

COMMENTARY

It's Not a Cedar Tree, Therefore It's Not a Tree:
A Commentary on Yao and Ma (2023)Fadel K. Matta¹ and Emma L. Frank²¹ Department of Management, Terry College of Business, University of Georgia² Department of Management, Peter T. Paul College of Business and Economics, University of New Hampshire

Yao and Ma (2023) recently reviewed and reanalyzed 31 studies published in top-tier journals utilizing polynomial regression and response surface methods. Their work offers a useful holistic framework for how to test and categorize various forms of congruence; however, they ultimately advance cautionary conclusions about the extent to which 28 of the 31 studies provide “evidence of congruence” and call into question whether the practical implications of these studies are valid (p. 446). In this commentary, we clarify this inference stems largely from theoretical and empirical oversights made in Yao and Ma (2023). We bring to light issues surrounding (a) proposals that exact correspondence is the theoretical goal (despite 26 of the 31 studies *explicitly hypothesizing* deviation from that form) and (b) suggestions that authors did not adequately consider empirics they did report. Most critically, Yao and Ma suggested their reanalysis provides conclusions that *differ* from the reviewed studies in 28 (of 31) instances. We demonstrate that, when one accounts for the form of congruence the authors explicitly theorized, the type of congruence supported as well as the inferences discussed in the studies differ from those in Yao and Ma’s reanalysis in only nine of 31 studies (rather than 28). This commentary seeks to rectify the theoretical, empirical, and inferential misconceptions in Yao and Ma (2023) that may lead readers to inaccurately assess past work and threaten future work in this vein. We outline a path for scholars interested in applying this method moving forward.

Keywords: congruence effect, person–environment fit, contingency, exact correspondence effect, a holistic perspective

With the use of polynomial regression and response surface methods to study congruence effects on the rise, Yao and Ma (2023) recently took stock of the current state of the literature. In their review and reanalysis, they identify several potentially serious theoretical, empirical, and inferential issues with extant work and provide guidance for future scholars using the method. Although Yao and Ma (2023) provided a timely and—in many ways—valuable framework for congruence scholarship, a primary conclusion of their review and reanalysis of 31 studies is that

The exact correspondence effect, sometimes also labeled as the exact match effect or the perfect match effect, is only supported in three studies. Caution is hence warranted both for citing these [remaining 28] studies as

evidence of congruence and for proposing practical implications based on the findings in these studies. (p. 446)

Unfortunately, as we demonstrate in this commentary, this conclusion provides an inaccurate assessment of past work—one that not only conveys incorrect conclusions about what can be inferred from the extant literature but also potentially risks thwarting future work using polynomial regression to examine congruence effects. Below, we elaborate on the theoretical, empirical, and inferential misconceptions in Yao and Ma (2023) that necessitate being brought to light.

Transparency and Openness

Given this is a commentary on a review article, Transparency and Openness Promotion guidelines related to data sharing, code sharing, hypotheses preregistration, analysis preregistration, and materials sharing are all not applicable. All coded data from the reviewed studies relevant to the commentary are included in Tables 1–3.¹

Theoretical Misconceptions: Exact Correspondence as the Goal of Congruence Research

Yao and Ma (2023) concluded that studies should do a better job of theoretically explicating the type of congruence being examined. However, it is problematic and thus important to note that their work

¹ Details on coding procedure outlined as additional online material posted on the website of the Center for Open Science at https://osf.io/r4tvc/?view_only=2f456dd6487b41c6861c24efa1199b30.

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Table 1
Group 1: Theoretical, Empirical, and Inferential Considerations

No.	Author	Theoretical consideration			Empirical consideration		Inferential consideration			
		(1) Hypothesizes alternative form	(2) Valenced phenomenon	(3) Alternative form hypothesized	(4) Parameters not applied according to Yao and Ma (2023)	(5) Parameters not applied reported in original work	(6) Parameters not applied support hypothesized form	(7) Conclusion in original article	(8) Conclusion derived from Yao and Ma (2023)	(9) Differences in inference between 7 and 8
1	Baer et al. (2021)	Yes	Positively valenced <i>Trust</i>	Congruence effect <i>Hypothesis 1</i> Linear level effect	a_2	Yes <i>Table 3 on p. 191</i>	Fully	Exact correspondence <i>Supported (H1)</i> Linear level effect <i>Supported (H2)</i>	Exact correspondence and linear level effect	None
2	Cole et al. (2013)	No	No valence <i>Power distance values</i>	Congruence effect <i>Hypothesis 2</i>	a_1 and a_2	Yes <i>Table 2 on p. 969</i>	Partially a_2 exhibits negative curvature	Exact correspondence <i>Supported (H1)</i> unpredicted <i>curvilinear level effect noted on p. 968)</i>	Exact correspondence and curvilinear level effect	None
3	Dahm et al. (2015)	No	No valence <i>Time allocation</i>	Congruence effect <i>Hypothesis 1</i> Linear level effect	a_1 and a_2	Yes <i>Table 6 on p. 779</i>	Fully	Exact correspondence <i>Supported (H2)</i>	Exact correspondence effect	None
4	Matta et al. (2015)	Yes	Positively valenced <i>Leader-member exchange</i>	Congruence effect <i>Hypothesis 1</i> Linear level effect	a_2	Yes <i>Table 2 on p. 1697</i>	Fully	Exact correspondence <i>Supported (H1)</i> Linear level effect <i>Supported (H2)</i>	Exact correspondence and linear level effect	None
5	Richard et al. (2021)	Yes	Positively valenced <i>Racial diversity</i>	Congruence effect <i>Hypothesis 1</i> Linear level effect	a_2	Yes <i>Table 4 on p. 1368</i>	Fully	Exact correspondence <i>Supported (H1)</i> Linear level effect <i>Supported (H2)</i>	Exact correspondence and linear level effect	None
6	Wilson et al. (2018)	Yes	Negatively valenced <i>Family-to-work conflict</i>	Congruence effect <i>Hypothesis 1</i> Linear level effect	a_2	Yes <i>Table 2 on p. 727</i>	Fully	Exact correspondence <i>Supported (H1)</i> Linear level effect <i>Supported (H2)</i>	Exact correspondence and linear level effect	None

Note. The parameters not applied (Column 4) were drawn from Yao and Ma's (2023) in-text descriptions as well as their Tables 1–3. The conclusion derived from Yao and Ma (2023; Column 8) was drawn from their Tables 1–4. The difference in inference (Column 9) directly compares the conclusions reported in each original study based on the authors' hypothesized form of congruence (Column 7) and the corresponding conclusions from Yao and Ma's (2023) reanalysis (Column 8) and codes any inferential discrepancy (coding "none" if none exists). H = hypothesis.

Table 2
Group 2: Theoretical, Empirical, and Inferential Considerations

No.	Author	Theoretical consideration			Empirical consideration		Inferential consideration			
		(1) Hypothesizes alternative form	(2) Valenced phenomenon	(3) Alternative form hypothesized	(4) Parameters not applied according to Yao and Ma (2023)	(5) Parameters not applied reported in original work	(6) Parameters not applied support hypothesized form	(7) Conclusion in original article	(8) Conclusion derived from Yao and Ma (2023)	(9) Differences in inference between 7 and 8
1	Beus et al. (2020)	No	Mixed valence <i>Promotion and prevention of climates</i>		a_1 and a_2	Yes Table 5 on p. 257	Fully	Exact correspondence Supported (H1)	Exact correspondence effect	None
2	Bermiss and McDonald (2018)	No	No valence <i>Political ideology</i>		a_1 , a_2 , p_{10} , and p_{11}	No a_1 , p_{10} , and p_{11} not reported	Partially a_2 exhibits negative curvature and p_{21} indicates contingency	No congruence effect Not supported (H1)	Exact correspondence and squared linear effect with contingency	None
3	Liu et al. (2021)	Yes	No valence <i>Risk orientation</i>	Congruence effect <i>Hypothesis 1a</i> Curvilinear level effect	a_1	Yes Table 3 on p. 154	Fully	Exact correspondence Supported (H1a) Curvilinear level effect Supported (H3a)	Exact correspondence and curvilinear level effect	None
4	Mullins et al. (2015)	Yes	Positively valenced <i>Control over competence, superiority, and mastery</i>	Congruence effect <i>Hypotheses 3a</i> Congruence effect <i>Hypotheses 5a and 6a</i> Linear level effect <i>Hypothesis 5b</i> Curvilinear level effect	None			Exact correspondence Supported (H5a and H6a) Linear level effect Supported (H5b) Curvilinear level effect Supported (H6b)	Exact correspondence and curvilinear level effect	None
5	Wilson et al. (2016)	Yes	Positively valenced <i>Agreeableness</i>	No congruence effect hypothesized <i>regression to test an incongruence pattern</i>	a_1 and a_4	Yes Table 3 on p. 1416	n/a	Incongruence effect Does not predict a congruence effect	No congruence effect	None
6	Wilson et al. (2021)	Yes	Negatively valenced <i>Depersonalization</i>	Congruence effect <i>Hypothesis 1</i> Linear level effect <i>Hypothesis 2</i>	a_2	Yes Tables 2 and 4 on pp. 278 and 283	Fully	Exact correspondence <i>2/3 outcomes (H1)</i> Linear level effect <i>3/3 outcomes (H2)</i> (commensurate compatibility for the 3rd noted on p. 284)	Exact correspondence and linear level effect <i>(2/3 of outcomes)</i> Commensurate compatibility and linear level effect <i>(1/3 outcomes)</i>	None

Note. The parameters not applied (Column 4) were drawn from Yao and Ma's (2023) in-text descriptions as well as their Tables 1–3. The conclusion derived from Yao and Ma (2023; Column 8) was drawn from their Tables 1–4. The difference in inference (Column 9) directly compares the conclusions reported in each original study based on the authors' hypothesized form of congruence (Column 7) and the corresponding conclusions from Yao and Ma's (2023) reanalysis (Column 8) and codes any inferential discrepancy (coding "none" if none exists), H = hypothesis.

Table 3
Group 3: Theoretical, Empirical, and Inferential Considerations

No.	Author	Theoretical consideration			Empirical consideration		Inferential consideration			
		(1) Hypothesizes alternative form	(2) Valenced phenomenon	(3) Alternative form hypothesized	(4) Parameters not applied according to Yao and Ma (2023)	(5) Parameters not applied reported in original work	(6) Parameters not applied support hypothesized form	(7) Conclusion in original article	(8) Conclusion derived from Yao and Ma (2023)	(9) Differences in inference between 7 and 8
1	Bashshur et al. (2011)	Yes	Positively valenced <i>Perceptions of organizational support</i>	Congruence effect <i>Hypotheses 1a, 2a, 3a</i> Linear level effect <i>Hypotheses 1b, 2b, 3b</i>	p_{10} and p_{11}	No	n/a	Congruence effect <i>Supported (H1a, H2a, H3a)</i> Linear level effect <i>Supported (H1b, H2b, H3b)</i> (unpredicted curvilinear level effect for third noted on p. 566)	Commensurate compatibility and linear level effect for 2/3 of outcomes <i>Additional curvilinear level effect for the third outcome</i>	Form specified as commensurate compatibility congruence effect
2	Campagna et al. (2020)	Yes	Positively valenced <i>Trust</i>	No congruence effect <i>Linear effect along congruence line (Hypothesis 3)</i> <i>Linear effect along incongruence line (Hypothesis 4)</i>	p_{10} and p_{11}	No	n/a	<i>Partial support for H3</i> <i>No support for H4 (unpredicted congruence with linear level effect noted on p. 1007)</i>	Exact correspondence and linear level effect	None
3	Cao and Hamori (2020) ^a	Yes	Positively valenced <i>Developmental job experiences</i>	Congruence effect <i>Hypothesis 1</i> Linear level effect <i>Hypothesis 2</i>	p_{10} and p_{11}	No	n/a	Congruence effect <i>Supported (H1)</i> Linear level effect <i>Supported (H2)</i>	Exact correspondence and curvilinear level effect	Support for exact correspondence congruence effect qualified by the unpredicted curvilinear level effect
4	Carter and Mossholder (2015)	Yes	Positively valenced <i>Trust</i>	Congruence effect <i>Hypothesis 1</i> Linear level effect <i>Hypothesis 2</i>	p_{10} and p_{11}	No	n/a	Congruence effect <i>Supported for one of two outcomes (H1)</i> Linear level effect <i>Supported (H2)</i> <i>Support for H1</i> <i>Partial support for H2</i>	Commensurate compatibility and linear level effect for one of two outcomes	Form specified as commensurate compatibility congruence effect
5	Ehrhardt and Riggins (2019)	Yes	Positively valenced <i>Relational attachment</i>	No congruence effect <i>Deficiency to congruence (Hypothesis 1)</i> <i>Congruence to excess (Hypothesis 2)</i>	p_{10} and p_{11}	No	n/a	No congruence effect <i>Support for H1</i>	No congruence effect	None
6	Graham et al. (2018) ^a	Yes	No valence <i>Power distance values</i>	Congruence effect <i>Hypothesis 1</i> Moderated congruence effect <i>Hypothesis 3</i>	p_{10} and p_{11}	No	n/a	Congruence effect <i>Not supported (H1)</i> Moderated congruence effect <i>Supported (H3)</i>	No congruence effect	None

(table continues)

Table 3 (continued)

No.	Author	Theoretical consideration			Empirical consideration		Inferential consideration			
		(1) Hypothesizes alternative form	(2) Valenced phenomenon	(3) Alternative form hypothesized	(4) Parameters not applied according to Yao and Ma (2023)	(5) Parameters not applied reported in original work	(6) Parameters not applied support hypothesized form	(7) Conclusion in original article	(8) Conclusion derived from Yao and Ma (2023)	(9) Differences in inference between 7 and 8
7	Jansen et al. (2016) ^a	No	Positively valenced <i>Change-supportive perceptions</i>	Congruence effect <i>Hypotheses 1 and 2</i>	p_{10} and p_{11}	No	n/a	Congruence effect <i>Not supported (H1)</i> Congruence effect <i>Supported (H2)</i> <i>(appropriately qualified with a discussion of the linear level effect on p. 960)</i>	Commensurate compatibility and linear level effect <i>(one outcome)</i> No congruence effect <i>(one outcome)</i>	Form specified as commensurate compatibility congruence effect
8	Jordan et al. (2013)	Yes	Positively valenced <i>Ethical reasoning</i>	No congruence effect hypothesized <i>Makes polynomial predictions along incongruence line</i>	p_{10} and p_{11}	No	n/a	No congruence effect	No congruence effect	None
9	Kim et al. (2019)	Yes	Positively valenced <i>Pay level</i>	Commensurate compatibility effect <i>Hypotheses 1a and 2a</i> Linear level effect <i>Hypothesis 1b</i>	p_{10} and p_{11}	No	n/a	Commensurate compatibility congruence effect <i>Supported (H1a and H2a)</i> Linear level effect <i>Supported (H1b)</i>	Commensurate compatibility and linear level effect with contingency <i>(one outcome)</i> Commensurate compatibility with contingency <i>(one outcome)</i>	Support for one of two outcomes qualified by an unpredicted rotated surface contingency
10	Lambert et al. (2012)	Yes	Positively valenced <i>Consideration and Initiating Structure</i>	Congruence effect <i>Hypotheses 1 and 2</i> Linear level effect <i>Hypotheses 3 and 4</i>	p_{10} and p_{11}	No	n/a	Congruence effect <i>Supported for five of 12 outcomes (H1 and H2)</i> Linear level effect <i>Supported for five of 12 outcomes (H3 and H4)</i> <i>(unpredicted curvilinear level effect for three of 12 outcomes noted on p. 920)</i>	Exact correspondence and linear level effect <i>(one outcome)</i> Commensurate compatibility and linear level effect <i>(one outcome)</i>	Form specified for one of 12 outcomes as commensurate compatibility congruence effect
11	Liao et al. (2019) ^a	Yes	Positively valenced <i>Resource contributions</i>	No congruence effect hypothesized <i>Makes polynomial predictions along the slope of incongruence line</i>	p_{10} and p_{11}	No	n/a	An unpredicted congruence effect emerges in the results <i>Not discussed as it was not relevant to hypotheses</i>	Commensurate compatibility and linear level effect	None
12	Ouyang et al. (2018) ^a	Yes	Positively valenced <i>Favor giving</i>	No congruence effect hypothesized <i>Tests incongruence pattern</i>	p_{10} and p_{11}	No	n/a	Incongruence effect <i>Does not predict a congruence effect</i>	No congruence effect	None

(table continues)

Table 3 (continued)

No.	Author	Theoretical consideration			Empirical consideration		Inferential consideration			
		(1) Hypothesizes alternative form	(2) Valenced phenomenon	(3) Alternative form hypothesized	(4) Parameters not applied according to Yao and Ma (2023)	(5) Parameters not applied reported in original work	(6) Parameters not applied support hypothesized form	(7) Conclusion in original article	(8) Conclusion derived from Yao and Ma (2023)	(9) Differences in inference between 7 and 8
13	Richard et al. (2017)	Yes	Positively valenced <i>Racial diversity</i>	Congruence effect <i>Hypothesis 1</i> Linear level effect <i>Hypothesis 2</i>	p_{10} and p_{11}	No	n/a	Congruence effect <i>Supported (H1)</i> Linear level effect <i>Supported (H2)</i> (unpredicted <i>curvilinear level effect noted on p. 2395</i>)	Commensurate compatibility and curvilinear level effect	Form specified as commensurate compatibility congruence effect
14	Rosen et al. (2020) ^a	Yes	Positively valenced <i>Challenge stressors</i>	Congruence effect <i>Hypothesis 1</i> Linear level effect <i>Hypothesis 2</i>	p_{10} and p_{11}	Yes <i>Footnote 6 on p. 1189</i>	Fully	Congruence effect <i>Supported (H1)</i> Linear level effect <i>Supported (H2)</i>	Exact correspondence and linear level effect	None
15	Tepper et al. (2018) ^a	Yes	Positively valenced <i>Transformational leadership</i>	Congruence effect <i>Hypothesis 1</i> Linear level effect <i>Hypothesis 2</i>	p_{10} and p_{11}	No	n/a	Congruence effect <i>Supported (H1)</i> Linear level effect <i>Supported (H2)</i>	Commensurate compatibility and linear level effect	Form specified as commensurate compatibility congruence effect
16	Vidvarthi et al. (2014) ^a	Yes	Positively valenced <i>Leader-member exchange</i>	Congruence and linear level effect <i>Hypotheses 3a and 3b</i>	p_{10} and p_{11}	No	n/a	Congruence and linear level effect <i>Supported (H3a and 3b)</i>	Exact correspondence and linear level effect	None
17	Vogel et al. (2020) ^a	Yes	Positively valenced <i>Meaningfulness</i>	Congruence effect <i>Hypothesis 3</i> Linear level effect <i>Hypothesis 4b</i>	p_{10} and p_{11}	No	n/a	Congruence effect <i>Supported (H3)</i> Linear level effect <i>Supported (H4b)</i>	Exact correspondence and linear level effect	None
18	Wong et al. (2017) ^a	Yes	Positively valenced <i>Autonomy expectations</i>	Congruence effect <i>Hypothesis 1a</i> Linear level effect <i>Hypothesis 1b</i>	p_{10} and p_{11}	No	n/a	Congruence effect <i>Supported (H1)</i> Linear level effect <i>Not supported (H2)</i>	Exact correspondence effect	None
19	Zhang et al. (2012) ^a	Yes	Positively valenced <i>Proactive personality</i>	Congruence effect <i>Hypothesis 1</i> Linear level effect <i>Hypothesis 2</i>	p_{10} and p_{11}	No	n/a	Congruence effect <i>Supported (H1)</i> Linear level effect <i>Supported (H2)</i>	Exact correspondence and curvilinear level effect	Support for exact correspondence congruence effect qualified by the unpredicted curvilinear level effect

Note. The parameters not applied (Column 4) were drawn from Yao and Ma's (2023) in-text descriptions as well as their Tables 1–3. The conclusion derived from Yao and Ma (2023; Column 8) was drawn from their Tables 1–4. The difference in inference (Column 9) directly compares the conclusions reported in each original study based on the authors' hypothesized form of congruence (Column 7) and the corresponding conclusions from Yao and Ma's (2023) reanalysis (Column 8) and codes any inferential discrepancy (coding "none" if none exists). Group 3 studies labeled congruence effect in "Conclusion in original article" because without testing p_{10} and p_{11} , it is unclear as to whether exact correspondence or commensurate compatibility congruence effect. H = hypothesis.

^aMultilevel studies in Group 3.

does not recognize and consider each reviewed study's theoretical predictions and suggests a study should not be cited as "evidence of congruence" if it fails to support their "ideal form" (p. 446). This is particularly concerning, given that (a) exact correspondence is only one—very specific—form of a congruence effect, (b) the nature of this "ideal form" makes it extremely uncommon with most organizational phenomena, and the emphasis placed on it implicitly sets an unrealistic—and theoretically problematic—bar for future research, and (c) the majority of studies reviewed by Yao and Ma (2023) actually hypothesized deviation from this "ideal form." We elaborate on each of these points below.

Theoretical Problems With Focusing Only on Exact Correspondence

Congruence effects refer to a broad category of difference score effects (between two variables in predicting an outcome variable). On that note, as appropriately acknowledged by Yao and Ma (2023, p. 446), "congruence effects have different types, including but not limited to the exact correspondence effect and the commensurate compatibility effect." Their review provides a useful overview of the differences between these two types of congruence effects—specifically, exact correspondence indicates that perfect fit (i.e., fit exactly along the congruence line) is optimal for the dependent variable, and commensurate compatibility indicates the fit relationship that exists is shifted laterally in either direction such that the optimal combination may be at a slight degree of misfit in one specific direction. In addition to the general distinction between exact correspondence and commensurate compatibility, any specific congruence relationship may also vary depending on levels while holding congruence constant at high fit (i.e., the absolute values of the two predictor variables). For instance, although fit between two variables may be optimal compared to misfit at any given level (e.g., using a 5-point Likert scale, 1-1, 2-2, 3-3, 4-4, 5-5 maximize the dependent variable relative to various combinations of misfit), fit at high levels (5-5) may still enhance outcomes relative to fit at low levels (1-1; i.e., a linear level effect). Finally, congruence effects may also have contingencies. That is, outcomes may be maximized for congruence but only at certain amounts of the two component predictors (e.g., values only maximized when congruence occurs at 4-4, but not when congruence occurs at 2-2).²

To support *only* an exact correspondence effect—which is levied as the "ideal form" and implied benchmark used by Yao and Ma (2023) in their reanalysis—the congruence effect must demonstrate exact correspondence, exhibit no level effects (linear or curvilinear), and exhibit no contingencies. Importantly, beyond the fact that 26 of 31 articles reviewed provided theory for and explicitly hypothesized a form of congruence other than the exact "ideal form" (see Column 1 in Tables 1–3), it is important to note that this specific form of congruence effect is (and *theoretically should be*) uniquely rare in the organizational sciences. Most constructs studied in the organization sciences broadly—and those reviewed and discussed in Yao and Ma (2023) specifically—are inherently valenced. As one example, several studies have examined trust (a positively valenced construct—i.e., one widely shown to exhibit positive linear effects on beneficial outcomes; Colquitt et al., 2007; De Jong et al., 2016) from a congruence perspective (e.g., Baer et al., 2021; Carter & Mossholder, 2015). With that in mind, although one may predict trust fit (i.e., high–high or low–low trust) is optimal for a specific outcome of interest relative to misfit, the inherent positive valence of the trust construct itself should naturally result in high–high trust being even

more beneficial to an outcome of interest relative to low–low trust (despite low–low trust still being superior to situations of misfit). In fact, given the prevalence of linear level effects when examining congruence effects (stemming from the valence of the constructs under investigation), Edwards and Rothbard (1999) extended fit theory for precisely this reason—coining the term "metafit" to denote this effect and providing conceptual grounding for why fit at high levels of a positively valenced construct may be preferred over fit at low levels (see also Lambert et al., 2012; Tepper et al., 2018).

Not Considering the Theoretical Predictions of the Reviewed Studies

With the above as a backdrop, it is crucial to recognize that 25 of the 31 studies included in Yao and Ma (2023) featured valenced constructs (23 positively valenced and two negatively valenced; see Column 2 in Tables 1–3). As such, it is theoretically proper that 18 of the 31 studies explicitly hypothesized a linear level effect in addition to a congruence effect (with two additional studies hypothesizing a curvilinear level effect). Critically, their hypotheses and underlying theory would be *unsupported*, then, if only exact correspondence (with no linear level effect) emerged. Because Yao and Ma contextualized their conclusions as though all reviewed studies intended to show only exact correspondence (i.e., stating "caution is hence warranted" because only three of 31 studies match this form, p. 446), readers may infer that the majority of this work arrived at incorrect conclusions or failed to align with the theory they laid out. Importantly, however, closer inspection reveals that nearly every study reviewed (26 out of 31; see Columns 1 and 3 in Tables 1–3) explicitly hypothesized deviation from this specific form of congruence—and rightfully so. In fact, six of the 31 studies included in Yao and Ma's review used polynomial regression and response surface methods but made no congruence effect predictions at all (given that scholars often theorize and test the joint effects of two variables on an outcome where there is no reason to believe that the optimal or minimal outcome is anywhere near the midpoints of either variable), rendering an exact correspondence effect—and even congruence effects more broadly—irrelevant to the tests of their theorizing.

In sum, the fact that only three of the 31 reviewed studies meet the bar for Yao and Ma's (2023) "ideal form" of congruence is not necessarily indicative of problems with the theory and empirics in those works, as readers of Yao and Ma would likely conclude. Rather, these findings often appropriately reflect the nature of the phenomena under investigation (a point we further investigate in the sections to come) and, in general, have aligned with the authors' explicit theorizing. As a final point of comparison, we direct readers to Edwards and Cable (2009), which is widely considered to be the "how to" guide for testing congruence effects (including by Yao & Ma, 2023, p. 451). Edwards and Cable (2009) examined 36 direct effect congruence models and 36 total effect congruence models. Although congruence was broadly supported for a wide array of outcomes, the "ideal form" of congruence applied in Yao and Ma

² Online appendix figures 1–4 (https://osf.io/r4tvc/?view_only=2f456dd6487b41c6861c24efa1199b30) provide illustrative examples of exact correspondence versus (a) exact correspondence with a linear level effect (appendix figure 1), (b) exact correspondence with a curvilinear level effect (appendix figure 2), (c) a commensurate compatibility congruence effect (appendix figure 3), and (d) contingency (appendix figure 4).

(i.e., exact correspondence with no level effects or contingencies, p. 456) was supported in exactly two of the 36 direct effect models and two of the 36 total effect models (see table 3 on p. 665 of Edwards & Cable, 2009). We note this is, in fact, a smaller proportion than the three of 31 in Yao and Ma's (2023) review. This echoes and reaffirms the notion that exact correspondence is but one specific form of congruence—and one that is (and theoretically should be) extremely rare in the organizational science domain.

Empirical Misconception: Applied Versus Reported Conditions in the Reviewed Studies

The primary empirical inaccuracy in Yao and Ma (2023) is the suggestion that 30 of the 31 studies reviewed did not adequately apply all five conditions needed to accurately test congruence effects (see Table 4)—that is, $a_4 < 0$ (curvilinear effect along the incongruence line—indicating some form of congruence exists), a_1 (linear level effect) is a null effect, a_2 (curvilinear level effect) is a null effect, $p_{10} = 0$ (exact correspondence if supported vs. commensurate compatibility if not), and $p_{11} = 1$ (no contingency). They bucket the reviewed studies into three groups. Group 1 consists of studies they suggest did not adequately apply either a_1 and/or a_2 . Group 2 consists of studies they note consider p_{20} and p_{21} (rather than p_{10} and p_{11}) and additionally suggest some combination of not adequately applying a_1 and/or a_2 .³ Group 3 consists of studies that do not apply p_{10} and p_{11} .⁴

These potential omissions appear problematic at first blush; however, the discussion of these empirical omissions is to varying degrees misleading. Beginning with Groups 1 and 2, it is critical to acknowledge that 11 of the 12 studies (91.7%) reported all five of the conditions in their tables (for locations and page numbers in the original studies, see Column 5 in Tables 1 and 2). Although Yao and Ma (2023) acknowledged that Groups 1 and 2 reported the needed parameters, they go on to suggest that 11 of the 12 studies in these groups “did not use the five required conditions to accurately test congruence effects” (p. 451; see also their Tables 1 and 2), presumably because these results were not explicitly discussed in the text. As shown in Column 5 of Tables 1 and 2, the most prevalent conditions Yao and Ma considered omitted from testing were the null effects for a_1 and/or a_2 when not discussed by the original authors in the text. However, these parameters were (a) reported in each article's tables (in 11 of the 12 studies) and (b) in fact null—or in line with the hypothesized form—in almost every case (fully supportive for nine of the 12 studies, partially supportive for two of the 12, and not relevant to the predictions in the final study).

Shifting to Group 3, these articles did not consider or report p_{10} and p_{11} . This is a point on which we agree there is some degree of ambiguity surrounding the type of congruence effect that may exist. Indeed, without knowing p_{10} and p_{11} , the specific form of congruence could be exact correspondence, commensurate compatibility, or either of the two with potential contingencies.⁵ As such, we echo Yao and Ma (2023) that future studies should report the appropriate principal axis intercept and slope (e.g., p_{10} and p_{11}) to discern exactly what type of congruence effect exists.

There is certainly a need for clearer empirical reporting in the congruence effect literature, and Yao and Ma (2023) provided sound guidance in this regard. At the same time, readers of Yao and Ma may conclude that nearly every study reviewed did not apply all appropriate conditions when testing their hypotheses. When it comes to Groups 1 and 2, given that (a) nearly every study in these groups reported all five

of the required parameters in their tables (11 of 12 studies) and (b) the majority of those parameters matched the required conditions (and in 11 of 12 cases, supported congruence), Yao and Ma's suggestion that these studies “did not use the five required conditions to accurately test congruence effects” (p. 451) is potentially misleading and something readers should be aware of. When it comes to Group 3, although the omitted parameters (p_{10} and p_{11}) are not relevant to whether a congruence effect exists but rather the type of congruence effect that exists, we do agree these parameters should be reported to allow precise inferences on the nature of the congruence effect.

Inferential Misconception: Evidence of Congruence in Reviewed Studies

The theoretical and empirical issues forwarded by Yao and Ma (2023) resulted in a somewhat discouraging assessment of the trustworthiness of inferences that can be drawn from the studies reviewed. Below, we consider the extent to which the theoretical and empirical misconceptions outlined above potentially drove this outlook. With that in mind, we directly compare the conclusions reported in each original study based on the authors' hypothesized form of congruence⁶ and the corresponding conclusions from Yao and Ma's (2023) reanalysis (see Columns 3, 7, 8, and 9 in Tables 1–3).

Beginning with Group 1, four of the six studies hypothesized congruence with a linear level effect (because of the construct's valence). Shown in Columns 7 and 8, the results in each original article fully supported exact correspondence with a linear level effect, which was further confirmed in Yao and Ma's (2023) reanalysis. In other words, the results were consistent with the authors' expectations (although those expectations were not limited to exact correspondence only), and Yao and Ma's work corroborated those findings. The remaining two studies predicted only a congruence effect (no level effects). For the first, the study's results showed an exact correspondence effect, and this was affirmed by Yao and Ma. For the other, their results revealed exact correspondence with a curvilinear level effect (which they appropriately acknowledged in the article), and Yao and Ma's reanalysis confirmed this specific form. Thus, for Group 1, the inferences reported in these studies were fully aligned with the hypothesized form of congruence (or appropriately contextualized in one case). To illustrate the inferential problem at hand, although the original authors' interpretations and discussions

³ As a point of clarity, p_{20} and p_{21} are the relevant principal axes when testing whether values are minimized (convex) rather than maximized (concave) in situations of congruence (Edwards, 2002; Edwards & Parry, 1993).

⁴ We note that one article included in Group 3 did in fact report and explicitly discuss these parameters (Rosen et al., 2020; see p. 1180 of their article). Although we believe it should have been included in Group 1, we discuss it in Group 3 to be consistent with Yao and Ma's (2023) classifications.

⁵ In speculating on why these parameters may be omitted in those studies, the majority (11 out of 19; indicated with a superscript a in Table 3) of articles included in Group 3 used multilevel data. Given that p_{10} and p_{11} involve nonlinear combinations of regression coefficients, they require nonparametric procedures such as bootstrapping to test their statistical significance. Most multilevel analysis programs (e.g., Mplus and HLM) have no such bootstrapping capabilities. Thus, further guidance is needed in terms of how to handle such situations.

⁶ For the hypothesized form, the hypothesized deviations (e.g., predicted level effects) are applied to the “ideal form” standard (i.e., exact correspondence). For example, if a study predicted congruence with a linear level effect, we apply Yao and Ma's (2023) standard that exact correspondence and a linear level effect are required for full support.

Table 4*Conditions Required to Demonstrate Exact Correspondence as Well as the Form of Congruence if Specific Condition Is Not Supported*

Condition required for exact correspondence effect	Conceptual meaning	Consequence for congruence if response surface parameter condition is <i>not</i> supported	Example surface plot
Condition 1 $a_4 < 0$	The surface is curved downward along the incongruence line	No congruence effect in any form is supported	
Condition 2 Principal axis intercept and slope $p_{10} = 0$	The outcome variable is maximized along the congruence line	If $a_4 < 0$ and $p_{10} \neq 0$ Commensurate compatibility congruence effect rather than exact correspondence effect—that is, the fit relationship that exists is shifted laterally in either direction such that the optimal combination is at a slight degree of misfit in one specific direction	Online appendix figure 3b
$p_{11} = 1$		If $a_4 < 0$ and $p_{11} \neq 1$ Congruence effect with contingency—that is, the outcome variable is maximized at congruence but only at certain amounts of the two component predictors (e.g., values only maximized when congruence occurs at 4 – 4, but not when congruence occurs at 2 – 2)	Online appendix figure 4b
Condition 3 $a_1 = 0$	The outcome variable increases linearly along the congruence line moving from low–low to high–high	If $a_4 < 0$ and $a_1 \neq 0$ Congruence with a linear level effect—that is, in addition to the congruence effect, low–low differs from high–high (holding congruence constant along the congruence line)	Online appendix figure 1b
$a_2 = 0$	The outcome variable increases curvilinearly along the congruence line moving from low–low to high–high	If $a_4 < 0$ and $a_2 \neq 0$ Congruence with a curvilinear level effect—that is, in addition to the congruence effect, low–low curvilinearly differs from high–high (holding congruence constant along the congruence line)	Online appendix figure 2b

Note. When testing that values are minimized (rather than maximized) by congruence, Condition 1 would test for $a_4 > 0$ (rather than $a_4 < 0$), and Condition 3 would test p_{20} and p_{21} as the principal axis intercept and slope (rather than p_{10} and p_{11}). a_1 = slope along congruence line; a_2 = curvature of the surface along the congruence line; a_3 = slope along incongruence line; a_4 = curvature of the surface along the incongruence line; p_{10} and p_{11} = intercept and slope of the first principal axis; p_{20} and p_{21} = intercept and slope of the second principal axis. Example surface plots included as additional online material posted on the website of the Center for Open Science at https://osf.io/r4tvc/?view_only=2f456dd6487b41c6861c24efa1199b30.

of results confirmed support for the appropriate type of congruence (and were identical to Yao and Ma's reanalysis in every case), Yao and Ma recommended caution in interpreting these studies' conclusions (p. 446) because the congruence effects found deviate from their "ideal form."

The same trend is seen with the studies included in Group 2. Here, three of the six studies hypothesized congruence with some form of level effect (either linear or curvilinear). For all three, the original article exhibited exact correspondence with the predicted level effect, and this pattern was again confirmed in Yao and Ma (2023). Of the remaining three studies, two predicted only a congruence effect (no level effects). Of these, one of the study's results showed an exact correspondence effect, and this was affirmed by Yao and Ma's reanalysis. The other study reported no support for congruence, and Yao and Ma classified it as exact correspondence and a squared linear effect with contingency. Thus, the original authors were more conservative in their interpretation than Yao and Ma. The final study did not predict a congruence effect (the authors used polynomial regression to test an incongruence pattern). Their hypotheses were appropriately discussed, the proper results were reported in the original article, and Yao and Ma similarly classified it as not supporting congruence. In all six cases, the original authors' interpretation of results was identical to (or more conservative than) those arrived at in Yao and Ma's reanalysis, and in four of the six cases, the data

confirmed the expected type of congruence effect. Again, however, Yao and Ma advised caution in interpreting all but one of these studies' conclusions because the reanalysis compared each against the "ideal form" standard rather than the hypothesized form of congruence.

When it comes to Group 3, Yao and Ma's (2023) reanalysis provides additional value in several cases. At the same time, we start by highlighting that the original authors' discussions of results were identical to Yao and Ma's (2023) reanalysis in 10 of the 19 cases. For instance, three of the studies in Group 3 predicted congruence with a linear level effect, their results fully supported congruence with a linear level effect, and Yao and Ma's reanalysis confirmed exact correspondence with a linear level effect (paralleling our discussions above for Groups 1 and 2).⁷ In the remaining nine studies in Group 3, although all supported a congruence effect in some form, Yao and Ma's reanalysis did provide clarity on the *type* of congruence effect (when not explicitly predicted or discussed)—six were clarified as commensurate compatibility effects (for at least

⁷ Five studies in Group 3 did not predict a congruence effect (they used polynomial regression to test a variety of specific contrasts along the response surface). In each case, their hypotheses were appropriately discussed, and the proper results were reported. Yao and Ma (2023) classified these studies as not supporting congruence three times, once as exact correspondence and a linear level effect, and once as commensurate compatibility and a linear level effect.

one outcome), two were explicated as exact correspondence effects qualified by an unpredicted curvilinear level effect, and one was contextualized by an unpredicted rotated surface contingency.

In sum, a primary inference likely to be drawn from Yao and Ma (2023) is that only three studies out of 31 appropriately examined (theoretically) and demonstrated (empirically) congruence. However, upon closer inspection, we clarify that 26 of the 31 studies demonstrated sufficient evidence of congruence effects (albeit not strictly “ideal form” congruence), and 22 of the 31 studies provided identical inferences to Yao and Ma’s reanalysis (when considering the form of congruence explicitly hypothesized and the discussion of results in the original work).

Discussion

Considering Theory, Empirics, and Inferences in Unison

When it comes to Groups 1 and 2, the conclusion that “Caution is hence warranted both for citing these studies as evidence of congruence and for proposing practical implications based on the findings in these studies” (Yao & Ma, 2023, p. 446) is inaccurate and warrants reconsideration. As we hope is now clear, this takeaway is the product of two potential missteps: Yao and Ma (2023) (a) evaluated each study reviewed as if it was theorizing a form of congruence that the studies explicitly *did not theorize* (and that we underscore is but *one type* of congruence that should be the exception, not the rule, in most organizational studies) and (b) suggested the reviewed articles did not consider conditions that they did, in fact, report (and that most often were supportive). Indeed, when considering the type of congruence that was predicted, the results reported and discussed in the reviewed articles, and the results from Yao and Ma’s (2023) reanalysis of those articles, the inferences are identical in every case. When it comes to Group 3, while these studies largely supported congruence generally, Yao and Ma’s (2023) reanalysis provided utility in contextualizing the specific *type* of congruence in several ambiguous cases (as a result of these studies not reporting p_{10} and p_{11}). On that note, although the reported inferences based on the hypothesized congruence effects were identical to those arrived at in Yao and Ma’s (2023) reanalysis for 10 of the 19 studies, the reanalysis provided additional insight on the type of congruence effect for nine studies (when not explicitly predicted or discussed).

Research on Congruence Effects Moving Forward

In light of our clarifications, it is important to consider which takeaways from Yao and Ma (2023) bear repeating, which should be reconsidered, and where congruence scholarship can go from here. We begin by noting Yao and Ma provide useful guidance on what should be tested when examining congruence effects and how to classify different types of congruence based on those tests. With Yao and Ma (2023) as a guidepost, future studies should strive to be as thorough and transparent as possible in describing the *type* of congruence being predicted and reporting the five conditions used to test congruence effects.

At the same time, beyond the misconceptions surrounding past work we outline, two additional inferences from Yao and Ma (2023) have the potential to impede future scholarship. First, Yao and Ma (2023, p. 460) concluded that “research hypotheses should be developed based on all three core theoretical issues (i.e., asymmetries in the effects of misfit, variation in outcomes along the fit line, and the contingency).” While we agree that all three issues should be

discussed in light of results, some of these features are common and lend themselves to a priori theorizing (e.g., linear level effects as the result of a construct’s valence; which are often already predicted in the literature—18 of 31 studies), whereas others are extremely rare and not conducive to a priori prediction (e.g., contingencies—one of 31 studies). In attempting to follow these guidelines, congruence scholars may feel obliged to (a) make null predictions in every study for rare, nuanced, and typically emergent features (e.g., contingencies) and/or (b) develop theory about features that are nearly impossible to predict a priori. Rather than making this a theoretical requirement, we recommend future work base a priori predictions on the theoretical issues germane to their construct of interest but also ensure proper reporting and discussion of all three core issues relevant to the form of congruence in their results.

Second, although Yao and Ma (2023) labeled exact correspondence (with no level effects or contingencies) as the “ideal form” of congruence, the true “ideal form” in any given study is the type of congruence informed by theory and the nature of the construct under examination. Perhaps the greatest future-oriented risk that has the potential to emerge from Yao and Ma (2023) is that (a) reviewers may infer that congruence effects other than *only* exact correspondence do not provide full “evidence of congruence” (p. 446) and (b) scholars interested in examining congruence may be deterred from studying phenomena likely to deviate from *only* exact correspondence as a result (even though most studies in the organizational sciences examine valenced constructs that inherently should deviate from that form). Thus, we want to close by calling attention to the fact that exact correspondence *only* is not the goal—testing one’s hypothesized form of congruence is. Indeed, just because it’s not a cedar tree (exact correspondence), does not mean it is not a tree (a congruence effect).

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