researchers could randomly assign each member of the dyad to profile 1 or profile 2, run analyses based on the current models, reassign members to the profiles, rerun the analysis, and so on. This process could be conducted repeatedly, and the results could be aggregated across the repetitions.

No Index of Pure Similarity

As implied by the current models, there is no index of "pure" similarity. That is, no component reflects profile similarity as completely independent of normativeness and distinctiveness. The components represent blends of similarity, distinctiveness, and normativeness, and they can be used to gauge the presence and potential meaning of normativeness and distinctiveness. Because no single component represents pure"similarity, the components are most informative when examined together.

Relatedly, when examining Distinctive Similarity, researchers should recognize that it is an important but conservative form of profile similarity. That is, Distinctive Similarity reflects similarity only in ways in which an individual is distinctive from the group norm. For example, in self-other agreement, Distinctive Agreement reflects the degree to which a target and a judge agree on the ways in which the target is nonnormative. Therefore, when computing Distinctive Agreement scores, no "credit" is given for accurate evaluations of the ways in which a target is truly normative. Consequently, a relatively normative target is likely to receive a lower Distinctive Agreement correlation than is a relatively nonnormative target. Given the conservative nature of Distinctive Similarity, logic suggests that it often should be examined alongside other indices of similarity and normativeness, particularly Overall Similarity. Thus, Distinctive Similarity is not *the* index of pure similarity; rather, it is an important component of the complete picture of similarity. A value of the current framework is that it provides coherent conceptual and psychometric models that tie Distinctive Similarity to Overall Similarity and to meaningful facets of Normativeness. Researchers using this framework can have confidence that the components are conceptually and statistically cohesive, and they can understand precisely how the components complement each other.

Scaling and Fisher's Transformation

Two additional technical recommendations are relevant to correlational profile analysis. First, researchers examining profile similarity should evaluate Cohen's (1969) concerns about scaling. Specifically, the direction in which variables are scored can affect a correlational index of profile similarity. Cohen suggests that one solution to this

problem is to reflect each variable about the scales' midpoint, to append these values onto the normally scored profiles, and to compute the correlation between expanded profiles. The current models are valid for this index. In two of the applications described above, analyses were conducted on profiles as originally scored and on reflected profiles. In neither case did the analyses produce different conclusions. Nevertheless, researchers should examine the possibility that reflections lead to different conclusions. Second, researchers should use Fisher's transformation when working with profile similarity correlations, particularly when conducting significance tests of mean correlations. In the applications described above, the similarity, normativeness, and distinctiveness correlations were computed, and then transformed using Fisher's r to z transformation.

Integration With and Differentiation From Other Approaches to Profile Similarity

Psychologists have grappled with the challenges of profile similarity since at least the 1940s (e.g., Cattell, 1949; du Mas, 1946). A full articulation of all relevant issues is beyond the scope of this article, but the current models can be placed in the context of two relatively well-known perspectives.

Cronbach's Decomposition of Personality Judgments

Cronbach (1955) examined components of profile similarity in personality judgments. His highly influential perspective concerns designs in which a single judge rates multiple targets, who also provide self-ratings. In his framework (Equation 3a, p. 192), a judge's general accuracy arises from four elements: Elevation, Differential Elevation, Stereotype Accuracy, and Differential Accuracy. Elevation is the difference between a judge's mean rating of targets (averaged across all items and multiple targets) and the mean rating provided by those multiple targets (averaged across all items and all targets). Differential Elevation is the degree to which a judge accurately detects differences among the targets' average ratings, averaged across items. Stereotype Accuracy is the accuracy with which a judge rates "the generalized other" (p. 179). That is, it is the similarity between a judge's profile of mean ratings (averaged across targets) and the target's profile of mean self-ratings (averaged across targets). Finally, Differential Accuracy is a judge's "ability to predict

differences between [targets] on any item.'' As originally defined, Elevation, Differential Elevation, and Stereotype Accuracy are not applicable at the level of a pair of profiles. That is, they are not quantified for each target-judge pair.

With a significant reconceptualization, Cronbach's (1955) Stereotype Accuracy and Differential Accuracy can be integrated with the models presented in the current article. Cronbach's data structure can be reconceptualized as including multiple unique judge/target pairs. That is, rather than conceptualizing the two sets of profiles as being provided by a single judge rating multiple targets with each target providing a self-rating, they could be seen as arising from multiple judges, each of whom rates a single different target (e.g., Table 2). This reconceptualization creates an association between Cronbach's Stereotype Accuracy and the *Generalized Normative Agreement* component in the models above (i.e., Generalized Mean Similarity, more broadly). Specifically, Cronbach (Equation 2, p. 179) decomposes Stereotype Accuracy into variances and a correlation. If the data are reconceptualized as described above, then this correlation *is* the Generalized Normative Agreement correlation in the current models (Equation 9). Similarly, Cronbach's Differential Accuracy component is closely related to the ''Distinctive Agreement'' component in the models above (i.e., Distinctive Similarity more broadly). Cronbach (p. 192) describes two possible decompositions of Differential Accuracy. Again, if the data are reconceptualized as described above, then one of these possible decompositions (labeled DA^2_{oj} in Cronbach's notation) includes a correlation that is equivalent to the Distinctive Agreement correlation in the models above.[4]

Although the current framework can be integrated with Cronbach (1955), it differs in at least two important ways. First, Cronbach's framework is articulated in two highly specific contexts: (a) the substantive context of personality judgment and (b) the methodological context of a single judge providing ratings of multiple targets, with each target providing self-ratings. This specificity served Cronbach's original goals, but it limits his framework as a general perspective on profile similarity. That is, researchers must recast the conceptual issues from personality judgment to their domain of study, and they must reconceptualize (if possible) the data structure in a way that fits their methods. In contrast, the current models are articulated in two

4. A detailed discussion of the integrations and differentiations is available online at: http://www.wfu.wdu/ $\sim$ furrrm/integrations.doc

general ways: (a) in terms that are applicable to a wide range of substantive contexts (see Table 4) and (b) with regard to a data structure very common in profile similarity research. Specifically, many, if not most, examinations of profile similarity involve the pairing of each profile with a single other profile (e.g., when each husband is paired with his wife, when each individual's behavior in one situation is paired with his or her behavior in a second situation, or when each individual's personality profile at one age is paired with his or her profile at another age).

More importantly, the second departure from Cronbach's framework is that the current models provide more information. That is, some of the components in the current models are not reflected in Cronbach's framework, even when it is reconceptualized to fit the relevant data structure Specifically, the Within-Profile Normativeness, the Cross-Profile Normativeness components, and the Global Normativeness components are unique to the current models. As illustrated earlier, these components are likely to be highly meaningful in many examinations of profile similarity.

Kenny's Decomposition of Dyadic Data

Along with Cronbach (1955), Kenny and his colleagues (Kenny, Kashy, & Cook, 2006; Kenny & Winquist, 2001) provide an example of the decomposition of profile similarity into components reflecting some form of distinctiveness or normativeness. In a discussion of the measurement of interpersonal sensitivity, Kenny and Winquist describe the profile analysis applicable when there is one perceiver per target and one target per perceiver (i.e., a "1P1T" design). This corresponds exactly with the common design for many analysis of profile similarity (e.g., one husband per wife and one wife per husband), which is the basis of the current models. In their discussion of a profile analysis of these data (pp. 275–277), Kenny and Winquist describe a stereotype accuracy correlation analogous to the Generalized Normative Agreement in the current models (see the discussion of Cronbach's stereotype accuracy, above). In addition, they "remove the effects of stereotype accuracy" (p. 276) by computing a correlation that parallels the Distinctive Agreement correlation in the current models. Although the models described in the current article share some overlap with Kenny and Winquist's (2001) analysis, they differ in an important way. Specifically, the current models go beyond the Kenny and Winquist approach by articulating a wider set of

components, by providing multiple ways of decomposing similarity, by placing the components within coherent, fully integrated models, and by extending the logic to multiple domains of psychological research.

Summary

The analysis of profile similarity is an intuitively appealing procedure used in many areas of psychology. Researchers have long recognized that, despite its intuitive appeal, profile similarity has conceptual and statistical problems. Despite this recognition, there has been little consensus regarding a conceptually and psychometrically coherent way of handling such problems. Of specific interest for the current article is the normativeness problem and its effects on profile similarity correlations. The framework presented in the current article decomposes the "shape" facet of profile similarity into components reflecting blends of similarity, normativeness, and distinctiveness. The primary purpose of the current articlewas to detail the conceptual and psychometric foundations of the framework and to place it in the context of profile similarity more generally. In addition, the article presented four applications of the framework, demonstrating its utility and importance.

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Appendix A

Details of the Initial Decomposition

This Appendix presents algebraic details of the components and accuracy of the initial decomposition (Equation 3).

Defining the components of the initial decomposition

This section presents the definitional and computational formulas for the covariance components of the initial decomposition:

$$\text{Overall Similarity } \sigma_{x_{iv1}x_{iv2}} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}(x_{iv1} - \bar{x}_{i\bullet 1})(x_{iv2} - \bar{x}_{i\bullet 2})$$

$$= \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}x_{iv2} - \bar{x}_{i\bullet 1}\bar{x}_{i\bullet 2}$$

Generalized Normative Similarity

$$\sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}(\bar{x}_{\bullet v1} - \bar{x}_{\bullet\bullet 1})(\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 2})$$

$$= \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\bar{x}_{\bullet v1}\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 1}\bar{x}_{\bullet\bullet 2}$$

The remaining covariances include the "distinctiveness" scores, and they rely on the mean of an individual's profile of distinctiveness scores. An individual's distinctiveness on a variable (x'_{ivp}) and his or her mean distinctiveness across variables ($\bar{x}'_{i\bullet p}$) are:

$$x'_{ivp} = x_{ivp} - \bar{x}_{\bullet vp}$$

$$\bar{x}'_{i\bullet p} = \frac{1}{\mathrm{n_v}}\sum_{\mathrm{v=1}}^{\mathrm{n_v}}\left(\mathrm{x_{ivp}} - \bar{\mathrm{x}}_{\bullet\mathrm{vp}}\right) = \frac{1}{\mathrm{n_v}}\sum_{\mathrm{v=1}}^{\mathrm{n_v}}\mathrm{x_{ivp}} - \frac{1}{\mathrm{n_v}}\sum_{\mathrm{v=1}}^{\mathrm{n_v}}\bar{\mathrm{x}}_{\bullet\mathrm{vp}} = \bar{\mathrm{x}}_{\mathrm{i}\bullet\mathrm{p}} - \bar{\mathrm{x}}_{\bullet\bullet\mathrm{p}}$$

Distinctive Similarity

$$\sigma_{x'_{iv1}x'_{iv2}} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\left(x'_{iv1} - \bar{x}'_{i\bullet 1}\right)\left(x'_{iv2} - \bar{x}'_{i\bullet 2}\right)$$

$$\sigma_{x'_{iv1}x'_{iv2}} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}(x_{iv1} - \bar{x}_{\bullet v1} - \bar{x}_{i\bullet 1} + \bar{x}_{\bullet\bullet 1})(x_{iv2} - \bar{x}_{\bullet v2} - \bar{x}_{i\bullet 2} + \bar{x}_{\bullet\bullet 2})$$

$$\sigma_{x'_{iv1}x'_{iv2}} = \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}x_{iv1}x_{iv2} - \bar{x}_{i\bullet 1}\bar{x}_{i\bullet 2}\right] - \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}x_{iv1}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet 1}\bar{x}_{\bullet\bullet 2}\right] -$$

$$\left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}x_{iv2}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet 2}\bar{x}_{\bullet\bullet 1}\right] + \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\bar{x}_{\bullet v1}\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 1}\bar{x}_{\bullet\bullet 2}\right]$$

Mean/Distinctive Similarity 1

$$\sigma_{x'_{iv1}\bar{x}_{\bullet v2}} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\left(x'_{iv1} - \bar{x}'_{i\bullet 1}\right)(\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 2})\sigma_{x'_{iv1}\bar{x}_{\bullet v2}}$$

$$= \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}(x_{iv1} - \bar{x}_{\bullet v1} - \bar{x}_{i\bullet 1} + \bar{x}_{\bullet\bullet 1})(\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 2})$$

$$\sigma_{x'_{iv1}\bar{x}_{\bullet v2}} = \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}x_{iv1}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet 1}\bar{x}_{\bullet\bullet 2}\right] - \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\bar{x}_{\bullet v1}\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 1}\bar{x}_{\bullet\bullet 2}\right]$$

Mean/Distinctive Similarity 2

$$\sigma_{x'_{iv2}\bar{x}_{\bullet v1}} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\left(x'_{iv2} - \bar{x}'_{i\bullet 2}\right)\left(\bar{x}_{\bullet v1} - \bar{x}_{\bullet\bullet 1}\right)$$

$$\sigma_{x'_{iv2}\bar{x}_{\bullet v1}} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\left(x_{iv2} - \bar{x}_{\bullet v2} - \bar{x}_{i\bullet 2} + \bar{x}_{\bullet\bullet 2}\right)\left(\bar{x}_{\bullet v1} - \bar{x}_{\bullet\bullet 1}\right)$$

$$\sigma_{x'_{iv2}\bar{x}_{\bullet v1}} = \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet 2}\bar{x}_{\bullet\bullet 1}\right] - \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\bar{x}_{\bullet v1}\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 1}\bar{x}_{\bullet\bullet 2}\right]$$

Algebraic Proof of the Initial Decomposition

The following demonstrates the accuracy of the initial decomposition (Equation 3 in the text):

$$\sigma_{x_{iv1}x_{iv2}} = \sigma_{x'_{iv1}x'_{iv2}} + \sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} + \sigma_{\bar{x}_{\bullet v1}x'_{iv2}} + \sigma_{\bar{x}_{\bullet v2}x'_{iv1}}$$

$$\begin{array}{c}\text{Overall}\\ \text{Similarity}\end{array} = \begin{array}{c}\text{Distinctive}\\ \text{Similarity}\end{array} + \begin{array}{c}\text{Generalized}\\ \text{Normative}\\ \text{Similarity}\end{array} + \begin{array}{c}\text{Mean}\\ \text{Distinctive}\\ \text{Similarity 1}\end{array} + \begin{array}{c}\text{Mean}\\ \text{Distinctive}\\ \text{Similarity 2}\end{array}$$

Overall similarity

$$= \left\{\begin{array}{l}\left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}x_{iv2} - \bar{x}_{i\bullet 1}\bar{x}_{i\bullet 2}\right] - \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet 1}\bar{x}_{\bullet\bullet 2}\right]\\ -\left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet 2}\bar{x}_{\bullet\bullet 1}\right] + \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\bar{x}_{\bullet v1}\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 1}\bar{x}_{\bullet\bullet 2}\right]\end{array}\right\}$$

$$+\left\{\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\bar{x}_{\bullet v1}\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 1}\bar{x}_{\bullet\bullet 2}\right\}$$

$$+\left\{\left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet 1}\bar{x}_{\bullet\bullet 2}\right] - \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\bar{x}_{\bullet v1}\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 1}\bar{x}_{\bullet\bullet 2}\right]\right\}$$

$$+\left\{\left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet 2}\bar{x}_{\bullet\bullet 1}\right] - \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\bar{x}_{\bullet v1}\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 1}\bar{x}_{\bullet\bullet 2}\right]\right\}$$

Terms cancel each other out, reducing to:

$$\text{Overall similarity} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}x_{iv2} - \bar{x}_{i\bullet 1}\bar{x}_{i\bullet 2}$$

Appendix B

Decomposition of Model 1

This Appendix presents algebraic details of the accuracy of Model 1 (Equations 4 and 7).

Defining the Components of Model 1

This section presents the definitional and computational formulas for the covariance components of Model 1. The Overall Similarity, Generalized Normative Similarity, and Distinctive Similarity components are as defined in Appendix A. Model 1 includes two Within-Profile Normativeness components and a Global Normativeness component:

Within-Profile Normativeness 1

$$\sigma_{x_{iv1}\bar{x}_{\bullet v1}} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}(x_{iv1} - \bar{x}_{i\bullet 1})(\bar{x}_{\bullet v1} - \bar{x}_{\bullet\bullet 1})$$

$$= \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet 1}\bar{x}_{\bullet\bullet 1}$$

Within-Profile Normativeness 2

$$\sigma_{x_{iv2}\bar{x}_{\bullet v21}} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}(x_{iv2} - \bar{x}_{i\bullet 2})(\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 2})$$

$$= \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet 2}\bar{x}_{\bullet\bullet 2}$$

The Global Normativeness component reflects the similarity between the Pair Mean profile and the Global Mean Profile. Recall (Eq. 5 in the text) that a score on a variable in the Pair Mean profile is $\bar{x}_{iv\bullet}$, making the mean of the profile $\bar{x}_{i\bullet\bullet}$. In addition, a score on a variable in the Global Mean profile is $\bar{x}_{\bullet v\bullet}$, making the mean of this profile $\bar{x}_{\bullet\bullet\bullet}$.

Global Normativeness

$$\sigma_{\bar{x}_{iv\bullet}\bar{x}_{\bullet v\bullet}} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}(\bar{x}_{iv\bullet} - \bar{x}_{i\bullet\bullet})(\bar{x}_{\bullet v\bullet} - \bar{x}_{\bullet\bullet\bullet})$$

$$= \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\bar{x}_{iv\bullet}\bar{x}_{\bullet v\bullet} - \bar{x}_{i\bullet\bullet}\bar{x}_{\bullet\bullet\bullet}$$

The elements in this Equation can be broken down further, which will allow convergence with the other components in Model 1:

$$\bar{x}_{iv\bullet} = \frac{x_{iv1} + x_{iv2}}{2} \quad \bar{x}_{\bullet v\bullet} = \frac{\bar{x}_{\bullet v1} + \bar{x}_{\bullet v2}}{2} \quad \bar{x}_{i\bullet\bullet} = \frac{\bar{x}_{i\bullet1} + \bar{x}_{i\bullet2}}{2}$$

$$\bar{x}_{\bullet\bullet\bullet} = \frac{\bar{x}_{\bullet\bullet1} + \bar{x}_{\bullet\bullet2}}{2}$$

Replacing terms,

Global Normativeness

$$= \frac{1}{n_v}\sum_{v=1}^{n_v}\left[\left(\frac{x_{iv1} + x_{iv2}}{2}\right)\left(\frac{\bar{x}_{\bullet v1} + \bar{x}_{\bullet v2}}{2}\right) - \left(\frac{\bar{x}_{i\bullet1} + \bar{x}_{i\bullet2}}{2}\right)\left(\frac{\bar{x}_{\bullet\bullet1} + \bar{x}_{\bullet\bullet2}}{2}\right)\right]$$

$$= \frac{1}{4}\left(\frac{1}{n_v}\sum_{v=1}^{n_v} x_{iv1}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet1}\bar{x}_{\bullet\bullet1}\right) + \frac{1}{4}\left(\frac{1}{n_v}\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet2}\bar{x}_{\bullet\bullet2}\right)$$

$$+ \frac{1}{4}\left(\frac{1}{n_v}\sum_{v=1}^{n_v} x_{iv1}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet1}\bar{x}_{\bullet\bullet2}\right) + \frac{1}{4}\left(\frac{1}{n_v}\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet2}\bar{x}_{\bullet\bullet1}\right)$$

Note that the elements comprising Global Normativeness are exactly the two "Within-Profile Normativeness" scores, defined above, and the two "Cross-Profile Normativeness" scores defined in Model 1.

Algebraic Proof of Model 1

The following demonstrates the accuracy of Model 1 (Equation 4 in the text)

$$\sigma_{x_{iv1}x_{iv2}} = \sigma_{x'_{iv1}x'_{iv2}} - \sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} - \sigma_{\bar{x}_{\bullet v1}x_{iv1}} - \sigma_{\bar{x}_{\bullet v2}x_{iv2}} + 4\sigma_{\bar{x}_{iv\bullet}\bar{x}_{\bullet v\bullet}}$$

$$\begin{matrix}\text{Overall}\\\text{Similarity}\end{matrix} = \begin{matrix}\text{Distinctive}\\\text{Similarity}\end{matrix} - \begin{matrix}\text{Generalized}\\\text{Normative}\\\text{Similarity}\end{matrix} - \begin{matrix}\text{Within-}\\\text{Profile}\\\text{Normativeness 1}\end{matrix} - \begin{matrix}\text{Within-}\\\text{Profile}\\\text{Normativeness 2}\end{matrix} + \begin{matrix}4^{*}\text{Global}\\\text{Normativeness}\end{matrix}$$

Over similarity

$$= \left\{\begin{array}{l}\left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}x_{iv2} - \bar{x}_{i\bullet1}\bar{x}_{i\bullet2}\right] - \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet1}\bar{x}_{\bullet\bullet2}\right]\\ -\left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet2}\bar{x}_{\bullet\bullet1}\right] + \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} \bar{x}_{\bullet v1}\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet1}\bar{x}_{\bullet\bullet2}\right]\end{array}\right\}$$

$$- \left\{\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} \bar{x}_{\bullet v1}\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet1}\bar{x}_{\bullet\bullet2}\right\}$$

$$-\left\{\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet 1}\bar{x}_{\bullet\bullet 1}\right\} - \left\{\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet 2}\bar{x}_{\bullet\bullet 2}\right\}$$
$$+4\left\{\begin{array}{l}\frac{1}{4}\left(\frac{1}{n_v}\sum_{v=1}^{n_v} x_{iv1}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet 1}\bar{x}_{\bullet\bullet 1}\right) + \frac{1}{4}\left(\frac{1}{n_v}\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet 2}\bar{x}_{\bullet\bullet 2}\right) \\ +\frac{1}{4}\left(\frac{1}{n_v}\sum_{v=1}^{n_v} x_{iv1}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet 1}\bar{x}_{\bullet\bullet 2}\right) + \frac{1}{4}\left(\frac{1}{n_v}\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet 2}\bar{x}_{\bullet\bullet 1}\right)\end{array}\right\}$$

And once again, terms cancel each other out, reducing to:

$$\text{Overall similarity} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}x_{iv2} - \bar{x}_{i\bullet 1}\bar{x}_{i\bullet 2}$$

Finally, Equation 4 can be transformed to Equation 7, because each covariance is the product of a corresponding correlation and the standard deviations of the two variables, producing.

$$r_{x_{iv1}x_{iv2}} = \frac{\sigma_{x'_{iv1}}\sigma_{x'_{iv2}}r_{x'_{iv1}x'_{iv2}} - \sigma_{\bar{x}_{\bullet v1}}\sigma_{\bar{x}_{\bullet v2}}r_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} - \sigma_{\bar{x}_{\bullet v1}}\sigma_{x_{iv1}}r_{\bar{x}_{\bullet v1}x_{iv1}} - \sigma_{\bar{x}_{\bullet v2}}\sigma_{x_{iv2}}r_{\bar{x}_{\bullet v2}x_{iv2}} + 4\sigma_{\bar{x}_{iv\bullet}}\sigma_{\bar{x}_{\bullet v\bullet}}r_{\bar{x}_{iv\bullet}\bar{x}_{\bullet v\bullet}}}{\sigma_{x_{iv1}}\sigma_{x_{iv2}}}$$

Appendix C

Details of Model 2

This Appendix presents algebraic details of the accuracy of Model 2 (Equations 8 and 9). To enhance clarity, this proof focuses primarily on the Model as defined on the covariance metric.

Defining the Components of Model 2

This section presents the definitional and computational formulas for the covariance components of Model 2. Again, Overall Similarity, Generalized Normative Similarity, and Distinctive Similarity are as defined in Appendix A. Model 2 includes two Cross-Profile Normativeness components:

Cross-Profile Normativeness 1

$$\sigma_{x_{iv1}\bar{x}_{\bullet v2}} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}(x_{iv1} - \bar{x}_{i\bullet 1})(\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 2})$$

$$= \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet 1}\bar{x}_{\bullet\bullet 2}$$

Cross-Profile Normativeness 2

$$\sigma_{x_{iv2}\bar{x}_{\bullet v1}} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}(x_{iv2} - \bar{x}_{i\bullet 2})(\bar{x}_{\bullet v1} - \bar{x}_{\bullet\bullet 1})$$

$$= \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet 2}\bar{x}_{\bullet\bullet 1}$$

Algebraic Proof of Model 2

The following demonstrates the accuracy of Model 2 (Equation 8 in the text)

$$\sigma_{x_{iv1}x_{iv2}} = \sigma_{x'_{iv1}x'_{iv2}} - \sigma_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} + \sigma_{\bar{x}_{\bullet v1}x_{iv2}} + \sigma_{\bar{x}_{\bullet v2}x_{iv1}}$$

$$\begin{matrix}\text{Overall}\\ \text{Similarity}\end{matrix} = \begin{matrix}\text{Distinctive}\\ \text{Similarity}\end{matrix} - \begin{matrix}\text{Generalized}\\ \text{Normative}\\ \text{Similarity}\end{matrix} + \begin{matrix}\text{Cross-Profile}\\ \text{Normativeness 1}\end{matrix} + \begin{matrix}\text{Cross-Profile}\\ \text{Normativeness 2}\end{matrix}$$

Overall similarity

$$= \left\{ \begin{array}{l} \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}x_{iv2} - \bar{x}_{i\bullet 1}\bar{x}_{i\bullet 2}\right] - \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet 1}\bar{x}_{\bullet\bullet 2}\right] \\ -\left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet 2}\bar{x}_{\bullet\bullet 1}\right] + \left[\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} \bar{x}_{\bullet v1}\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 1}\bar{x}_{\bullet\bullet 2}\right] \end{array} \right\}$$

$$-\left\{\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v}\bar{x}_{\bullet v1}\bar{x}_{\bullet v2} - \bar{x}_{\bullet\bullet 1}\bar{x}_{\bullet\bullet 2}\right\}$$

$$+\left\{\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}\bar{x}_{\bullet v2} - \bar{x}_{i\bullet 1}\bar{x}_{\bullet\bullet 2}\right\} + \left\{\left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv2}\bar{x}_{\bullet v1} - \bar{x}_{i\bullet 2}\bar{x}_{\bullet\bullet 1}\right\}$$

Again, terms cancel each other out, reducing to:

$$\text{Overall similarity} = \left(\frac{1}{n_v}\right)\sum_{v=1}^{n_v} x_{iv1}x_{iv2} - \bar{x}_{i\bullet 1}\bar{x}_{i\bullet 2}$$

Equation 8 can be transformed to Equation 9, because each covariance is the product of a corresponding correlation and the standard deviations of the two variables, producing:

$$r_{x_{iv1}x_{iv2}} = \frac{\sigma_{x'_{iv1}}\sigma_{x'_{iv2}}r_{x'_{iv1}x'_{iv2}} - \sigma_{\bar{x}_{\bullet v1}}\sigma_{\bar{x}_{\bullet v2}}r_{\bar{x}_{\bullet v1}\bar{x}_{\bullet v2}} + \sigma_{\bar{x}_{\bullet v1}}\sigma_{x_{iv2}}r_{\bar{x}_{\bullet v1}x_{iv2}} + \sigma_{\bar{x}_{\bullet v2}}\sigma_{x_{iv1}}r_{\bar{x}_{\bullet v2}x_{iv1}}}{\sigma_{x_{iv1}}\sigma_{x_{iv2}}}$$