Individual-Intellectual Integrations on the Commonality Criterion in Russian Undergraduates

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Abstract: The commonality is one of underlying conditions that provide the individual-intellectual integrations. Three forms identify the commonality. The first is the causal commonality, the second is the generalizing commonality, third is the intertwining commonality. Confirmatory one- and two- factor analysis (CFA) and path analysis (PA) specified the operationalization of the commonality. 235 undergraduates at universities in Perm city (Russia) involved in this study. Participants were 178 women and 57 men, age 17 to 22 years (M = 18.61, SD = 0.88). The set of variables entered individuality traits (nervous system, temperament, and personality), fluid and crystallized intelligence, and creativity. The main results were as follows. (1) The variables of individuality provide individual-intellectual integrations and function as the causal commonality. (2) Variables of individuality and creativity provide individual-intellectual integrations and function as two forms of causal commonality. (3) The generalizing commonality did not arise by means of one- or two- factor CFA. (4) The intertwining commonality of the variables of individuality and the variables of intelligence and creativity has not found empirical support by means of PA. The recommendation proposes that although constructs of individuality and intelligence with creativity differ, researchers may apply to the commonality criterion.

Keywords: Individual-intellectual integrations, Commonality, Causal commonality, Generalizing commonality, Intertwining commonality

Introduction

The Commonality Criterion

Educational research is often relying on several and various theories (Fleenor & Eastman, 1997; Furnham,

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Monsen & Ahmetoglu, 2009; Kokkinos, 2007; Wilson, Woolfson, Durkin & Elliott, 2016; Van der Zee, Thijs & Schakel, 2002). Scholars incline to cover the issue from distinguishing viewpoints. However, this approach is not without drawbacks, because their common basis skips. To solve this theoretical clash, of particular attention is the commonality criterion.

The commonality criterion assumes the opportunity to integrate theories according to some systemic options, namely, system—subsystem, system—system, intertwining systems. The first option suggests that one theory embeds another theory similar to a common includes its part. The second option proposes that several theories relate as a whole and a whole. Then they come to a new commonality that is rather wider than theories apart. Finally, the third option considers each theory simultaneously as an independent system and as a subsystem of another theory. Thus, each theory functions both the system and the subsystem of another theory. In doing so, they intertwine.

Further, the system—subsystem option can be a basis to combine theories like a causal commonality. It means that one theory enables changes in another theory and the latter relies on the former. The system—system option implies that theories are functionally equivalent. Initially, they differ but there is a higher, broader and abstract level at which they generalize. One can entitle this level as the generalizing commonality. The intertwining systems option suggests that theories intersect. Then the intertwining commonality can arise.

Confirmatory factor analysis (CFA) and path analysis (PA) can operationalize the commonality criterion, thereby transferring it from a theoretical reasoning to an empirical form. The three empirical forms of commonality give rise.

One-factor CFA can detect the causal commonality this way. In a latent factor, the factor loadings of variables that identify one theory (“system 1”) are significant and highest whereas the factor loadings of variables that identify another theory (“system 2”) are moderate or small. Then, the factor loadings of the system 1 are markers of the latent factor. They indicate the “causal” commonality for systems 1 and 2.

One-factor CFA can also detect the generalizing commonality. Imagine that the factor loadings of variables that identify one and another theory (“system 1” and “system 2”) are equal approximat0ely. Then the latent factor explains their similar variance. Apparently, the factor loadings of variables that identify the systems 1 and 2 indicate the generalizing commonality. The latter appears beyond the factor loadings but may explain them. There are no clear rules to compare statistically the amount of factor loadings. Meanwhile the "rule of thumb" (e.g., the Chaddock scale) would help.

Two-factor CFA can detect the causal commonality and generalizing commonality to some extent of other way. In one latent factor, the factor loadings of variables mark the system 1 and the factor loadings of variables mark the system 2 in another latent factor. Then the “causal” commonality looks two-fold. The both systems produce investments to “causal” commonality. The generalizing commonality adds to the causal commonality if the

latent factors correlate. As a result, the causal commonality and the generalizing commonality supplement each other.

PA can detect the intertwining commonality. Some variables of the system 1 look as exogenous variables; they pass to some variables of the system 2 as endogenous variables. Conversely, some variables of the system 2 look as exogenous variables; they pass to some variables of the system 1 as endogenous variables. The same variable cannot be either exogenous or endogenous. Exogenous or endogenous function should not coincide. Then the variables of the systems 1 and 2 intertwine but their mix does not arise.

Individual-Intellectual Integrations

Psychologists attempted repeatedly to study the relationship of different features in respect with to the human mind and behavior. For example, they have studied how personality traits enable intelligence and creativity (Baker & Bichsel, 2006; Chang, Peng, Lin & Liang, 2015; Furnham & Nederstrom, 2010; Moutafi, Furnham & Crump, 2006; Moutafi, Furnham & Paltiel, 2005; Rammstedt, Lechner & Danner, 2018; Simon, Lee & Stern, 2020). Another area is to examine how personality traits and intelligence make investments in creativity (Batey, Chamorro-Premuzic & Furnham, 2009; Batey, Furnham & Safiullina, 2010; Furnham & Bachtiar, 2008). Of particular attention are promotions of intelligence and creativity on personality traits (Furnham & Cheng, 2017; Furnham & Treglown, 2018; Gorgol, Stolarski & Matthews, 2020). In fact, scholars studied the relationships of several systems (personality traits, intelligence, and creativity), but they did not produce correlations according to the commonality criterion. Researchers initially set the direction of the relationship, a priori assuming which of the systems was the cause and which was the effect. The commonality criterion though can cover this gap.

Three theories arise as integrable on the commonality criterion. V. S. Merlin's theory of integral individuality (Merlin, 1986), D. V. Ushakov's structural-dynamic theory of intelligence (Ushakov, 2003, 2011), and J. Guilford's theory of divergent (creative) thinking (Guilford, 1967). Russian famous psychologist V. S. Merlin has developed the theory of individuality as a hierarchical system. In particular, it entered the levels of the nervous system, temperament and personality (Merlin, 1986). To some extent, this approach is similar to that personality trait theorists developed (DeYoung, 2015; McAdams, Pals, 2006; McCrae, Costa, 2008). Crystallized and fluid intelligence gives rise of the structural-dynamic theory of D. V. Ushakov. Fluency, flexibility, and originality indicate divergent thinking by J. Guilford (1967).

Research Hypotheses

The theoretical analysis of the commonalty criterion and its operationnalization arrived at the following research hypotheses.

1. An integral individuality can parsimoniously represent through a part of its variables with the most loadings.
2. In one-factor CFA of individuality, intelligence and creativity variables, the individuality variables

bring the highest factor loadings.

3. In one-factor CFA, the variables of individuality, intelligence and creativity have approximately equal factor loadings.
4. In two-factor CFA, individuality variables enter one latent factor, and variables of intelligence and/or creativity another latent factor. These latent factors correlate.
5. Path analysis shows that there are polymorphic relationships between the variables of individuality with the variables of intelligence and creativity. Then the intertwining commonality appears.

Method

Participants

The study involved 235 students of higher educational institutions of Perm city (Russia), studying in the fields of humanities. Participants were 178 women and 57 men, age 17 to 22 years (M = 18.61, SD = 0.88). The gender composition in the sample reflects the gender ratio in the humanity area of universities.

Measures

Individuality Traits

The Pavlovian Temperament Survey (Strelau, Angleitner, & Newberry, 1999; Russian adaptation: Danilova & Shmelev, 1988) indicated the nervous system traits. The survey includes the following scales: Strength of excitation, Strength of inhibition, and Mobility of nervous processes.

The Formal Characteristics of Behaviour – Temperament Inventory (Strelau & Zawadzki, 1995); Russian adaptation: Strelau et al., 2009) indicated the temperament traits. The inventory includes the following scales: Briskness, Perseveration, Sensory sensitivity, Emotional reactivity, Endurance, and Activity.

The Big Five Inventory-2 (Soto & John, 2017; Russian adaptation: Shchebetenko et al., 2020) indicated the personality traits. The inventory includes the following scales: Extraversion, Agreeableness, Conscientiousness, Negative emotionality, and Open-Mindedness.

Intelligence

Raven's Progressive Matrices intended to measure the fluid intelligence (Raven, Raven, Court, 2012). A common scale was in use.

The Universal intelligence test (Baturin & Kurganskiy, 1995) intended to measure the crystallized intelligence. The subscales were as follows: Awareness, Missing words, Comprehensibility, Analogies, Inferences, and Word learning. The results of these subscales were summing up and a common scale indicated the above subscales.

Divergent (Creative) Thinking

Alternate Uses test (Wallach & Kogan, 1965; Russian adaptation: Averina, Shcheblanova, 1996) intended to measure divergent thinking. Three scales were calculating: Fluency, Flexibility, and Originality.

Data Analysis

PA, CFA, and principal component analysis (PCA) detected the integrations of individuality, intelligence, and creativity variables on the commonality criterion. PCA reduced the individuality variables to their small number with high loadings.

One-factor and two-factor CFA detected the causal and generalizing forms of commonality. The one-factor CFA intended to define a latent factor and manifest variables of individuality, intelligence, and creativity. The two-factor CFA intended to define two latent factors. The manifest variables of individuality suggested to engage in the first latent factor and the manifest variables of intelligence and creativity to engage in the second latent factor.

PA intended to define the intertwining commonality. Three models were in use. In the first model, the paths passed from the individuality variables (using the entire set, not a reduced one) to variables of intelligence and creativity. In the second model, paths passed from intelligence and creativity to individuality variables. Finally, the third model entered a combining model that included the first and second models under condition exogenous and endogenous variables do not coincide.

To assess the fit of CFA and PA models with empirical data, the following fit indices were in use: chi-square statistics, ratio of chi-square statistics to degrees of freedom (χ^2/df), comparative fit index (CFI), and root mean square error of approximation (RMSEA).

The data were preliminarily standardizing and converting into T-scores (M = 50, SD = 10). The SPSS Statistics v. 27 and SPSS AMOS v. 27 of IBM Corporation provided data processing.

Results

PCA of Individuality Variables

The PCA indicated one component with loadings of individuality variables. Table 1 shows the results of the PCA.

Table 1. Principal Component Analysis of Individuality Variables

Individuality variables	**Component 1**
Strength of excitation	.86
Briskness	.81
Extraversion	.78
Negative emotionality	-.77
Mobility of nervous processes	.76
Emotional reactivity	-.75
Endurance	.67
Activity	.67
Perseveration	-.62
Strength of inhibition	.47
Agreeableness	.46
Conscientiousness	.43
Open-Mindedness	.42
Sensory sensitivity	.22
Eigenvalue	5.88
Explained variance (%)	41.99

Note: variables arrange on loading magnitude.

Loadings ranged from .22 to .86. For further analysis, 4 variables with the highest loadings and reflecting different levels of individuality took into account: Strength of excitation (nervous system), Briskness (temperament), Extraversion and Negative emotionality (personality).

Factor scores detected each respondent. The correlation of entire set (14 variables) and the set that decreased (4 variables) of individuality variables was $r = .96$, $p < .001$.

Causal and Generalizing Commonality

The factor loadings of individuality, intelligence, and creativity variables entered a one-factor CFA (Table 2). The model included residual covariance: Extraversion—Crystallized intelligence, Fluid Intelligence—Crystallized intelligence, Crystallized Intelligence—Flexibility, Fluency—Originality, Fluency—Flexibility, and Originality— Flexibility.

Table 2. Factor Loadings of Individuality, Intelligence, and Creativity in One-Factor CFA Model

Variables of individuality, intelligence, and creativity	Factor 1
Individuality	
Strength of excitation	.86***
Briskness	.78***
Extraversion	.81***
Negative emotionality	-.67***
Intelligence	
Fluid intelligence	.11
Crystallized intelligence	.05
Creativity	
Fluency	-.01
Originality	.05
Flexibility	.07

Note: *** p < .001.

The individuality variables had all significant loadings in the factor: Strength of excitation (.86), Briskness (.78), Extraversion (.81), and Negative emotionality (-.67). The variables of intelligence and creativity were non-significant: Fluid intelligence (.11), Crystallized intelligence (.05), Fluency (-.01), Originality (.05), and Flexibility (.07). Table 5 summarizes the fit indices. Figure 1 shows a diagram of the model.

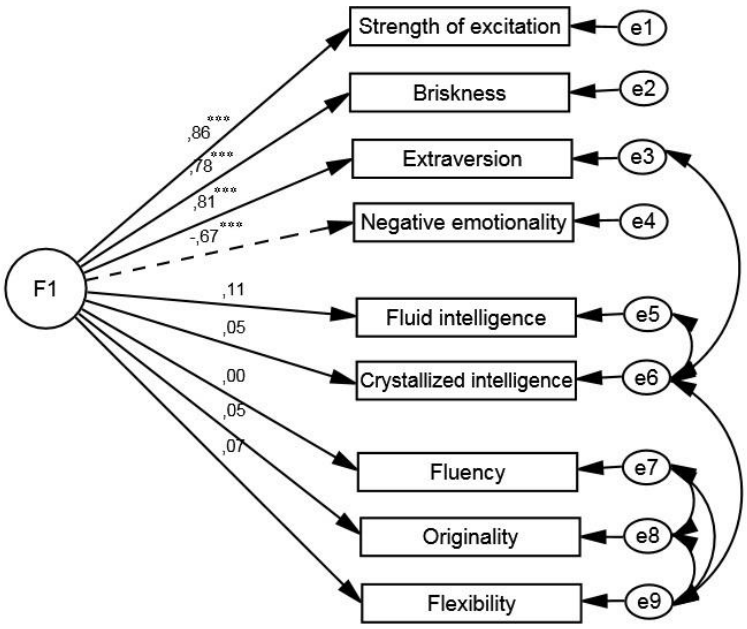

Figure 1. The One-Factor CFA Model

Note: continuous lines with arrows – paths with significant positive coefficients; discrete lines with arrows – paths with significant negative coefficients; continuous arcs with arrows – significant positive covariance between residuals;
*** $p < .001$.

The fit indices of the one-factor model indicated its fit with empirical data: $p(\chi^2) > .05$, $\chi^2 / df < 2$, CFI > .95, RMSEA < .05. The one-factor model emphasizes that the traits of individuality can function as the causal commonality in individual-intellectual integrations.

A two-factor CFA model (M_2) detected two latent factors. One latent factor included variables of integral individuality with most significant loadings. The manifest variables consisted of Strength of excitation (.85), Briskness (.80), Extraversion (.81), and Negative emotionality (-.66). Another latent factor included variables of creativity with most significant loadings. The manifest variables consisted of Fluency (.81), Originality (.98), and Flexibility (.92). The intelligence variables were non-significant: Fluid intelligence (.05) and Crystallized intelligence (.06). The model entered residual covariance: Briskness—Crystallized intelligence, Extraversion—Crystallized intelligence, Fluid intelligence—Crystallized intelligence, Crystallized intelligence—Flexibility. Latent factors did not correlate (Table 3). Table 5 shows the fit indices of the M_2 model. Figure 2 shows a diagram of the model.

Table 3. Factor Loadings of Individuality, Intelligence, and Creativity in The Two-Factor CFA Model

Variables of individuality, intelligence, and creativity	**Factor 1**	**Factor 2**
Individuality		
Strength of excitation	.85***	
Briskness	.80***	
Extraversion	.81***	
Negative emotionality	-.66***	
Intelligence		
Fluid intelligence		.05
Crystallized intelligence		.06
Creativity		
Fluency		.81***
Originality		.98***
Flexibility		.92***

Note: *** $p < .001$.

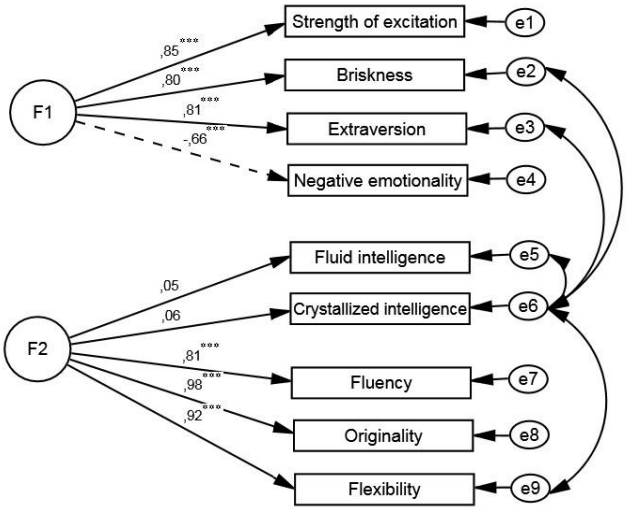

Figure 2. The Two-Factor CFA Model

Note: continuous lines with arrows – paths with significant positive coefficients; discrete lines with arrows – paths with significant negative coefficients; continuous arcs with arrows – significant positive covariance between residuals;

*** $p < .001$.

The fit indices of the two-factor model indicated its fit with empirical data: $p(\chi^2) > .05$, $\chi^2 / df < 2$, CFI > .95, RMSEA < .05. The two-factor model emphasizes that the traits of individuality and creativity function as two forms of the causal commonality in individual-intellectual integrations. The intelligence variables removed from a refining two-factor CFA model (M_3) because they received low and non-significant loadings in the second factor (Table 4).

Table 4. Factor loadings of the refining two-factor CFA model

Variables of individuality, intelligence and creativity	**Factor 1**	**Factor 2**
Individuality		
Strength of excitation	.84***	
Briskness	.80***	
Extraversion	.81***	
Negative emotionality	-.67***	
Creativity		
Fluency		.81***
Originality		.98***
Flexibility		.92***

Note: *** - $p < .001$.

The manifest variables of the first latent factor represented individuality traits with significant loadings: Strength of excitation (.84), Briskness (.80), Extraversion (.81), and Negative emotionality (-.67). The creativity variables received significant loadings in the second factor: Fluency (.81), Originality (.98), and Flexibility (.92). Entirely, the loadings of the manifest variables in the M_3 model did not differ from the loadings of the manifest variables in the M_2 model. The exception was in that of a Strength of excitation loading slightly reduced (-.01) and a Negative emotionality loading slightly increased (.01). Table 5 shows the fit indices of the M_3 model. Figure 3 shows a diagram of the model.

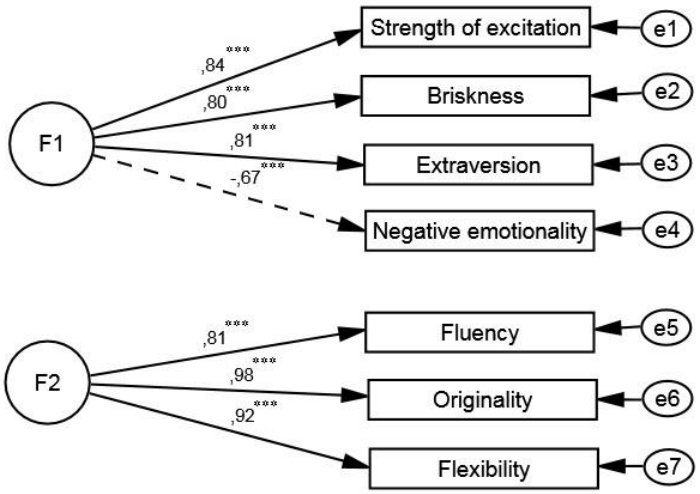

Figure 3. The Refining Two-Factor CFA Model

Note: continuous lines with arrows – paths with significant positive coefficients; discrete lines with arrows – paths with significant negative coefficients; continuous arcs with arrows – significant positive covariance between residuals;
*** $p < .001$.

The fit indices of the refining two-factor model indicated its fit with empirical data: $p(\chi^2) > .05$, $\chi^2 / df < 2$, CFI > .95, RMSEA < .05. The refining two-factor model emphasizes that the traits of individuality and creativity function as two forms of the causal commonality in individual-intellectual integrations.

The results showed that the latent factors did not significantly correlate ($r = .05$, $p > .05$), and their common factor did not arise (no general variance of primary latent factors appeared).

Intertwining Commonality

Testing the fifth hypothesis involved three stages. First, the model of paths (M_4) from individuality to intelligence and creativity arose. The significant paths passed from Strength of excitation to Crystallized intelligence ($\beta = .25$; $p < .001$), from Emotional reactivity to Flexibility ($\beta = -.07$; $p < .01$), from Extraversion to Crystallized intelligence ($\beta = -.25$; $p < .001$), from Agreeableness to Fluid intelligence ($\beta = .13$; $p < .05$), from

Agreeableness to Flexibility (β = -.09; p <.001), and from Conscientiousness to Crystallized intelligence (β = -.17; p <.01). Table 5 shows the fit indices of the M_4 model.

Second, the model of paths (M_5) from intelligence and creativity passed to individuality variables. The paths were significant from Crystallized intelligence to Strength of excitation (β = .16; p < .001), from Flexibility to Emotional reactivity (β = -.30; p < .001), and from Originality to Emotional reactivity (β = .27; p < .01). Table 5 shows the fit indices of the M_5 model.

Third, the model (M_6) of intertwining commonality indicate polymorphic paths. They passed from Extraversion to Crystallized intelligence, from Agreeableness to Fluid intelligence and Flexibility, from Conscientiousness to Crystallized intelligence, and back from Originality to Emotional reactivity. Fig. 4 illustrates the polymorphic paths.

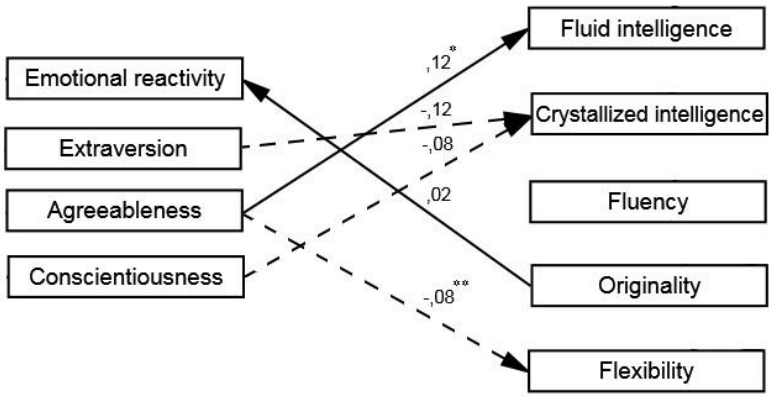

Figure 4. The path model of intertwining variables

Note: continuous lines with arrows – paths with significant positive coefficients; discrete lines with arrows – paths with significant negative coefficients; covariance between variables and residuals skip;
* - p < .05.

The fit indices of the path model of intertwining variables indicated its fit with empirical data: $p(\chi^2) > .05$, $\chi^2 / df < 2$, CFI > .95, RMSEA < .05.

The paths were non-significant from Extraversion to Crystallized intelligence (β = - .12; p > .05), from Conscientiousness to Crystallized intelligence (β = -.08; p > .05) and from Originality to Emotional reactivity (β = .02; p > .05). The paths were significant from Agreeableness to Fluid intelligence (β = .12; p < .05) and from Agreeableness to Flexibility (β = -.08; p < .01). Because the significant paths from individuality to intelligence and creativity remained, but from intelligence and creativity to individuality were non-significant, the intertwining of variables by polymorphic kind did not acknowledge. Table 5 shows the fit indices of the M_6 model.

Table 5. Fit Indices of Models

Model	χ^2	df	p	χ^2 / df	CFI	RMSEA
M_1. The one-factor CFA model	27.2	21	.164	1.30	.99	.036
M_2. The two-factor CFA model	22.1	23	.515	0.96	1.00	< .001
M_3. The refining two-factor CFA model	12.5	14	.565	0.89	1.00	< .001
M_4. The path model from individuality to intelligence and creativity	362.9	172	< .001	2.11	.93	.069
M_5. The path model from intelligence and creativity to individuality	388.8	176	< .001	2.21	.92	.072
M_6. The path model of intertwining variables	30.9	20	.057	1.54	.99	.048

Note: χ^2 – chi-square statistic; df – degrees of freedom; p – significance level; χ^2 / df – relative chi-square; CFI – Comparative fit index; RMSEA – Root mean square error of approximation

Discussion

Testing the first hypothesis showed that the most loadings of individuality variables can parsimoniously identify the individuality. The high correlation of the entire and decreasing set of individuality variables supports this assumption. In doing so, the decreasing set of variables refers to all the levels of individuality, namely, nervous system, temperament, and personality.

Testing the second hypothesis supported the assumption that in one-factor CFA of individuality, intelligence, and creativity the individuality variables received the most factor loadings. These data point to the individual-intellectual integrations under guidance of the individuality. The term "individual-intellectual integration" reveals the meaningful relationships of the traits of individuality, intelligence, and creativity. In the first approximation, they indicate the causal commonality.

The third hypothesis, that in one-factor CFA the variables of individuality, intelligence, and creativity have approximately equal factor loadings, have not received empirical support. This may mean that individuality, intelligence and creativity are not functionally equal and do not suggest the generalizing commonality.

The fourth hypothesis, that in two-factor CFA individuality variables enter one latent factor, and variables of intelligence and/or creativity enter another latent factor, has received empirical support. Indeed, results were consistent with above hypothesis. Individuality variables initiated the first latent factor. They suggest the causal commonality under guidance of the individuality. In turn, creativity variables initiated the second latent factor. They suggest the causal commonality under guidance of the creativity. However, these latent factors did not significantly correlate, and a common factor combining them did not arise. This means that two forms of the

causal commonality have received empirical support although their common factor did not appear. That is, the two-factor CFA was poor to find the generalizing commonality. Nevertheless, other criteria permit to get evidences in favor of the generalizing commonality in individual-intellectual integrations. For instance, the mediation criterion indicates that the generalizing commonality can still arise due to mediating links between the variables of individuality and creativity (Dorfman, Kalugin, 2021).

The fifth hypothesis that there are polymorphic relationships between the variables of individuality and the variables of intelligence and creativity has not received empirical support on our data. However, the model was statistically fit. This may mean that with a different set of variables of individuality, intelligence, and creativity, their intertwining could occur.

Conclusions and Limitations

The above results permit to come to the following conclusions.

1. Individuality variables provide individual-intellectual integrations and, in this capacity, function as the causal commonality.
2. Variables of individuality and creativity provide individual-intellectual integrations and, in this capacity, function as two forms of causal commonality.
3. The assumption of the generalizing commonality did not receive empirical support neither by one-factor nor two-factor CFA.
4. The assumption of the intertwining commonality by a polymorphic kind did not receive empirical support in respect with the variables of individuality and the variables of intelligence and creativity.

This study has some limitations. In particular, a set of individuality variables derives from different theories. They can introduce an eclectic and lead to statistical errors. For example, it is questionable about using a survey to measure traits of the nervous system. Similar doubts can emerge when the personality studies depart from the trait theory because it does not propose to make clear distinction between personal and temperamental traits. Likewise, the Raven test intends to measure the fluid intelligence whereas the questionnaire of Baturin and Kurgansky intends to measure the crystallized intelligence. The creative thinking takes into account divergent thinking by Guildford but other approaches to creativity are withdraw. Being aware of these clashes, the authors are cautious about the empirical data they received and try not drastic to reject the theoretical assumptions, even if currently their empirical support is outside.

For example, the generalizing commonality of individuality variables and the variables of intelligence and creativity by polymorphic kind suggests receiving the empirical support if the set of variables change. Besides, turning the view can enable to bring a predictable effect. Dorfman and Kalugin (2021) applied the mediation criterion. They found that the generalizing commonality of individuality variables and the variables of intelligence and creativity by polymorphic kind receive the empirical support through the mediation links.

Recommendations

The commonality criterion permits to identify the relationships between constructs that come from different theories. The commonality opens up the ways to find their relationships at the theoretical and empirical level and to develop relevant models. In particular, the individual-intellectual integrations may overcome gaps between theories and make them integrable due to the criterion of commonality. Thus, a new perspective arises with respect to Russian undergraduates' learning and education at universities.

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