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Using the HEXACO-100 to measure Individual Entrepreneurial Orientation: Introducing the HEXACO-IEO

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A B S T R A C T

Individual Entrepreneurial Orientation (IEO) is a three-dimensional conceptualization of personality traits that influence entrepreneurial outcomes, and it includes risk-taking, innovativeness, and proactiveness. Much is still unknown about IEO, in part due to the relative recency of its conceptualization and subsequent operationalization. Advancing our understanding of IEO could be greatly hastened if an existing, widespread measure was shown to approximate a supported measure of IEO. Existing datasets using this widespread measure could be reanalyzed to derive new inferences regarding IEO, and future authors administering this widespread measure for other purposes could simultaneously study IEO. One such nonproprietary measure that may gauge IEO is the HEXACO-100 (also labeled the HEXACO-PI-R). In the current article, we identify a collection of items from the HEXACO-100 that closely approximate a supported measure of IEO and its three dimensions, as evidenced by the measure's psychometric properties as well as convergent and criterion validity. We label this collection of items the HEXACO-IEO. The identification of this measure opens many avenues for future research. The HEXACO-100 has been studied alongside a wide array of constructs – constructs that can now be studied alongside IEO. Also, the current study connects IEO with specific dimensions of the HEXACO. As this framework has been linked with many personality theories, IEO can too be linked with these theories. We specifically suggest that the Situation, Trait, and Outcome Activation (STOA) model may offer notable insights into IEO. Thus, the current article provides many implications for research on entrepreneurship, personality, and their intersection.

Researchers have shown great interest in the personality of entrepreneurs for decades, likely because relationships between personality and entrepreneurial outcomes (e.g. entrepreneurial intent, behaviors, and performance) have been repeatedly supported (Begley and Boyd, 1987; Chell et al., 1991; De Vries, 1977; Leutner et al., 2014; Littunen, 2000). Originally, these studies tested the effects of specific personality traits, including need for achievement (Hansemark, 2003), locus of control (Pandey and Tewary, 1979), independence (Bull and Willard, 1993), and many others. More recent authors have now developed multidimensional conceptualizations of higher-order personality traits that solely include dimensions that predict entrepreneurial outcomes, and researchers either study the effects of the dimensions separately or aggregate the dimensions together to form a single multidimensional construct (Do and Dadvari, 2017; Jain and Ali, 2013; Tan et al., 1996). Such an approach provides a more directed course of study, and effect sizes obtained for multidimensional constructs are typically larger than studying individual predictors in isolation (Cromie, 2000; Miranda et al., 2017; Mueller and Thomas, 2001). One such multidimensional construct that has garnered much attention is Individual Entrepreneurial Orientation (IEO; Goktan and Gupta, 2015; Koe, 2016; Kollmann et al., 2007).

IEO contains the dimensions of risk-taking, innovativeness, and proactiveness (Ferreira et al., 2015; Jelenc et al., 2016; Joardar and Wu, 2011). The construct and its dimensions have been shown to predict entrepreneurial intention and success (Bolton and Lane, 2012; Ibrahim & Mas'ud, 2016; Koe, 2016), and it has been integrated into several theoretical models of entrepreneurship (Awang et al., 2016; Kollmann et al., 2007; Van der Westhuizen, 2017). IEO is also associated with outcomes beyond entrepreneurship. For instance, Gupta et al. (2016) supported that IEO predicts employee reactions to new technologies, whereas Fellnhofer et al. (2016) showed that IEO is related to employee job performance. Thus, IEO is an important collection of personality traits for entrepreneurship and as well as other

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domains of research.

Much is still unknown about IEO, in part due to the recency of its conceptualization and subsequent operationalization (Bolton, 2012; Bolton and Lane, 2012; Kollmann et al., 2007; Runyan et al., 2008). While IEO has been incorporated into theoretical frameworks, many outcomes, explanatory mechanisms, and boundary conditions proposed in such frameworks have yet to be sufficiently tested. Advancing our understanding of IEO could be greatly hastened if items from an existing, widespread measure were shown to approximate a supported measure of IEO (Bolton, 2012; Bolton and Lane, 2012). Existing datasets using this widespread measure could be reanalyzed to derive new inferences regarding IEO, even if the original researchers had not intended to study the construct. Likewise, future researchers administering this widespread measure for other purposes could simultaneously study IEO, broadening the audience that investigates IEO. These approximate IEO items could partially address the bandwidth-fidelity dilemma in studying the personality of entrepreneurs (Rauch and Frese, 2007; Soto and John, 2017). That is, the existing, widespread measure may be commonly applied because it is a wider conceptualization of personality and predict outcomes more broadly, whereas IEO measures may be studied only with entrepreneurs because it is a narrower conceptualization of personality and more strongly predicts relevant outcomes. While each measure has its benefits, researchers may also be wary of their concerns. Identifying a subset of items to gauge IEO in a broader measure could provide the "best of both worlds". Researchers could assess the wider relationships of the broader conceptualization, and they could also assess the stronger relationships of the narrower conceptualization using a single measure. Thus, identifying this measure may encourage researchers to study the personality of entrepreneurs who would otherwise be unwilling to do so.

One such measure that may be able to gauge IEO is the HEXACO-100 (also labeled the HEXACO-PI-R), which is a nonproprietary scale that is free to use for nonprofit academic purposes (Ashton and Lee, 2016; Ashton et al., 2014; De Vries et al., 2009; Lee and Ashton, 2018; Marcus et al., 2019; Romero et al., 2015). The HEXACO-100 is intended to gauge the entire HEXACO framework, named for its six primary dimensions: Honesty-humility, Emotionality, eXtraversion, Agreeableness, Conscientiousness, and Openness. Each dimension also has four subdimensions as well as an interstitial dimension (altruism), which results in the HEXACO-100 possessing 25 total dimensions. Prior authors have suggested and even supported that certain combinations of the HEXACO-100 items may gauge unintended constructs. For instance, Marcus et al. (2019) as well as Ruchensky et al. (2018) demonstrated that the HEXACO-100 can adequately measure psychopathy, and it has since been used for such in several studies (Hyatt et al., 2019; Moshagen et al., 2019; Sleep et al., 2019). Given that the HEXACO-100 includes conceptually-similar dimensions to risk-taking (fearfulness [reverse coded], social boldness), innovativeness (creativity, inquisitiveness), and proactiveness (prudence, diligence), similar efforts could identify a combination of items to adequately gauge IEO.

To achieve this goal, we identify combinations of HEXACO-100 items that adequately approximate a supported measure of IEO (Bolton, 2012; Bolton and Lane, 2012) by selecting the HEXACO-100 items with the largest correlations to the IEO dimensions. The new measure is labeled the HEXACO-IEO. We then assess the HEXACO-IEO's psychometric properties, its relationships with the IEO measure's dimensions, and both measures' relationships with IEO outcomes. Our results not only support that the HEXACO-IEO approximates the IEO measure, but also that the relations of the two measures are similar with various outcomes. We therefore produce a measure from the HEXACO-100 that can reliably be used to investigate IEO.

Given these considerations, the current article has many implications for research and practice. First, the HEXACO-100 has been studied with a broader array of outcomes than IEO, given the much more widespread usage of the HEXACO-100 compared to IEO measures (Bolton and Lane, 2012; Lee and Ashton, 2014, 2018). A reanalysis of prior datasets could uncover novel relationships and link new theoretical frameworks to IEO that may otherwise go unstudied. Second, the HEXACO-100 has been used for expansive data collection efforts. For example, Lee and Ashton (2018) collected a dataset of over 100,000 participants using the HEXACO-100, and Thielmann et al. (2019) collected a dataset across sixteen languages using the HEXACO-100. Reanalyzing these efforts and others could provide the largest investigations of IEO to date, producing firm conclusions (Lee and Ashton, 2018) and cross-cultural insights (Thielmann et al., 2019). Third, the HEXACO-IEO can address the bandwidth-fidelity dilemma in studying entrepreneur personality, widening the audience that studies IEO. Fourth, our investigation links IEO and its dimensions to relevant HEXACO dimensions. Such associations may uncover the placement of IEO in the broader scope of personality, expand the construct's nomological network, identify novel theoretical integrations, and detect directions for future research. Fifth, creating an IEO scale from the HEXACO-100 also creates scales for its three dimensions: risk-taking, innovativeness, and proactiveness. Our efforts can also enhance research on these three dimensions independent of IEO, and therefore the current article provides many theoretical implications for entrepreneurship, personality, and their intersection.

1. Study

1.1. Participants

Participants (N = 298, M_{age} = 39.04, SD_{age} = 10.88, 47% female, 89% United States) were recruited from Amazon's MTurk and provided monetary compensation. Several studies have supported the validity of results obtained using MTurk participants (Hauser and Schwarz, 2016; Necka et al., 2016; Smith et al., 2016). We only included participants that had completed more than 50 MTurk tasks with greater than 95% lifetime approval. We also excluded those that failed more than one attention check (e.g. "Please mark agree to show that you are paying attention") or failed to participate in multiple waves of data collection (described below). These strict inclusion criteria were chosen to ensure sufficient data quality, and they were based on prior suggestions for MTurk (Cheung et al., 2017; Sheehan, 2018; Smith et al., 2016). All statistics, including reported sample sizes, reflects the sample after excluding these participants.

1.2. Procedure

Initially, 653 participants signed up for the study through MTurk. They completed the first survey online, which included the HEXACO-100 and IEO measure. One week later, 298 participants completed a second survey, which included a measure of entrepreneurial attitudes. One week after the second survey, 237 participants completed a third survey, which included measures for entrepreneurial intent and entrepreneurial status (both ever and current).

1.3. Measures

1.3.1. HEXACO-100

The HEXACO-100 was administered (Lee and Ashton, 2018). The items have a predetermined order, and researchers commonly refer to items by this order. For instance, the example item, "People have often told me that I have a good imagination", is commonly referred to as Creativity 3, as it is the third item that measures the creativity dimension of openness to experience in the traditional ordering of the scale. The current article likewise uses this approach to refer to the HEXACO-100 items.

1.3.2. IEO

IEO was measured with the 10-item scale of Bolton and Lane (2012). The scale includes three items for risk taking ($\alpha = .75$), four items for innovativeness ($\alpha = .73$), and three items for proactiveness ($\alpha = .77$). An example item is, "I like to take bold action by venturing into the unknown" (risk taking). The scale has been shown to produce proper psychometric and validity information (Bolton, 2012; Bolton and Lane, 2012), making it an adequate indicator of IEO. It is also perhaps the most-used measure of IEO, suggesting that any convergent measure would be appealing to a wide audience of entrepreneurship scholars.

1.3.3. Entrepreneurial attitudes

Entrepreneurial attitudes were measured with the following three self-created items: "I have a positive attitude towards owning a business", "Owning a business does not sound bad to me", and, "I would enjoy owning a business". Their Cronbach's alpha was .94, and Supplemental Material A presents an exploratory factor analysis (EFA) supporting that these three items load onto a single factor.

1.3.4. Entrepreneurial intent

Entrepreneurial intent was measured with six items created by Liñán and Chen (2009), who provided psychometric and validity support. An example item is, "I am ready to do anything to be an entrepreneur". Its Cronbach's alpha was .96.

1.3.5. Entrepreneurial status

As done in prior studies (Laspita et al., 2012; Zhang and Arvey, 2009; Zhao and Seibert, 2006), entrepreneurial status was measured via two Yes or No questions. These questions were: "Have you ever started your own business?", and, "Do you currently operate your own business?". These two items were analyzed separately in all analyses, respectively labeled as "Ever" and "Current".

2. Results

To create the HEXACO-IEO, we first assessed the correlations of the HEXACO-100 items with the IEO scale dimensions. The HEXACO-100 items with the strongest correlations with these dimensions would produce aggregates that most closely approximate the original IEO dimensions. We did not have an a priori number of intended items per dimension, but we instead wanted to create dimensions that (a) loaded onto unique factors, (b) produced appropriate reliability statistics, (c) produced adequate convergent validity correlations (corrected for unreliability, $\rho > 0.70$), (d) produced bias-corrected heterotrait-monotrait (HTMT) ratio of correlation confidence intervals that included 0.85, and (e) produced similar criterion validity correlations to the original IEO scale. These criteria were based on prior similar studies (Henseler et al., 2015; Marcus et al., 2019; Ruchensky et al., 2018) and scale development suggestions (Carpenter, 2018; Clark and Watson, 1995; DeVellis, 2016; Gerbing and Anderson, 1988; Hinkin, 1995, 1998; Howard, 2016; Rossiter, 2002; Wright et al., 2017).

Because the HTMT ratio is a relatively new approach to assess convergent and discriminant validity, it should be presently discussed (Hair et al., 2016, 2020; Henseler et al., 2015). The HTMT ratio assesses item cross-correlations of two measures relative to their item inter-correlations, and the result indicates the extent to which the two measures are either distinct or convergent. Prior studies have shown that using a cutoff of 0.85 or above with bias-corrected confidence intervals produces the most accurate results (Henseler et al., 2015; Voorhees et al., 2016), and two measures should be considered to gauge the same construct if their HTMT ratio confidence intervals include 0.85 or above.

Also, our intent was to identify the items in an exploratory manner but assess their convergent and criterion validity in a confirmatory manner. For this reason, we selected our items and performed an EFA using a subset of 239 participants, whereas we assessed the convergent and criterion validity of the resultant scales using a subset of 59 participants. As the former subset was used for our EFA, this sample needed to include more participants.

Correlations of HEXACO-100 items with IEO dimensions are presented in Table 1. The correlations with risk-taking saw a drop in magnitude after six items; the correlations with innovativeness saw a drop in magnitude after ten items; and the correlations with proactiveness saw a drop in magnitude after eight items. We chose to retain six risk-taking items, six innovativeness items, and five proactiveness items for two reasons. First, four items strongly correlated to multiple IEO dimensions, and we chose to include these items

only with the more strongly correlated dimension. Second, items after the first five for proactiveness, while strongly correlated, did not appear to assess the content domain. These items referenced general feelings of optimism and well-being rather than proactiveness, whereas the first item items directly assessed the construct's content domain. Thus, the chosen items were ideal for our purposes.

We then conducted an exploratory factor analysis (EFA) with all chosen HEXACO-IEO items (Table 2) following traditional EFA guidelines (Hair et al., 1998; Hinkin, 1995, 1998; Howard, 2016). A three-factor solution was supported (eigenvalues = 4.753, 1.961, 1.897, 1.186, 0.914, 0.818, …), whether applying a visual scree plot analysis or a parallel analysis (95th percentile eigenvalues = 1.689, 1.547, 1.451, 1.373, 1.306, 1.244, …). Only one minor cross-loading emerged (Liveliness 1, 0.31), but we chose to retain this item because its strong primary factor loading (0.63). All items loaded strongly onto their primary factor (>0.35). For this reason, we did not remove any items and the factor structure of the HEXACO-IEO was supported.

Table 3 presents Cronbach's alphas and correlations. Innovativeness, proactiveness, and the total score each demonstrated appropriate internal consistency (Cronbach's alpha >.70), but risk-taking fell slightly short of expectations (0.66). Each HEXACO-IEO dimension and the total scale either met or closely approached appropriate convergent validity cutoffs with the IEO measure, and these convergent validity correlations were extremely strong when corrected for unreliability: risk-taking ($\rho = .78$), innovativeness ($\rho = .84$), proactiveness ($\rho = .90$), and the total scale ($\rho = .97$). The dimensions and total scale also met the HTMT ratio confidence interval cutoff. The HTMT ratio for risk taking was 0.82 (95%C.I.[0.57, 1.01]); the HTMT ratio for innovativeness was 0.86 (95%C.I.[0.64, 0.98]); the HTMT ratio for proactiveness was .92 (95%C.I.[0.72, 1.08]); and the HTMT ratio for the total scale was 0.97 (95%C.I.[0.91, 1.06]). Thus, the convergent validity of the HEXACO-IEO was supported.

Table 3 also includes the criterion validity correlations. None of the criterion validity correlations significantly differed between the HEXACO-IEO and IEO using either one- or two-tailed tests of correlation differences (all $p > .05$). The total scale scores were similar with entrepreneurial attitudes (HEXACO-IEO, $r = .20$; IEO, $r = .28$), intentions (HEXACO-IEO, $r = .24$; IEO, $r = .22$), ever status (HEXACO-IEO, $r = .31$; IEO, $r = .33$), and current status (HEXACO-IEO, $r = .25$; IEO, $r = .21$). Thus, all results were consistent among the two scales.

Table 1
Correlations of HEXACO-100 items with IEO dimensions.

HEXACO-100 Item	Risk-Taking	HEXACO-100 Item	Innovativeness	HEXACO-100 Item	Proactiveness
1.) Fearfulness 2	**.520**	**1.) Creativity 3**	**.467**	**1.) Organization 2**	**.588**
2.) Social Boldness 2	**.471**	2.) Fearfulness 2[a]	.429	**2.) Diligence 2**	**.502**
3.) Sociability 4	**.412**	**3.) Creativity 1 (Reverse Coded)**	**.426**	**3.) Diligence 1**	**.429**
4.) Anxiety 2	**.384**	**4.) Unconventionality 2**	**.421**	**4.) Organization 1**	**.415**
5.) Liveliness 1	**.384**	5.) Social Boldness 2[a]	.366	**5.) Diligence 3 (Reverse Coded)**	**.409**
6.) Social Boldness 3	**.375**	**6.) Inquisitiveness 2**	**.349**	6.) Social Self-Efficacy 1	.405
7.) Fearfulness 3 (Reverse Coded)	.326	7.) Social Boldness 3[a]	.339	7.) Liveliness 2	.399
8.) Sociability 3	.315	**8.) Creativity 2**	**.332**	8.) Prudence 3	.397
9.) Fearfulness 4	.313	9.) Liveliness 1[a]	.306	9.) Social Self-Efficacy 2	.384
10.) Creativity 1[a] (Reverse Coded)	.301	**10.) Inquisitiveness 1**	**.302**	10.) Prudence 4 (Reverse Coded)	.359

[a] Indicates item with stronger correlation with alternative dimension and therefore not included within this dimension.Bolded and underlined items included within final dimension scales. All correlations significant at .01 level.

Table 2
Exploratory factor analysis results.

	Risk Taking	Innovativeness	Proactiveness
1.) Fearfulness 2	.496		
2.) Social Boldness 2	.822		
3.) Sociability 4	.711		
4.) Anxiety 2	.632		
5.) Liveliness 1	.626		.311
6.) Social Boldness 3	.678		
7.) Creativity 3		.593	
8.) Creativity 1		.482	
9.) Unconventionality 2		.367	
10.) Inquisitiveness 2		.354	
11.) Creativity 2		.822	
12.) Inquisitiveness 1		.439	
13.) Organization 2			.588
14.) Diligence 2			.737
15.) Diligence 1			.570
16.) Organization 1			.389
17.) Diligence 3			.622

Only factor loadings greater than 0.30 shown.Eigenvalues = 4.753, 1.961, 1.897, 1.186, 0.914, 0.818, 0.785, 0.732 …

Table 3
Correlations and Cronbach's alphas of study variables.

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12
1.) Risk-Taking (HEXACO-IEO)	3.73	1.00	.66											
2.) Innovativeness (HEXACO-IEO)	4.91	1.24	.24	.83										
3.) Proactiveness (HEXACO-IEO)	5.45	.84	.04	.24	.74									
4.) HEXACO-IEO Total Score	4.70	.70	.64**	.80**	.56**	.77								
5.) Risk-Taking (IEO)	4.16	1.25	**.55****	.45**	.02	.54**	.75							
6.) Innovativeness (IEO)	4.47	1.02	.36**	**.65****	.07	.59**	.51**	.73						
7.) Proactiveness (IEO)	5.56	.88	.10	.44**	**.68****	.58**	.19	.25	.77					
8.) IEO Total Score	4.73	.79	.49**	.69**	.29*	**.76****	.82**	.80**	.58**	.79				
9.) Entrepreneurial Attitudes	4.29	1.35	.07	.27*	.03	.20	.33*	.22	.01	.28*	.94			
10.) Entrepreneurial Intentions	4.08	1.56	.25	.18	.03	.24	.37**	.16	-.12	.22	.52**	.96		
11.) Entrepreneurial Status (Ever)	.25	.44	.20	.32*	.06	.31*	.38**	.20	.12	.33*	.25	.43**	N/A	
12.) Entrepreneurial Status (Current)	.17	.38	.20	.21	.08	.25	.25	.10	.09	.21	.09	.42**	.77**	N/A

Bolded and underlined correlations represent convergent validity correlations.
*$p < .01$.
**$p < .01$.

3. Discussion

We identified a set of HEXACO-100 items that approximate the IEO scale and its dimensions, and we provided support for the validity of the HEXACO-IEO. The HTMT ratios and convergent validity correlations met or closely approached typical cutoffs (Carpenter, 2018; DeVellis, 2016; Rossiter, 2002; Wright et al., 2017), and these correlations were very strong when corrected for unreliability. These items also produced three distinct factors with minimal cross-loadings, and the Cronbach's alphas also met appropriate guidelines (Gerbing and Anderson, 1988; Hinkin, 1995, 1998). The relations of the IEO scales with the chosen outcomes were also not significantly different, supporting the criterion validity of the created measure. Together, these results provide strong support for the continued use of the HEXACO-IEO.

3.1. Implications

The current results can prompt a new type of IEO study, in which the construct is investigated via prior and future research efforts using the HEXACO-100. Novel relationships of IEO can be discovered by reassessing prior data. For instance, much is still unknown about the development of IEO, but prior authors have assessed the trajectory of personality across the lifespan using the HEXACO-100 (Ashton and Lee, 2016; Moshagen et al., 2019). Reassessing these datasets can uncover the development and growth of IEO. Likewise, the predominant study of IEO is its relationship to entrepreneurial outcomes, but some authors have begun to assess the relations of IEO with general employee behaviors (e.g. job performance; Fellnhofer et al., 2016). The HEXACO-100 has been used to study such outcomes, and researchers could reanalyze these prior datasets to discover novel mediating and moderating effects of IEO that have already been tested – and possibly even supported – with the HEXACO dimensions.

Regarding future studies, the HEXACO-IEO can aid in addressing the bandwidth-fidelity dilemma within entrepreneurship research. The measure allows future researchers to continue their study of a broad personality conceptualization while drawing more specific inferences regarding IEO. Thus, the HEXACO-IEO can allow the "best of both worlds" in the study of entrepreneurship and personality regarding the bandwidth-fidelity dilemma.

The current study also links IEO and its dimensions to the HEXACO framework. The HEXACO-IEO's risk-taking items were derived from the emotionality and extraversion dimensions, likely due to these two dimensions' associations with negative reactions to stressors and sensation seeking, respectively; the innovativeness items were derived from the openness dimension, likely due to its association with freedom of thought; and the proactiveness items were derived from the conscientiousness dimension, likely due to its association with dutifulness and hard-workingness. IEO should henceforth be seen as emerging from these broader aspects of personality – as an aggregated trait that is derived from aspects of emotionality, extraversion, openness, and conscientiousness. Such associations can link IEO with various theories of personality. Notably, Zettler et al. (2019) meta-analytically supported that the HEXACO dimensions' outcomes can be understood via the Situation, Trait, and Outcome Activation (STOA) model, which explain the behavioral expression of personality traits via domain-specific situational affordances (De Vries et al., 2016). Future research should assess whether IEO can also be understood via the STOA model – a theoretical perspective that has yet to be integrated with IEO. Similarly, life history theory and cybernetic theory have been used to explain the emergence and dimensionality of personality, including the HEXACO, but it has yet to be integrated with IEO (De Vries et al., 2016; Jonason et al., 2012). These theories may explain why these three dimensions form IEO, but also how these dimensions influence outcomes.

Lastly, the HEXACO-IEO may provide benefits beyond the chosen IEO scale (Bolton and Lane, 2012). Some authors have criticized that the IEO scale's innovativeness dimension may inadvertently gauge aspects of risk-taking (Fellnhofer et al., 2016), as the two dimensions demonstrate very strong correlations and an innovativeness item tends to cross-load into the risk-taking factor (Bolton, 2012). The HEXACO-IEO's innovativeness dimension appears to not gauge risk-taking, because the dimensions' correlation was smaller and more closely aligned with the conceptual distinctiveness of the two dimensions. Thus, the HEXACO-IEO may be ideal to use in future research even independent from the HEXACO-100.

3.2. Limitations

It should be recognized that the risk-taking dimension of the HEXACO-IEO only approached the convergent validity cutoffs. This leads to two considerations. First, innovativeness, proactiveness, and the total score of the HEXACO-IEO may provide relatively firm conclusions regarding these dimensions and IEO; however, researchers may consider assessing the risk-taking dimension of the HEXACO-IEO in a more exploratory manner, and results regarding this specific dimension may need to be replicated. Second, it is possible that the chosen IEO scale (Bolton, 2012; Bolton and Lane, 2012) does not capture the entire domain of risk-raking, and future research may want to assess whether a more comprehensive measure is needed to understand risk-taking in an entrepreneurial context.

Also, some authors have voiced concerns regarding the use of MTurk. We followed the recommendations of prior authors for using this data source, and we were conservative in our inclusion criteria. Participants that correctly responded to almost all attention checks and participated in multiple timepoints are believed to be sufficiently motivated, but future research should replicate the current results using varying data sources and methodological designs.

Similarly, our sample was largely American, which suggests that it is WEIRD (Western, Education, Industrialized, Rich, and Democratic; Henrich et al., 2010, Simons et al., 2017). Our results may not generalize to populations with other demographic profiles; however, the measurement invariance of the HEXACO-100 has been supported in 16 languages (Thielmann et al., 2019), and the psychometric properties and validity of the scale has been supported across even more countries (Lee and Ashton, 2018). We assume that our results could be supported in these other languages and countries, but future research is necessary to confirm this notion.

Lastly, we assessed the convergent validity of the HEXACO-IEO with only Bolton and Lane's (2012) scale, but other measures of IEO exist – such as Goktan and Gupta's (2015) scale. Future researchers should investigate the validity of the HEXACO-IEO with other measures, and they should also assess other forms of validity not investigated in the current article.

4. Conclusion

Our goal was to identify a set of HEXACO-100 items that approximate a supported IEO measure. This goal was firmly achieved for the total scale as well as the innovativeness and proactiveness dimensions, and future research can progress soundly using the HEXACO-IEO to gauge these traits. The risk-taking dimension's results closely approached the desired cutoffs, and future research can use the HEXACO-IEO to study this trait in an exploratory manner. Thus, we open several avenues of research for entrepreneurship, personality, and their intersection.

Author statement

Dr. Matt C. Howard completed all portions of the current manuscript.

Declaration of competing interest

Dr. Matt C. Howard has no conflicts of interest regarding the current submission.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jbvi.2020.e00163.

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