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Evaluating the Dimensionality of Self-Determination Theory's Relative Autonomy Continuum

Kennon M. Sheldon[1,2], Evgeny N. Osin[2], Tamara O. Gordeeva[2,3], Dmitry D. Suchkov[2], and Oleg A. Sychev[4]

Abstract

We conducted a theoretical and psychometric evaluation of self-determination theory's "relative autonomy continuum" (RAC), an important aspect of the theory whose validity has recently been questioned. We first derived a Comprehensive Relative Autonomy Index (C-RAI) containing six subscales and 24 items, by conducting a paired paraphrase content analysis of existing RAI measures. We administered the C-RAI to multiple U.S. and Russian samples, assessing motivation to attend class, study a major, and take responsibility. Item-level and scale-level multidimensional scaling analyses, confirmatory factor analyses, and simplex/circumplex modeling analyses reaffirmed the validity of the RAC, across multiple samples, stems, and studies. Validation analyses predicting subjective well-being and trait autonomy from the six separate subscales, in combination with various higher order composites (weighted and unweighted), showed that an aggregate unweighted RAI score provides the most unbiased and efficient indicator of the overall quality of motivation within the behavioral domain being assessed.

Keywords

self-determination theory, relative autonomy continuum, multidimensional scaling, simplex modeling

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Self-Determination Theory (SDT) and the Relative Autonomy Continuum (RAC)

According to SDT, all motivated behaviors are accompanied by a sense of why one is doing the behavior, reasons upon which people can report if asked. In other words, all behaviors come with a "perceived locus of causality" (PLOC). SDT further proposes that all motivated behaviors can be located on an underlying autonomy continuum, somewhere between feeling a complete lack of self-determination (external PLOC or E-PLOC) to feeling completely self-determined (internal PLOC or I-PLOC). In effect, a PLOC assessment reveals whether or not a person believes in his or her own free will; such a belief has been shown to have many positive consequences, whether or not the belief is true in a philosophical or scientific sense (Deci & Ryan, 2001; Ryan & Deci, 2006, 2017).

Although the PLOC concept is compelling and has garnered much research support over the years, some recent criticisms have emerged of the PLOC concept and of the corresponding RAC. This article aims to reaffirm the validity of these concepts and to extend our understanding of them. This article also aims to provide the field with a Comprehensive Relative Autonomy Index (C-RAI), whose items were derived from a thorough content analysis of existing RAI measures.

To understand the autonomy continuum, it is useful to consider the diagram in Figure 1 (reprinted from Ryan & Deci, 2000b) and to also consider the evolution of the theory that led to this diagram. SDT began with the discovery of the "undermining effect" (Deci, 1971, 1972), in which the introduction of an external incentive reduced people's desire to keep doing a formerly enjoyable behavior. In terms of the diagram, external motivation (near the left extreme of the continuum) reduced intrinsic motivation (at the right

[1]University of Missouri, Columbia, USA
[2]National Research University Higher School of Economics, Moscow, Russia
[3]Lomonosov Moscow State University, Russia
[4]Altai State Academy of Education, Biysk, Russia

Corresponding Author:
Kennon M. Sheldon, University of Missouri, 203E McAlester Hall, Columbia, MO 65211, USA.
Email: sheldonk@missouri.edu

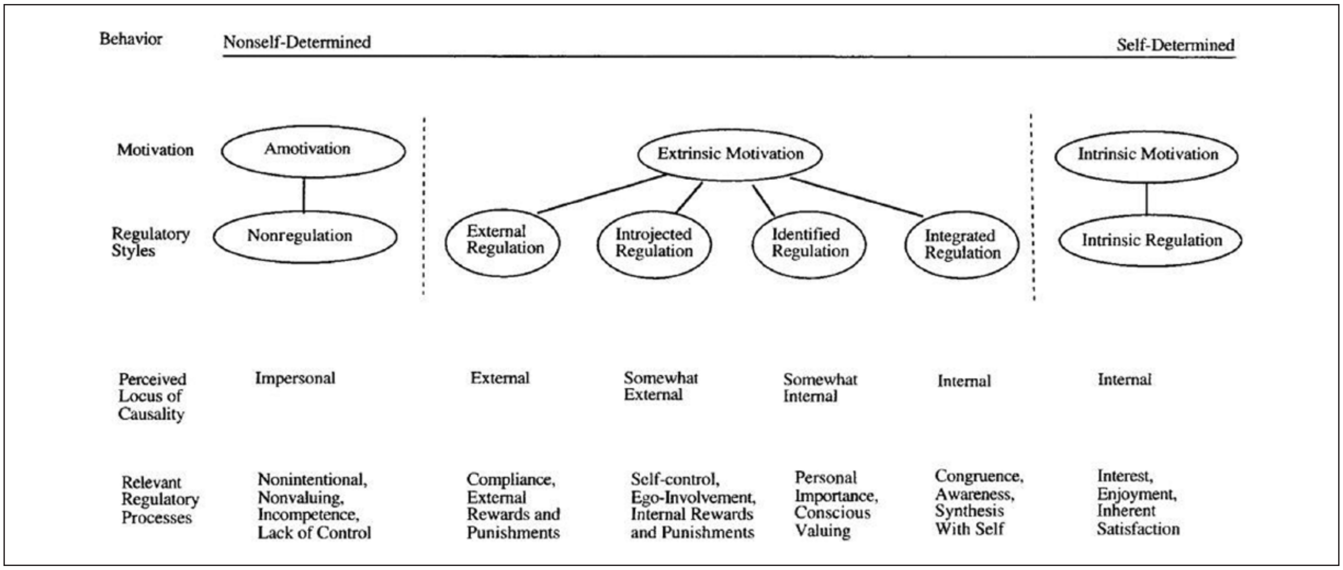

Figure 1. The self-determination continuum showing types of motivation with their regulatory styles, loci of causality, and corresponding processes.

extreme), presumably because salient incentives tend to induce E-PLOC which interferes with I-PLOC (although these experiments did not directly measure external motivation). The undermining effect was shown for many other contextual factors besides external incentives, including pressure, deadlines, controlling language, and surveillance. These factors all have in common the fact that they can undermine people's sense of autonomy, inducing an E-PLOC.

However, the distinction between intrinsic motivation (doing a behavior because the doing is itself the reward) and extrinsic motivation (doing a behavior only to get a reward or avoid a punishment after the behavior is over) proved too simple; further research showed that there are other, more intermediate forms of motivation between these two extremes, as shown in the diagram. Ryan and Connell (1989) officially introduced the autonomy continuum idea in a study of children's academic and prosocial motivation, demonstrating via simplex correlational analysis that external, introjected, identified, and intrinsic motivations could be arranged along a continuum of autonomy or internalization, ranging from low to high, respectively. In a simplex structure, associations between constructs are systematically ordered in magnitude, so that constructs located next to each other on a theoretical sequence tend to be very positively correlated, whereas constructs located further from each other on the sequence are less positively correlated, to the point where constructs at opposite ends of the sequence can sometimes be negatively correlated.

As shown in Figure 1, the four motivations identified by Ryan and Connell (1989) can be mapped onto the autonomy continuum as follows: External motivation (approaching rewards or avoiding punishments) has the highest E-PLOC, because it typically comes with a feeling of being compelled or induced to act by an external contingency. Introjected motivation (proving oneself worthy or avoiding guilt) has become partly internalized into the self, with some degree of I-PLOC because the person induces himself or herself to act. Identified motivation (acting to express values) has been fully internalized into the self, thus no self-induction is required; however, such behavior may not be enjoyable for its own sake, and thus there may not be intrinsic motivation. Intrinsic motivation has the highest I-PLOC, because the person enjoys and thus wholeheartedly wants to do the behavior. External and introjected motivations (at the left) are called "controlled" motivations, and identified and intrinsic motivations (at the right) are called "autonomous" motivations. External, introjected, and identified motivations are all "extrinsic" motivations because behavior itself is not the reward in these three cases. Identified motivation is unique because it is an extrinsic motivation (i.e., it is not done for the sake of the experience itself), but nevertheless, it is also an autonomous motivation (because there is full internal assent to doing the behavior). Identified motivation represents psychosocial maturity, in which an individual willingly takes on potentially nonenjoyable tasks (i.e., changing baby's diaper) because it expresses an important personal commitment (i.e., keeping baby healthy and happy).

The RAC continuum provides a powerful ordering concept, which can help researchers to make sense of many different theoretical perspectives upon motivation. Behaviorist perspectives insist that all behaviors have (in reality) an external locus of causality, because they are controlled by external incentives (no matter how people perceive their causality). Psychodynamic and Freudian perspectives emphasize introjections and internal struggles, in which healthy or societally approved behavior is often conflicted, driven by guilt and the superego. Existential and humanistic perspectives emphasize the importance of identifying with what one does, acting in good faith and with full commitment even in the face of difficulty and absurdity. Personality developmental perspectives emphasize the importance of children internalizing the cultural prescriptions and norms they encounter, on their way to adulthood. Cognitive developmental perspectives emphasize the importance of exploratory and search behavior (i.e., intrinsically motivated play) for neural and intellectual development. In a sense, the SDT autonomy continuum concept not only recapitulates people's personal journey toward mature agency and citizenship, it also recapitulates the development of motivation theories during the 20th century, toward an adequate conception of people's dialectical struggle for self-determination in the face of biological and social constraints.

Controversies Concerning the RAC and the RAI

However, there are number of disagreements regarding the autonomy continuum concept, involving issues that are both conceptual and methodological. One measurement issue is that there are a wide variety of scales in use to assess the autonomy continuum. The SDT website contains at least seven different relative autonomy scales, and many more different sets of items have been generated by researchers uniquely for a particular study (Assor, Vansteenkiste, & Kaplan, 2009; Chemolli & Gagné, 2014). At times, several different scales are even used within the same multistudy research article (Roth, Assor, Kanat-Maymon, & Kaplan, 2006). In part, this unseemly diversity is justified by the widely different domains, in which relative autonomy has been assessed (e.g., academic motivation, relationship motivation, work motivation, sport motivation, leadership motivation). However, we noticed that most subscales have a limited, recurring number of semantic elements, in part because there are limited numbers of ways in the English language to describe certain concepts. Thus, we thought that a common core of item meanings might be extractable from the entire set of accumulated measures, to create a scale which might be generally applicable across behavioral domains. Creating such a comprehensive RAI was the preliminary goal of our research.

A more important issue concerns the meaning and validity of the RAC. Positions on this issue go to both extremes. On one extreme, researchers debate the question of which weighting scheme should be used to combine scores derived from different regions of RAC (Grolnick & Ryan, 1987; Kusurkar, Ten Cate, Vos, Westers, & Croiset, 2013; Sheldon, 2014; Vallerand & Bissonnette, 1992; Vallerand, O'Connor, & Hamel, 1995). For example, researchers often compute an RAI by subtracting controlled motivations from autonomous motivations, using the formula (identified + intrinsic − introjected − external). In making this computation, should the extremes of the continuum (reflecting extra I-PLOC or extra E-PLOC) receive extra weighting, and if so, what should the weighting coefficients be? This debate takes the validity of the RAC for granted and simply asks about the best technical procedure for locating a person on that continuum. The current article addresses the weighting issue explicitly, by comparing the associations of weighted and unweighted RAIs with the important outcomes of subjective well-being (SWB) and trait autonomy.

On the other extreme of the validity question is a recent article of Chemolli and Gagné (2014), which argued that RAIs should not be used at all. Drawing on Guttman's (1954) radex theory concerning the structure of ability tests, they stated that there are irreducible qualitative differences between the various forms of motivation discussed above, and thus that RAI scores are based on the "untenable" assumption that "a person is situated in one location on the continuum even though this 'position' is derived from scores on multiple locations on this continuum" (p. 578). Instead, Chemolli and Gagné advocate using the motivation subscale scores individually or, if necessary, aggregating subscale information using polynomial regression or person-based profile analyses, rather than using the conventional difference score approach. The current article examines polynomial regression and profile-based scoring procedures, as well as conventional difference score procedures.

Relevant Psychometric Theory

Although Chemolli and Gagné (2014) presented analyses purportedly supporting their arguments, we disagree with their interpretations of those analyses. Their primary argument against the existence of an RAC was their finding that the structures of the Multidimensional Work Motivation Scale and the Academic Motivation Scales were not unidimensional. However, confirmatory factor analysis (CFA) studies have already shown that there is a multidimensional structure for RAI measures (Baldwin & Caldwell, 2003; Fernet, Senécal, Guay, Marsh, & Dowson, 2008; Lafrenière, Verner-Filion, & Vallerand, 2012; Li & Harmer, 1996; Vallerand et al., 1992; Wang, Hagger, & Liu, 2009). Furthermore, we argue that the very assumption of a single *common factor* is not consistent with simplex, which is a different type of data structure, involving an *order factor*.

The notion of order factors was introduced by Guttman (1954), who showed that common factors and order factors are not mutually exclusive, but rather are complementary data structures, which can coexist in the same dataset. The contribution of a common factor is reflected in a *uniform* increase in the magnitude of all the correlation coefficients in a matrix. The contribution of an order factor is reflected in the increase of absolute *differences* in the magnitude of correlation coefficients in the same matrix. Guttman described two types of an order dimension, simplex and circumplex. A simplex structure exists when the variables can be ordered in such a way that the correlation coefficients monotonously decrease from the diagonal, whereas in a circumplex they first decrease and then increase.

Building on Guttman's work, McDonald (1980) demonstrated that in terms of the common-factor model, a simplex can be represented by *two* (rather than one) orthogonal factors with related loadings (i.e., the variables in the middle of the simplex are expected to have roughly equal loadings on both factors, which poses a challenge to common rotation algorithms aiming for a "simple structure"). Early models of simplex and circumplex structures did not allow for negative correlations between the variables and relied on prior knowledge of their order (Anderson, 1960; Guttman, 1954). A major step forward was taken by Browne (1992), who developed a procedure to derive an empirical ordering of variables on a circumplex without any a priori hypotheses and showed that a simplex can be viewed as a special (incomplete) case of a circumplex. Graphically, the variables forming a circumplex must be ordered in a circle on a plane defined by two orthogonal dimensions, which can be recovered using conventional principal component analysis (PCA) or multidimensional scaling (MDS). A simplex would be represented by a semicircle or arc. The *order* of variables on a circumplex or a simplex is reflected in their polar coordinates (angles) rather than by their linear coordinates on either one of the dimensions defining the plane.

Again, Ryan and Connell (1989) argued that the RAC is a single order factor, a simplex. However, in empirical datasets operationalizing the RAC, a common factor contributing equally to all the RAC domains (motivation strength or acquiescence) can also be expected. The differences in the relative magnitude of the common factor and the order factor may result in seemingly different factor structures obtained in different datasets after rotation, but the order of the variables on the semicircle (or arc) is expected to be invariant. Our reanalysis of some published correlation matrices for the Motivation at Work Scale (MAWS) and the Academic Motivation Scale (AMS) shows that this is indeed the case (see the supplement).

In cases when each motivation type is represented by several items, the RAC structure becomes hierarchical, with several first-order factors corresponding to individual regulation types and a single second-order simplex dimension, which is likely to be found in the correlations of subscales, rather than individual items (this type of structure is discussed by Cattell, 1988). In such datasets, the simplex dimension can be recovered using MDS both at item and scale level (as done by Roth et al., 2006) or modeled using CFA as a simplex-like (autoregressive) pattern of associations between first-order factors (Li & Harmer, 1996; Wang et al., 2009). In the current research, we employed both of these approaches to establish the empirical order in a set of items and scales comprising the autonomy continuum. We also used circumplex modeling proposed by Browne (1992), which allowed us to derive an empirical ordering of variables from the data and to test the goodness of fit of the resulting model.

An additional criticism of RAI measures by Chemolli and Gagné (2014) concerned SDT researchers' typical practice of using difference scores when computing a single RAI. It is true that using difference scores to combine unrelated or poorly related items is highly problematic. However, an empirical order dimension constitutes just such a justification: For a circular profile, the coordinates of a point reflecting its "predominant theme" can be obtained as a pair of weighted sums of centered scale scores with weights for each scale defined by the cosine and sine of its respective angle on the circular dimension (Gurtman & Pincus, 2003). With a simplex, where the angles of scales only range from 0° to 180°, their respective cosine weights would decrease monotonously from 1 to −1, making the resulting formula for the X dimension essentially the same as a weighted RAI.

Individual profiles for circumplex measures are expected to have a sinusoidal form, which can be modeled using a cosine function (Gurtman & Balakrishnan, 1998; Gurtman & Pincus, 2003). In the special case of a simplex, the individual profile is limited to the top half of the cosine curve and is expected to resemble an inverted U with a single peak corresponding to the predominant motivation type. A difference score, such as the RAI, would reflect the position of this peak, giving valid and important information about the person's entire motivational system. In a supplemental "Study 3" examining our combined datasets, we used hierarchical linear modeling to model individual profile shapes and investigated the association of the RAI with real data-based individual profile parameters. For simplex-based profiles, the cosine function becomes difficult to fit due to a smaller number of data points, but its inverted-U shape can be approximated with a quadratic function, which has a number of important advantages (it is nonperiodic, computationally simple, and compatible with the conventional linear modeling framework).

The current research also aimed to investigate the validity of different approaches to computing the individual scores, comparing the effects of weighted and unweighted RAI scores upon relevant outcomes. We expected that RAI ("quality" of motivation), in combination with a measure of profile elevation ("quantity" of motivation; mean of all the six scales), would together capture most or all of the outcome-relevant variance of the subscales. Our criterion variables in these validity tests were the predictive associations of the various motivation variables with subjective well-being and with trait autonomy orientation. Roth et al. (2006) used a similar strategy of correlating the different RAI motivations with positive affect (PA), finding that subscale correlations with PA became stronger the closer the subscale was to the extreme of the RAC; most strongly negative for external motivation and most strongly positive for intrinsic motivation. For this reason, we expect the measure derived from the RAI scoring method to be most strongly (or at least equally strongly) associated with the satisfaction and well-being outcomes, across a range of outcomes, compared with any of the single subscales that comprise it. Such a finding would further suggest that computing an aggregate RAI is the preferred methodology for researchers.

Enumerating the Types of Motivation

Another important recent issue concerns the question of how many specific forms of motivation should be differentiated within the RAC. Still most standard is the set of four motivations first examined together by Ryan and Connell (1989): namely, external, introjected, identified, pos and intrinsic. However, there are at least two other forms that have been repeatedly studied during the last 25 years: amotivation, in which there is no intentional regulation of one's motivated behavior, and integrated motivation, in which one's various identified motivations have been all integrated with each other, at a higher level. There is a growing consensus that integrated motivation is problematic to measure, at least by self-report (Gagné et al., 2015; Roth, Assor, Niemiec, Ryan, & Deci, 2009). Thus, we did not attempt to assess integrated motivation items within our own paired-item paraphrase project. However, we did include amotivation items in our project, as we thought amotivation (nonintentional motivation) would provide a valuable counterpoint to the rest of the items, which reference intentional motivations of varying degrees of internalization. We hypothesized that MDS analyses would show that the amotivation items anchor the leftmost extreme of the RAC, representing the least amount of autonomy. External motivation should be more autonomous than amotivation (i.e., to the right of amotivation on the continuum), because an externally motivated person at least has a stable conscious intention to approach the reward or incentive, which the amotivated person does not.

Other forms of regulation have been proposed. Recently, Assor et al. (2009) differentiated introjected motivation into two types: approach (approaching self-worth) and avoidance (avoiding loss of self-worth), finding different patterns of effects for the two measures and showing that approach-introjection lies between avoidance-introjection and identification on the RAC. We evaluated whether this distinction would emerge in our own data.

In sum, we conducted a set of studies to develop and cross-validate a new measure of the RAC, while validating the theoretical psychometric structure undergirding a very important part of SDT. We conducted these investigations within two different cultures, the United States and Russia, to evaluate the cross-cultural generalizability of effects. We expected that the structure of the RAC would be the same in both cultures, confirming the robustness of the postulated structure across language and cultural groups.

Study 1

Method

Inductive item content analysis. The aim of the first study was to develop a set of items and investigate its structure. We began by assembling a list of every RAI item we could find, from both published and unpublished scales (see the appendix for a list of every RAI measure that was consulted). Two of the authors then conducted a constant comparative paraphrase analysis (Kuiken, Schopflocher, & Wild, 1989), in which they independently examined every possible pair of items to determine whether the same basic idea was being expressed by both items. Where this was judged to be the case (typically when the same primary word was being used in both items), a simplified paraphrase was created that captured the shared content of the two items.

After making all judgments and paraphrases independently, the analysts met to resolve discrepancies and to work toward a master paraphrase list. Some source items were never matched with another item, and thus their content did not make it into the derived set of paraphrases. A few source items were matched with other source items despite the fact that the two items purportedly came from different RAI subscales (e.g., "because it is important to me" appeared in both designated intrinsic and designated identified subscales). This illustrates the conceptual looseness we sometimes found at the boundaries of the designated subscales. Thirty-five summary paraphrases were derived within this initial process (shown in the appendix).

Participants. Participants of Study 1 ($N = 958$) included four samples, two U.S. student samples from the University of Missouri (Samples 1 and 3), and two comparable Russian student samples from universities in Tomsk and Omsk (Sample 2), and from Biysk and Moscow (Sample 4). The respondents who gave the same answer to all the RAI items ($n = 38$) and those with more than three missing responses ($n = 6$) were excluded. The resulting final sample sizes, behavioral stems, and demographic data are shown in Table 1. The percentage of missing data was very small (0.23%), and we used expectation maximization (EM) imputation to replace the missing answers for exploratory analyses.

Data analysis strategy. The analysis involved several stages. At the first stage, we performed exploratory analyses using data combined across the four samples, attempting to establish a comprehensive RAI measure. As our paraphrase set exhausted the consensual content of commonly employed RAI scales, we had a unique opportunity to examine the natural structure of all item content composing the RAC. We expected the set of items to have a hierarchical structure with two sources of shared variance, a lower order structure of items grouped into six correlated subscales and a higher order simplex structure of relationships among subscales. Because exploratory factor analysis attempts to find a parsimonious set of dimensions accounting for all the shared variance of items and the presence of a simplex structure makes rotation unstable, the lower order and the higher order structure are often conflated in the resulting model (e.g., scales separated by smaller spaces on the simplex tend to form a

Table 1. Demographic Composition of Study 1 Samples.

Sample	Stem	*n*	Gender (% female)	Age, *M* (*SD*)
1. The United States	Why did you choose this major?	142	74.26	20.35 (1.01)
2. Russia	Why did you choose this major?	243	84.77	18.57 (1.24)
3. The United States	Why do you go to class?	323	53.68	19.14 (0.99)
4. Russia	Why do you go to class?	250	72.83	18.93 (1.23)

single factor). With such datasets, the "bottom-up" procedure of hierarchical cluster analysis is a more optimal exploratory strategy (Revelle, 1979), as the lower order clusters would be formed by sets of items sharing the largest amount of variance (i.e., reflecting the same subscale) and the higher order clusters would capture the spaces among subscales on the simplex. To establish homogeneous sets of items reflecting the different facets of motivation, we used hierarchical clustering (Ward's method with Squared Euclidean metric on items standardized to *z* scores by variable) on the 35 items. To ensure the unidimensionality of the resulting item sets and to select the best indicators for each construct, we then performed exploratory factor analysis within each set and sample, to identify the best-performing items. As will be described below, this stage of analysis resulted in a set of 24 items forming six subscales (four items per subscale).

At the second stage, we looked for the second-order RAC in these 24 items, both at the level of 24 items and at the level of six subscales. First, we used Guttman–Lingoes nonmetric MDS implemented in Statsoft Statistica 6 (Borg & Lingoes, 1987; Guttman, 1968) based on the item and scale correlation matrices (pooled across the four samples using Fisher transformation to reduce the potential bias resulting from nonequal means). Next, we evaluated the fit of the correlation matrix in each sample to a simplex model by calculating congruence coefficients (Ryan & Connell, 1989) and by using the CIRCUM software (Browne, 1992), which allowed us to test how well the correlation matrix can be represented by a single dimension of order (simplex or circumplex). We used the chi-square statistic and root mean square error of approximation (RMSEA) reported by the program to evaluate the fit of the model, taking into account the findings by Kenny, Kaniskan, and McCoach (2015), showing that higher RMSEA values are expected in models with fewer degrees of freedom.

At the third stage, we performed single-sample CFAs in Mplus 7.31 to formally evaluate the fit of the first-order measurement model structure. We also tested for the second-order simplex structure within this CFA, operationalized as an autoregressive model (Jöreskog, 1988; Little, 2013), in which each of the first-order factors was regressed on the previous one in the continuum, starting with amotivation. Because we were only interested in the invariance of the metric model, we standardized the item scores within each sample and pooled the data from different samples. Because the skewness and kurtosis values of item distributions were

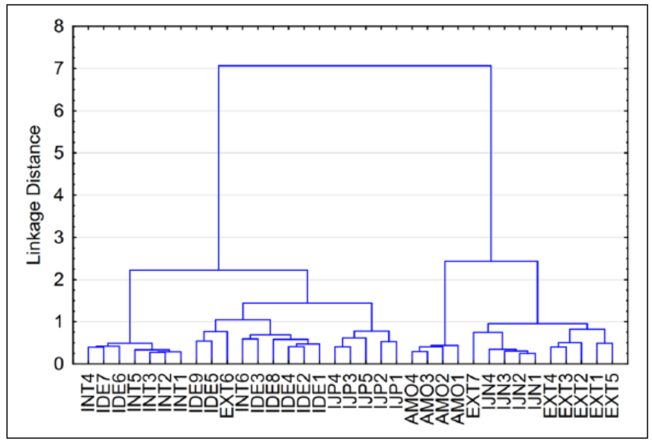

Figure 2. Dendrogram of the hierarchical cluster structure of the 35 items, pooled Study 1 data.
Note. INT = intrinsic; IDE = identified; IJP = positive introjection; IJN = negative introjection; EXT = external; AMO = amotivation.

outside the (−2, 2) range in several instances, we used the robust maximum likelihood estimator with mean-adjusted chi-square (MLM) also known as the Satorra–Bentler chi-square. We used comparative fit index (CFI) > .90 and RMSEA < .08 as criteria of acceptable fit (Brown, 2015). Furthermore, we tested a series of multigroup CFA models, evaluating the configural, metric, and scalar measurement invariance of the first-order model across the American and Russian cultural samples to evaluate score comparability. We also tested for invariance of the second-order regression (simplex) structure. Because the chi-square difference test is overly sensitive in large samples, we mainly relied on the difference in practical fit indices (ΔCFI $\geq$ .010, ΔRMSEA $\geq$ .015, following Chen, 2007) to compare nested models.

Results

Cluster analyses. Hierarchical cluster analysis (see Figure 2) revealed six homogeneous groups of items, interpretable (from left to right) as intrinsic motivation, identified motivation, positive introjected motivation, amotivation, negative introjected motivation, and external motivation (one item, "because X helps (or will help) me get money or some other reward," fell into the identified cluster and was deleted for reasons which will be discussed later). In addition to representing six individual subscale clusters, Figure 2 also shows that two higher order clusters exist, corresponding to the classic dis-

Table 2. Pooled Correlations, Reliabilities, and Descriptive Statistics for Study 1 Scales.

		Intrinsic	Identified	Positive introjection	Negative introjection	External	Amotivation
Intrinsic			.53***	.33***	.19***	.06	.00
Identified		.79***		.57***	.46***	.04	−.34***
Positive introjection		.24***	.30***		.58***	.28***	−.09*
Negative introjection		−.21***	−.22***	.27***		.40***	−.05
External		−.29***	−.34***	.18***	.72***		.34***
Amotivation		−.59***	−.63***	−.07	.48***	.58***	
Sample 1 (n = 142)	M (SD)	3.99 (0.80)	4.12 (0.78)	3.62 (0.73)	2.20 (0.96)	1.95 (0.92)	2.00 (1.01)
	α	.87	.86	.68	.86	.88	.91
Sample 2 (n = 243)	M (SD)	3.98 (0.96)	3.94 (0.86)	3.19 (0.93)	1.67 (0.78)	1.71 (0.71)	1.83 (0.94)
	α	.94	.83	.76	.82	.74	.87
Sample 3 (n = 323)	M (SD)	3.17 (0.77)	3.76 (0.65)	3.66 (0.71)	3.66 (0.79)	3.04 (0.77)	2.28 (0.97)
	α	.80	.73	.71	.77	.61	.87
Sample 4 (n = 250)	M (SD)	3.46 (0.89)	3.78 (0.79)	3.63 (0.87)	3.21 (1.00)	3.10 (0.80)	1.98 (0.83)
	α	.89	.81	.82	.84	.63	.8

Note. Pooled correlations for Samples 1 and 2 are given below the diagonal, for Samples 3 and 4 above the diagonal.
*p < .05. **p < .01. ***p < .001.

tinction in SDT between autonomous (self-determined) motivations and controlled (non-self-determined) motivations.

We next performed exploratory factor analyses (using a maximum likelihood method) within each of the six clusters of items, in each of the four samples independently. We succeeded in identifying four items for each of the six factors, all with loadings above .50 in each of the four samples (the complete set of item factor loadings in the four samples is available upon request). Descriptive statistics and reliabilities of the six resulting four-item scales are presented in Table 2, along with descriptives for the well-being variables.

Testing the RAC (simplex + MDS). Next, we performed an MDS analysis at the item level using the pooled correlation matrix, comparing the fit of one-dimensional and two-dimensional models. As expected given simplex structure, the one-dimensional model showed worse fit (stress .115, alienation .143), compared with the two-dimensional model (stress .055, alienation .067). In the two-dimensional model, the items were ordered along a semicircle (shown in Figure 3). To quantify the positions of items on the simplex, we calculated their polar coordinates (using atan2 function), which turned out to be completely in line with the theoretical sequence of regulation types on the autonomy continuum. The item paraphrases and polar coordinates are given in Table 3.

We proceeded to use MDS to investigate the structure at the subscale rather than the item level (see Figure 4). The simplex congruence coefficients for the correlation matrices ranged from .62 to .84 (M = 0.75) across the four samples, corresponding to 38% to 71% of the variance explained by the simplex structure. In the pooled matrix, both the

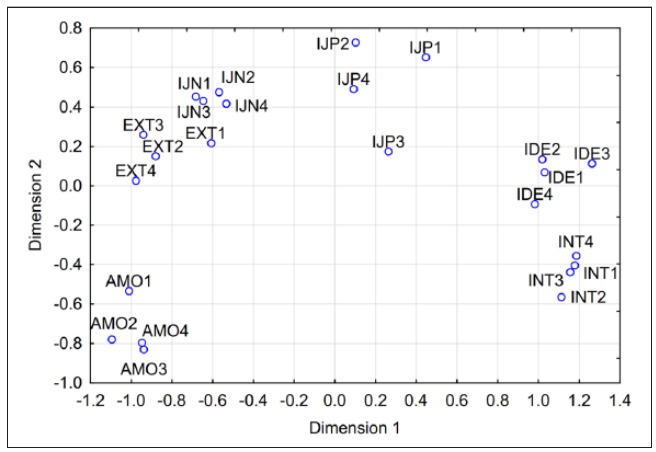

Figure 3. Results of item-level multidimensional scaling of the reduced 24-item set, pooled Study 1 data.
Note. INT = intrinsic; IDE = identified; IJP = positive introjection; IJN = negative introjection; EXT = external; AMO = amotivation.

one-dimensional and two-dimensional MDS models showed excellent fit (alienation and stress below .001). The resulting coordinates are shown in Table 4. The sequence of scales in polar coordinates based on the two-dimensional structure conformed to the theoretical expectations, reflecting the autonomy continuum (amotivation, external, negative introjection, positive introjection, identified, and intrinsic motivation).

To cross-validate the coordinates of items and scales using a different method, which provides a more comprehensive range of fit measures, we modeled the data using CIRCUM software. We tested different values of m, the number of free parameters in the Fourier correlation function, aiming to choose one that would result in optimal fit

Table 3. Dimensional and Polar Coordinates of the Final 24 Items as Computed by MDS and Circumplex Modeling, Study 1.

		MDS, two dimensions			
Item	Paraphrase	Dimension 1	Dimension 2	Angle ϕ	CIRCUM Angle, ° (95% CI)
INT2	"Fun"	1.11	−0.56	2.04	355 [353, 358]
INT3	"Pleasure"	1.16	−0.44	1.93	358 [356, 0]
INT1	"Enjoy"	1.18	−0.40	1.90	0 [0, 0]
INT4	"Interesting"	1.19	−0.36	1.86	2 [0, 4]
IDE4	"Personal choice"	0.98	−0.09	1.66	16 [13, 19]
IDE1	"Strongly value"	1.03	0.07	1.50	13 [10, 15]
IDE3	"Meaningful"	1.26	0.11	1.48	16 [13, 20]
IDE2	"Personally important"	1.02	0.14	1.44	19 [15, 22]
IJP3	"Boosts my self-esteem"	0.26	0.17	0.98	84 [81, 88]
IJP1	"Want to feel proud of myself"	0.45	0.65	0.60	65 [60, 69]
IJP4	"Want to feel good about myself"	0.09	0.49	0.18	81 [77, 84]
IJP2	"Want to prove to myself that I am capable"	0.10	0.73	0.14	68 [64, 72]
IJN2	"Would feel ashamed if I didn't"	−0.57	0.48	−0.87	123 [120, 126]
IJN4	"Don't want to feel bad about myself"	−0.53	0.42	−0.91	113 [110, 116]
IJN3	"Would feel like a failure if I didn't"	−0.65	0.43	−0.98	126 [123, 129]
IJN1	"Would feel guilty if I didn't"	−0.68	0.45	−0.99	126 [123, 129]
EXT1	"Important people will like me better"	−0.61	0.22	−1.23	133 [130, 137]
EXT3	"I'll get in trouble if I don't"	−0.94	0.26	−1.30	146 [143, 150]
EXT2	"Others will get mad if I don't"	−0.88	0.15	−1.40	140 [137, 143]
EXT4	"I don't have any choice"	−0.98	0.03	−1.54	149 [145, 152]
AMO1	"I once had good reasons, now I don't"	−1.01	−0.53	−2.06	193 [190, 196]
AMO2	"Honestly, I don't know why"	−1.10	−0.78	−2.19	194 [191, 197]
AMO4	"I used to know why, but I don't anymore"	−0.95	−0.80	−2.27	196 [193, 199]
AMO3	"I am not sure, I wonder whether I should continue"	−0.94	−0.83	−2.30	196 [193, 199]

Note. The items are sorted by the resulting angle ϕ with its sign inverted (higher values reflect higher degrees of autonomy). MDS = multidimensional scaling; CI = confidence interval; INT = intrinsic; IDE = identified; IJP = positive introjection; IJN = negative introjection; EXT = external; AMO = amotivation.

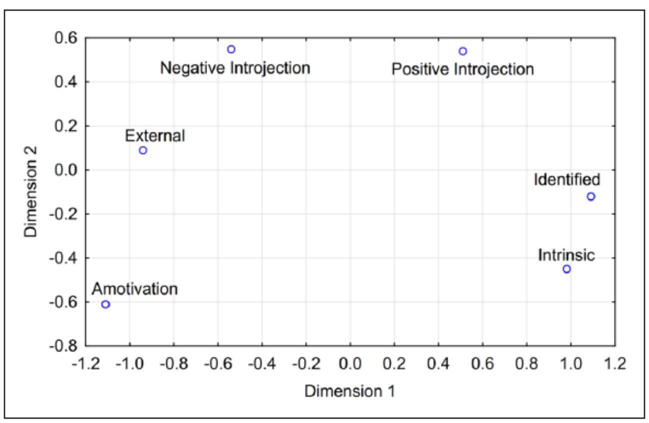

Figure 4. Results of multidimensional scaling at the scale level, pooled Study 1 data.

and meaningful parameter estimates, while not overparametrizing the model (Fabrigar, Visser, & Browne, 1997). A model for 24 items with m = 7, unconstrained communalities, and unconstrained angles showed acceptable fit to the data, χ^2 = 829.81 (222), p < .001; CFI = .945; nonnormed fit index (NNFI) = .932; RMSEA = .053, 90% CI = [.049, .057]. The communality estimates for individual items ranged from 0.57 to 0.84 (M = 0.76). The sequence of items in polar coordinates agreed with theoretical predictions and the CIs for items from adjacent scales did not overlap, supporting the discriminant validity of the groups of items measuring different motivation types. The model with item communalities constrained to equality also fit the data acceptably well, χ^2 = 1,126.78 (245), p < .001; CFI = .921; NNFI = .911; RMSEA = .061, 90% CI = [.058, .065], suggesting that the 24 items can be ordered along a single dimension, which would capture 76% of their variance. The fit indices for the unconstrained model based on six scale scores with m = 1 were acceptable as well, χ^2 = 20.88 (3), p < .001; CFI = .991; NNFI = .956; RMSEA = .079, 90% CI = [.049, .112]).

Overall, the findings show that the items and scales reveal the theoretically expected semicircular structure and their empirical sequence within this structure is in line with the predictions based on SDT's typical conception of the RAC.

CFAs. We followed by applying a more stringent CFA method to evaluate the fit of a six-subscale measurement model and test the simplex hypothesis using an autoregressive approach. In the pooled dataset, a six-factor exploratory structural

Table 4. Dimensional and Polar Coordinates of the of the Subscales Derived From MDS and Circumplex Modeling, Study 1.

Scale	One-dimensional MDS	Two-dimensional MDS			Circumplex model	
		Dimension 1	Dimension 2	Angle ϕ	Communality	Angle, ° (95% CI)
Intrinsic	1.15	0.98	−0.45	2.00	.69	0 [0, 0]
Identified	1.15	1.09	−0.12	1.68	1.00	11 [5, 16]
Positive introjection	0.41	0.51	0.54	0.76	.64	63 [54, 71]
Negative introjection	−0.33	−0.54	0.55	−0.78	.85	103 [96, 111]
External	−0.85	−0.94	0.09	−1.48	.76	133 [125, 142]
Amotivation	−1.54	−1.11	−0.61	−2.07	.86	184 [174, 195]

Note. MDS = multidimensional scaling; CI = confidence interval.

Table 5. Results of Multigroup CFAs, Study 1.

Model	χ^2 (*df*)	CFI	RMSEA (90% CI)
Pooled sample			
1. Six-factor ESEM	341.79 (147)	.973	.037 [.032, .042]
2. Six-factor CFA	709.73 (237)	.938	.046 [.042, .050]
3. Six-factor CFA with simplex	916.55 (246)	.912	.053 [.050, .057]
Multigroup, across country			
1. Configural invariance	1,043.49 (474)	.930	.050 [.046, .054]
2. Metric invariance	1,069.96 (492)	.929	.050 [.045, .054]
3. Metric invariance with simplex	1,289.16 (510)	.905	.056 [.053, .060]
4. Metric with simplex constrained	1,339.07 (516)	.900	.058 [.054, .062]
Multigroup, across stem			
1. Configural invariance	1,010.29 (474)	.936	.049 [.044, .053]
2. Metric invariance	1,038.83 (492)	.934	.048 [.044, .052]
3. Metric invariance with simplex	1,212.92 (510)	.915	.054 [.050, .058]
4. Metric with simplex constrained	1,343.00 (516)	.901	.058 [.054, .062]

Note. ESEM = exploratory structural equation modeling; CFA = confirmatory factor analysis; CFI = comparative fit index; RMSEA = root mean square error of approximation; CI = confidence interval.

equation modeling (ESEM) model (1) for 24 items showed a good fit (see Table 5), with standardized loadings on the relevant scales ranging from 0.35 to 0.87 (M = 0.64) and cross-loadings all below 0.31. The six-factor CFA measurement model (2) also showed a good fit in the pooled sample (standardized factor loadings ranging from 0.57 to 0.85). There were significant modification indices related to nonzero cross-loadings and item covariances. However, we chose not to include any modifications into the model, to keep it more theoretically interpretable.

The estimated correlations between the latent factors (given in Table 6) were mostly consistent with the simplex structure (the congruence coefficients were 0.86 and 0.85 for Models 1 and 2, respectively). We proceeded by fitting the model (3) with a simplex structure based on the CFA model. We found strong and significant modification indices concerning inclusion of a negative association between intrinsic motivation and amotivation (consistent with past research that has found negative associations between the extremes of the simplex; Ryan & Connell, 1989). The fit of the resulting simplex model was acceptable in the pooled sample and we chose not to include any modifications to keep the model parsimonious.

We proceeded by investigating the invariance of the measurement model and the simplex structure across the two different countries and two different situations. In both cases, there was no statistically significant difference between the fit of configural invariance model (1) and metric invariance model (2) based on the chi-square difference test. The further introduction of a simplex structure (Model 3) and that of equality constraints on the simplex regression coefficients (Model 4) resulted in a significant reduction of fit; however, the model fit was still acceptable.

In sum, our CFAs showed that the set of 24 items has an invariant structure of six factors, whose intercorrelations agree with the postulated simplex structure. The simplex structure showed invariance across languages and situations.

Brief Discussion

In Study 1, we created a comprehensive measure of the major forms of motivation comprising the autonomy continuum,

Table 6. Latent Factor Correlations, Study 1.

	Intrinsic	Identified	Positive introjection	Negative introjection	External	Amotivation
Intrinsic		.58***	.26***	.03	−.11*	−.25***
Identified	.74***		.46***	.21***	−.18**	−.48***
Positive introjection	.33***	.56***		.48***	.23***	−.06
Negative introjection	.03	.23***	.59***		.57***	.15**
External	−.12**	−.18***	.29***	.68***		.52***
Amotivation	−.29***	−.56***	−.09*	.16***	.56***	

Note. Correlations based on the exploratory structural equation modeling (ESEM) model are given above the diagonal, those based on the confirmatory factor analysis (CFA) model are given below the diagonal.
*p < .05. **p < .01. ***p < .001.

Table 7. Correlations, Reliabilities, and Descriptive Statistics for Study 2 Scales.

	Intrinsic	Identified	Positive introjection	Negative introjection	External	Amotivation	*M* (*SD*)	α
Intrinsic		.65***	.33***	.14*	−.03	−.19**	3.17 (0.96)	.88
Identified	.60***		.32***	.25***	−.02	−.33***	3.76 (0.80)	.74
Positive introjection	.39***	.54***		.15**	.16**	−.05	3.63 (0.91)	.76
Negative introjection	.20**	.32***	.54***		.59***	.06	2.72 (0.96)	.75
External	.05	.04	.31***	.55***		−.21***	2.58 (0.83)	.59
Amotivation	−.20**	−.40***	−.22***	.00	.28***		1.81 (0.76)	.77
M (*SD*)	3.50 (0.75)	3.86 (0.66)	3.92 (0.70)	3.55 (0.85)	3.16 (0.77)	2.30 (0.96)		
α	.81	.78	.74	.80	.65	.87		

Note. Data for the U.S. sample are given below the diagonal, for the Russian sample above the diagonal.
*p < .05. **p < .01. ***p < .001.

derived from a thorough content analysis of existing measures followed by a thorough psychometric analysis. Cluster, MDS, circumplex modeling, and CFAs all supported the existence of the RAC, which is a critical aspect of contemporary SDT. This continuum is best described as a simplex structure existing at the subscale level, although it can be found at the item level as well (Figure 3).

Notably, we were led by our analyses to exclude "because of the money or other external rewards" from the external motivation item set, because the item behaved more like an identified motivation item. We will defer consideration of this result until the General Discussion.

In Study 2, we attempted to replicate the basic results of Study 1, while extending the application of the new C-RAI items. Specifically, we asked participants to rate their motivation for "taking responsibility" within important domains of their lives. Personal responsibility is a complex construct which links individual agents to consensual social contracts (Rychlak, 1979), providing an important (if somewhat abstract) domain in which to investigate variations in the degree of motivational internalization. Notably, we assume that our conclusions should apply within any domain or level of abstraction of motivated behavior, ranging from very tangible ("taking out the trash," "cooking breakfast") to very abstract ("finding a life path," "taking responsibility"); this assumption requires further validation, of course.

Study 2

Method

Participants. Participants of Study 2 (N = 589) included two undergraduate student samples: a U.S. sample from the University of Missouri (n = 278, 45.1% female, M age = 19.1 years), and a comparable Russian sample (n = 311, 69.6% female, M age = 19.6 years) comprised by students from Tomsk State University and Omsk State University. We applied the same data screening procedures as in Study 1 to remove invalid (n = 19) and incomplete (n = 2) questionnaires.

Instrument. We used the same C-RAI used in Study 1. The students were first asked to rate the extent to which they take responsibility for each of the six areas of their life ("studies," "family life," "health," "friendships," "own happiness and future," "romantic relationships"). They were then asked to choose one most important area from the list and answer our 24 motivation item-paraphrases with the stem, "I take responsibility for this area of my life, because . . ." We hoped

Table 8. Dimensional and Polar Coordinates of the of the Subscales Derived From MDS and Circumplex Modeling, Study 2.

Scale	One-dimensional MDS	Two-dimensional MDS			Circumplex model	
		Dimension 1	Dimension 2	Angle ϕ	Communality	Angle, ° (95% CI)
Intrinsic	1.03	0.92	−0.55	2.11	.66	0 [0, 0]
Identified	1.03	0.89	−0.16	1.75	.95	3 [356, 10]
Positive introjection	0.47	0.53	0.37	0.96	.56	42 [33, 52]
Negative introjection	−0.09	−0.20	0.59	−0.32	.79	83 [73, 92]
External	−0.66	−0.83	0.50	−1.03	.80	110 [101, 120]
Amotivation	−1.79	−1.31	−0.76	−2.09	.73	187 [180, 203]

Note. MDS = multidimensional scaling; CI = confidence interval.

Table 9. Results of CFAs, Study 2.

Sample	Model	χ^2 (*df*)	CFI	RMSEA (90% CI)
The United States	1. Six-factor CFA initial	432.49 (237)	.907	.054 [.046, .063]
	2. Six-factor CFA modified	341.50 (234)	.949	.041 [.031, .050]
	3. Simplex	388.14 (243)	.931	.046 [.038, .055]
Russia	1. Six-factor CFA initial	605.83 (237)	.850	.071 [.064, .078]
	2. Six-factor CFA modified	450.11 (234)	.912	.054 [.047, .062]
	3. Simplex	524.94 (243)	.885	.061 [.054, .068]
Pooled	Six-factor ESEM	341.95 (147)	.951	.047 [.041, .054]
	1. Six-factor CFA initial	697.48 (237)	.890	.057 [.053, .062]
	2. Six-factor CFA modified	458.19 (234)	.947	.040 [.035, .046]
	3. Simplex	567.17 (243)	.923	.048 [.043, .053]
Multigroup	Configural	786.68 (468)	.930	.048 [.042, .054]
	Metric	812.92 (486)	.928	.048 [.042, .053]
	Simplex	932.09 (504)	.906	.054 [.048, .059]
	Simplex constrained	946.27 (510)	.904	.054 [.049, .059]

Note. ESEM = exploratory structural equation modeling; CFA = confirmatory factor analysis; CFI = comparative fit index; RMSEA = root mean square error of approximation; CI = confidence interval.

to replicate the MDS (item- and scale-level) results found Study 1. We also performed simplex/circumplex and confirmatory factor analytic modeling, as before.

Results

MDS and circumplex modeling. The descriptive statistics and reliabilities for the C-RAI are given in Table 7. The congruence coefficient was .82 for the U.S. sample and .63 for the Russian sample.

Using CIRCUM software, we found that the model for 24 items with 5 free parameters in the Fourier correlation function (m = 5) showed acceptable fit to the data, χ^2 = 702.00 (222), p < .001; CFI = .929; NNFI = .911; RMSEA = .060, 90% CI = [.055, .065]. The communality estimates for individual items ranged from 0.38 to 0.84 (M = 0.70). The angular item coordinates were all in line with the theoretical sequence of regulation types on the RAC and the CIs for items from adjacent scales did not overlap with one exception. The model with item communalities constrained to equality showed a worse fit to the data, χ^2 = 1,037.74 (247), p < .001; CFI = .882; NNFI = .868; RMSEA = .074, 90% CI = [.069, .078], suggesting possible differences in the extent to which the content of individual items may be applicable to the specific context of taking responsibility. The fit indices for the unconstrained model based on six scale scores with m = 1 were also quite good, χ^2 = 10.37 (3), p < .05; CFI = .992; NNFI = .960; RMSEA = .064, 90% CI = [.025, .109], and the observed sequence of scales in angular coordinates based on circumplex modeling and MDS (see Table 8) was in line with the theoretical predictions.

CFA. In Study 2, the fit of the theoretical measurement model (1) in the U.S. sample was marginally acceptable, but the fit in the Russian sample was inadequate (see Table 9). We investigated the modification indices and found three strong outliers suggesting correlated uniqueness for Items IJN1 ("I would feel guilty if I didn't") and IJN2 ("I would feel ashamed if I didn't"), Items IJP1 ("I want to feel proud") and IJP2 ("I want to prove to myself that I am capable"), as well as Items IDE1 ("I strongly value it") and INT1 ("I enjoy it"). Because these modification indices were replicated in both cultural samples, they may be associated with the specific

Table 10. Latent Factor Correlations, Study 2.

	Intrinsic	Identified	Positive introjection	Negative introjection	External	Amotivation
Intrinsic		.37	.32***	.13	−.13*	−.27**
Identified	.74***		.44***	.34***	.13	−.26
Positive introjection	.43***	.51***		.32***	.30***	−.17*
Negative introjection	.19**	.40***	.52***		.48***	.03
External	−.06	−.02	.31***	.85***		.25***
Amotivation	−.23***	−.44***	−.12*	.04	.36***	

Note. Correlations based on the exploratory structural equation modeling (ESEM) model are given above the diagonal, those based on the confirmatory factor analysis (CFA) model below the diagonal.
*$p < .05$. **$p < .01$. ***$p < .001$.

yet abstract nature of the stem ("taking responsibility"). After these indices were introduced, the modified model (2) showed a good fit to the data. The loadings of all these items on their respective scales remained pronounced and significant ($\lambda > .40$; $p < .001$) in both countries, suggesting that these additional covariances do not undermine the meaning of the factors and the model as a whole. The introduction of a simplex structure into the model (3) resulted in a reduced fit (more pronounced in the Russian sample).

We tested the same set of models with a pooled matrix. The ESEM and modified CFA fit the data well, and the estimated factor correlation matrices were consistent with the simplex structure (see Table 10; the values of the congruence coefficients were .86 and .74 for the ESEM and CFA models, respectively). We also found an acceptable fit of the simplex model to the pooled matrix (the parameters of the model are given in Figure 5); all the factor loadings and regression coefficients were statistically significant.

Finally, in multigroup modeling, the configural model based on the modified CFA model fit the data well and the metric invariance model was not different statistically. The introduction of the set of simplex regressions again somewhat reduced the model fit, but the fit was still acceptable and the addition of equality constraints on the simplex structure coefficients did not impact it significantly.

Brief Discussion

Despite the very different nature of the stem ("why do you take responsibility" instead of "why do you go to class/choose your major"), the findings of Study 2 replicated the Study 1 results. In exploratory MDS and circumplex modeling analyses, we found the same type of data structure. The results of the CFAs showed a good fit of the simplex structure to the U.S. sample and an acceptable fit to the Russian sample. The measurement model showed good invariance across cultures. The additional covariances of pairs of negative and positive introjection items can be explained by the effect of the context of responsibility, which emphasizes the shame–guilt and pride. The covariance of Items INT1 and IDE1 suggests a strong similarity of intrinsic and identified motivations in their emotional content, which is corroborated by their close distance in the angular coordinates on the simplex.

In Study 3, we pooled all of the Study 1 and Study 2 data to conduct further psychometric investigations, with several aims. First, we aimed to explore the typical shapes of motivation profiles to find out whether they would be consistent with the simplex expectation (inverted-U shape with a single peak). Second, we aimed to model individual differences in profile shape to find out how the RAI, a simple heuristic measure based on observed scores, is related to estimates of parameters based on a more rigorous profile-based model. Finally, we aimed to compare the different approaches with computing subscale and aggregated C-RAI scores, as predictors of measures of well-being and trait autonomy. We hoped to show that a single unweighted RAI score, which is how many if not most researchers already treat RAI data, validly and efficiently captures the overall autonomy of a person's motivational system.

Study 3

Method

Participants. We used all the six samples from Studies 1 and 2 resulting in a combined sample (N = 1,547) of students from Russia (n = 804) and the United States (n = 743) who completed the C-RAI for one of three different types of activity (choosing a major, going to class, taking responsibility in an important life domain).

Instruments. In addition to the C-RAI, respondents in each sample completed three existing measures of subjective well-being and trait autonomy:

The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988; Russian version by Osin, 2012) is a list of 20 adjectives reflecting positive and negative emotions rated on a 5-point response scale and grouped into two scales, PA and Negative Affect (NA). The reliability coefficients ranged from .84 to .90 across our samples with mean alphas of .86 and .88 for PA and NA, respectively.

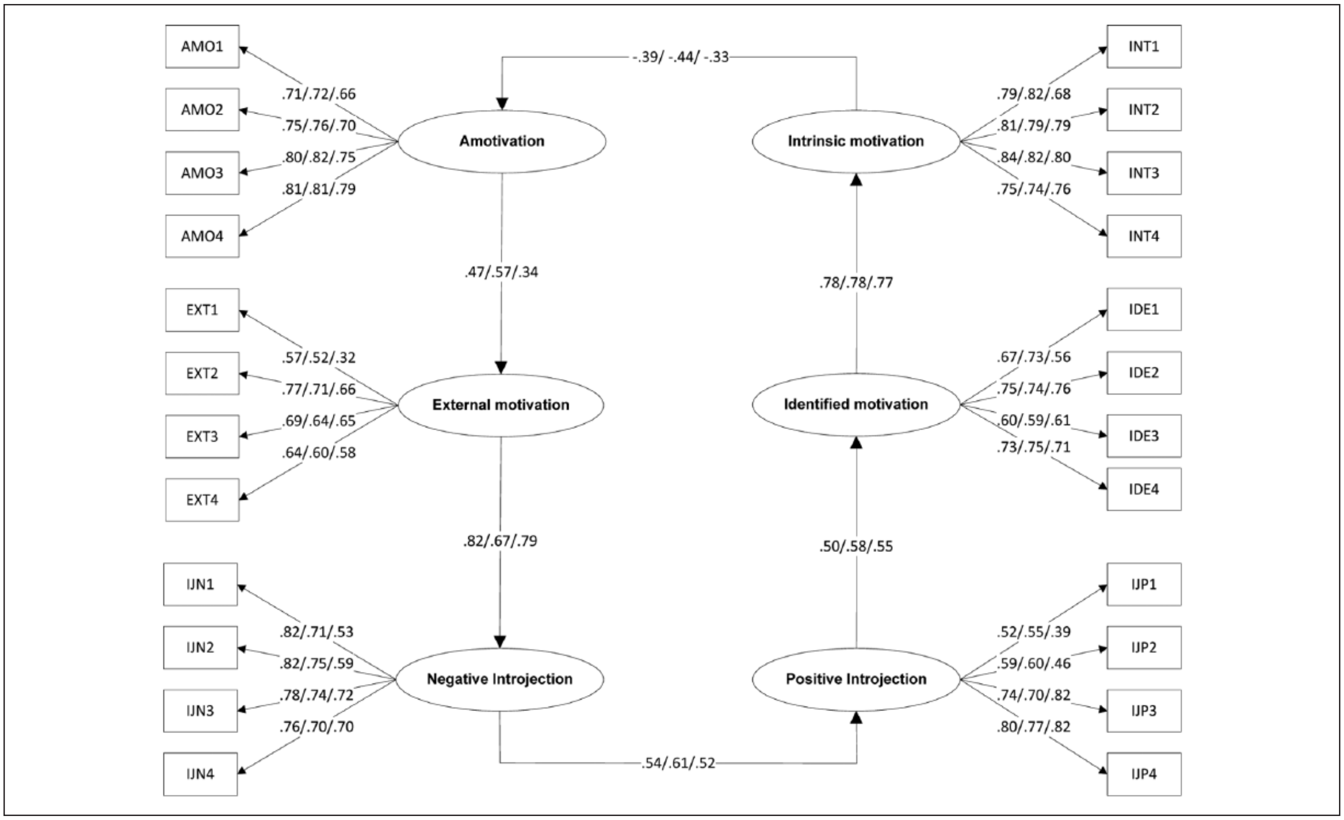

Figure 5. Parameters of the simplex CFA models.

Note. The parameter estimates are given for the simplex models using Study 1 and Study 2 dtata together with robust maximum likelihood estimator for clustered samples (MLR): $\chi^2(246) = 1{,}542.08$, $p < .001$, CFI = .958, RMSEA = .058 (90% CI = [.056, .061]), SRMR = .081—and for Studies 1 and 2 separately, in this order. CFA = confirmatory factor analysis; CFI = comparative fit index; RMSEA = root mean square error of approximation; CI = confidence interval; SRMR = standardized root mean square residual. Item labels correspond to Table 3: INT = intrinsic; IDE = identified; IJP = positive introjection; IJN = negative introjection; EXT = external; AMO = amotivation.

The Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985; Russian version by Osin & Leontiev, 2008) is a five-item measure of general life satisfaction which we administered using a 5-point response scale (α = .76-.86, mean α = .81).

The Index of Autonomous Functioning (IAF; Weinstein, Przybylski, & Ryan, 2012) is a 15-item measure of dispositional autonomy. We used two subscales of the IAF most relevant to the concepts of autonomy/control, namely, Authorship/Self-Congruence (ASC) subscale and the negatively-keyed Susceptibility to Control (StC) subscale. Each subscale includes five items rated on a 5-point scale. The reliability coefficients ranged from .80 to .88 for the ASC subscale (M = 0.84) and from .74 to .80 for the StC subscale (M = 0.76).

Before conducting substantive analyses, we performed multigroup CFA invariance analyses (detailed results available upon request), which supported the configural and metric invariance of each measure between the U.S. and Russian samples. The assumption of scalar invariance did not always hold, but scalar invariance was not essential for our purposes, as we only sought to compare effects, rather than means, across countries.

Data analysis strategy. To find out whether the typical profile shapes found across all samples could be described by a quadratic function, we performed a latent profile analysis on the six C-RAI scales in Mplus 7.4 with 1,000 and 100 sets of starting values used at the first and the second stage of optimization, respectively (STARTS = 1000 100), and 50 initial stage iterations (STITERATIONS = 50). The within-class variances for all the variables were freely estimated. For this analysis, we used standardized observed variable scores within each sample (Wang, Hagger, & Liu, 2009) to control for mean differences .

We followed by modeling individual differences in profile shape using a series of multilevel models with observed raw scores. The scores on the six scales (Level 1) were treated as a set of within-subject observations ordered by their degree of relative autonomy. Each C-RAI scale was assigned a constant weight W (centered, with equal unit intervals, from −2.5 for amotivation to 2.5 for intrinsic motivation) and observed scale score was regressed on this weight. We used a quadratic function to approximate the shape of individual profiles, resulting in the following Level 1 equation to model the score of individual i on scale j (S_{ij}):

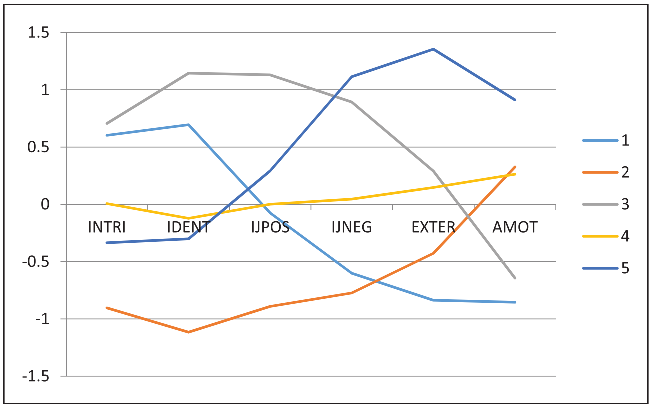

Figure 6. Profiles of the five classes, Study 3 pooled data.
Note. INTRI = intrinsic; IDENT = identified; IJPOS = positive introjection; IJNEG = negative introjection; EXTER = external; AMOT = amotivation.

$$S_{ij} = A_i \times W_j^2 + B_i \times W_j + C_i + r_{ij},$$

where A_i and B_i are random slopes, C_i is a random intercept, and r_{ij} is the residual.

In this equation, Parameter C describes the elevation of an individual profile, whereas the Parameters B and A in combination describe its shape and scatter. The values of the B parameter (linear term) reflect the position of the profile peak (positive values correspond to profiles with peaks in the autonomous region of the continuum, negative values to those with peaks in the controlled region). The values of the Parameter A describe the profile shape (A = 0 for linear profiles, A > 0 for U-shaped ones, and A < 0 for those with inverted-U shape). Higher absolute values of Parameters A and B describe profiles with higher scatter (for flat profiles, both A and B would approach zero).

First, we tested an intercept-only model (0) and two random intercept models (Model 1 with only a fixed linear term B and Model 2 with an additional quadratic term A), arriving at an equation describing the shape of an average profile. We followed by introducing random slopes for B (Model 3) and A (Model 4), thus allowing these parameters to vary across individuals. The random slopes and intercept were allowed to covary. We relied on information criteria and scaled log likelihood ratio difference test to judge the relative fit of models with increasing complexity.

Based on Model 4, we derived estimates of Parameters A, B, and C for each individual respondent. To evaluate the quality of the model, we used these parameters to calculate expected scores for each individual and studied the associations between these expected scores and observed scores.

To evaluate the validity of the RAI, we first investigated the associations of A, B, and C parameter estimates with RAI (a measure of quality of motivation) and the mean score (a measure of profile elevation, which may reflect the quantity of motivation). To control for aggregation bias, we pooled within-sample correlation matrices via Fisher transformation.

Finally, we compared the predictive validity of four sets of predictors (the three parameter estimates, weighted and unweighted RAI supplemented by the mean score, and six individual subscales) against the well-being outcomes and trait autonomy measures using multiple regressions.

Results

Motivation profiles. We compared models containing two to seven latent classes. The model with five latent classes showed the best information criteria and entropy values. Estimation of the six-class model resulted in nonidentification of the model even when the number of iterations was increased to 5000 and 500 for the first and the second optimization stage, respectively (STARTS =5000 500). The seven-class model had additional classes of small size (4% and 7% of the sample) with similar profile shapes to those in the five-class model. The resulting profiles of the five classes are shown in Figure 6; we do not attempt to name or interpret them. All the profiles were consistent with a quadratic function and generally in line with the expectations based on the simplex structure.

Individual profile shapes. First, we fit the random intercept models which describe the shape of an average profile. According to information criteria (given in Table 11) and the scaled log likelihood difference test, $\Delta\chi^2(1) = 373.44$, $p < .001$, the fit of Model 2 with a quadratic term was better than that of Model 1. The coefficient for the quadratic term was negative, in line with the inverted-U shape expectation. The positive coefficient for the linear term indicated that autonomous motivation was predominant for a majority of respondents.

We proceeded by estimating the two random slope models. The fit of Model 3 (with a random slope for the linear term B) was better than that of Model 2, $\Delta\chi^2(2) = 1{,}654.27$, $p < .001$, and Model 4 (with both random slopes for A and B) made a further improvement, $\Delta\chi^2(3) = 765.25$, $p < .001$. We used Model 4 to derive estimates of Parameters A, B, and C for each individual. To ensure the stability of the model, we also performed the same set of analyses with each sample separately and obtained nearly the same parameter estimates ($r = .99$ for B and C, and $r = .94$ for A).

The pooled correlation coefficients between the observed scores and those expected based on the model were .92 for intrinsic motivation, .85 for identified regulation, .81 for positive introjection, .87 for negative introjection, .83 for external regulation, and .93 for amotivation. When corrected for attenuation to reflect the differences in scale reliabilities using weighted reliability estimates, the lowest coefficient was .93 for positive introjection with the remaining ones in the .96 to 1.00 range. The median correlation between the six observed and the six expected scores across individuals was .88,

Table 11. The Fit Indices and Parameters of the Multilevel Models (N = 9,282).

	Random intercept models		Random slope models	
	1 Linear	2 Quadratic	3 Linear	4 Quadratic
Free parameters	4	5	7	10
Fit indices				
Log-likelihood	−12,739.89	−12,435.22	−11,960.61	−11,589.68
Scaling correction factor	1.378	1.429	1.184	1.106
AIC	25,487.78	24,880.45	23,935.21	23,199.35
BIC	25,516.32	24,916.13	23,985.16	23,270.71
M (variance)				
A, quadratic term		−0.091	−0.091	−0.091 (0.014)
B, linear term	0.326	0.326	0.326 (0.063)	0.326 (0.070)
C, intercept	3.098 (0.120)	3.364 (0.130)	3.364 (0.167)	3.364 (0.501)
Residual within-level variance	0.820	0.758	0.538	0.410

Note. Unstandardized parameters are given; all the parameters are significant at p < .001. AIC = Akaike information criterion; BIC = Bayesian information criterion.

Table 12. Pooled Zero-Order Correlations Between Motivation Profile Indices Based on Observed Scores and Multilevel Model.

	RAI, raw	RAI, weighted	RAI, equal-interval	*M*	A	B
RAI, raw						
RAI, weighted	.979***					
RAI, equal-intervals	.965***	.998***				
M score	−.018	.029	.042			
A (quadratic)	.037	−.011	−.025	−.689***		
B (linear)	.967***	.998***	.999***	.013	.016	
C (intercept)	−.032	.021	.035	.914***	−.926 ***	−.003

Note. RAI = Relative Autonomy Index.
***p < .001.

suggesting that the model approximates score profiles for most respondents fairly well.

Convergent validity of different motivation profile indices. To investigate the associations between different types of indices based on observed scores reflecting the overall characteristics of individual profile, we calculated an unweighted RAI score using the formula, INTRI + IDENT + IJPOS − IJNEG − EXTER − AMOT; a weighted RAI score using the formula, 3 × INTRI + 2 × IDENT + 1 × IJPOS − 1 × IJNEG − 2 × EXTER − 3 × AMOT; and an equal-interval RAI using the formula, 2.5 × INTRI + 1.5 × IDENT + 0.5 × IJPOS − 0.5 × IJNEG − 1.5 × EXTER − 2.5 × AMOT. We also calculated a mean score across all the six scales to reflect the elevation of the profile, which may be interpreted as "quantity" of motivation (or acquiescence response style). The pooled correlation matrix of these indices with model-based parameter estimates (A, B, and C) is given in Table 12.

RAI, regardless of the weighting scheme, emerged to capture essentially the same information as the linear term B estimated within the multilevel profile model. The mean score across the C-RAI scales was quite similar to the intercept C of the linear model. B and C, as well as RAI and Mean, were only weakly correlated, suggesting that these two components capture different components of score variance (distinct and nearly unrelated aspects of individual profiles). The differences in the magnitude of these associations across the six subsamples were insubstantial.

The A parameter showed strong negative associations with the C parameter (these associations were linear based on scatterplot). Given the inverted-U shape of the profiles ($A < 0$), this indicates that in our samples respondents whose profiles tended to be flat ($A \to 0$) also tended to give lower scores on all the C-RAI scales. Consequently, the Parameter A, despite being important theoretically, turns out to be redundant empirically because of its high collinearity with C. This suggests that the remaining two parameters, B and C (with weighted RAI and Mean being their reasonably close approximations), are sufficient to describe the empirical variety of individual profiles.

Table 13. Pooled Zero-Order Correlations of Motivation Indicators With Well-Being and Trait Autonomy, Study 3.

	SWB	SWLS	PA	NA	ASC	StC
Indices based on the multilevel model						
A (quadratic)	.03	.03	−.10***	−.12***	−.16****	−.30***
B (linear)	.36***	.26***	.31***	−.29***	.38***	−.30***
C (intercept)	−.02	−.02	.12***	.13***	.16***	.35***
Indices based on observed scores						
RAI, raw	.36***	.25***	.29***	−.31***	.38***	−.30***
RAI, weighted	.36***	.26***	.31***	−.29***	.39***	−.29***
Mean	−.01	.00	.13***	.13***	.13***	.34***
Observed scale scores						
Intrinsic	.25***	.20***	.28***	−.14***	.27***	−.08**
Identified	.26***	.18***	.28***	−.16***	.37***	−.08**
Positive introjection	.08**	.04	.16***	.00	.24***	.22***
Negative introjection	−.11*	−.07**	.03	.20***	.03	.35***
External	−.18***	−.12***	−.06*	.23***	−.12***	.35***
Amotivation	−.27***	−.20***	−.22***	.24***	−.29***	.30***

Note. SWB = subjective well-being; SWLS = Satisfaction With Life Scale; PA = Positive Affect; NA = Negative Affect; ASC = authorship/self-congruence; StC = susceptibility to control; RAI = Relative Autonomy Index.
*p < .05. **p < .01. ***p < .001.

Predictive validity of motivation profile indices. Our next set of analyses focused on predicting well-being and autonomous functioning using the various RAI subscales and the various combinations of subscales. The pooled correlations of the motivation indices (those based on the hierarchical linear model, on observed scores, and the six individual C-RAI subscales) with the well-being and trait autonomy indicators are given in Table 13.

The magnitude of the correlations of the RAI with the validity measures was nearly the same as that of the B parameter and the differences between the weighted and unweighted RAI versions were very minor. This suggests that RAI weighting schemes, which are quite assumption-laden, may not improve prediction and thus perhaps should be used only when theory justifies it.

The magnitude of the associations of the RAI with the validity indicators was generally higher than that exhibited by individual motivation subscales. The grand mean of the scores across the six scales ("quantity" of motivation) was consistently correlated only with StC, suggesting that this measure might be characterized by acquiescent and extreme responding. If so, the correlations of the individual motivation scales with the dependent variables may be boosted by the contribution of this response extremity bias; such a bias is not present in the RAI, because it is symmetrical (with three positive and three negative subscales).

To investigate whether the aggregate RAIs capture all the predictive variance associated with the individual motivation subscales, we performed a series of hierarchical multiple regression analyses. At Step 1, we entered into the regression model dummy variables for country, stem, and their interactions to control for systematic differences in the dependent variable (DV) scores. At Step 2, we entered either the B and C parameters of the multilevel model (Model 1), or RAI and Mean (Model 2a with weighted RAI and Model 2b with unweighted one), or the six individual subscales (Model 3) to compare the predictive validity of these sets of measures. The results are summarized in Table 14.

Because the dummy variables entered at the first step only explained a small proportion of the DV variance (less than 2%), for brevity, we do not report their respective beta coefficients. The amount of variance explained by the B and C parameters together and by the weighted RAI and Mean differed only for trait autonomy and the difference was minor (less than 1% of the variance). The amount of variance explained by the unweighted RAI was slightly lower than that explained by its weighted counterpart, although the differences were also minor (less than 1% of the variance). The amount of variance explained by the six individual subscales (all tolerances > .37) was nearly the same as that explained by the unweighted RAI for well-being indicators, but was somewhat higher (by 1.6%-1.7% of variance) than that explained by the RAI for the trait autonomy measures.

We also performed additional analyses to find out if any of the six subscales would show any incremental validity over the RAI and Mean (Model 4). After controlling for the country and stem (Step 1), the RAI and grand mean of the six scales were entered at Step 2, followed by the six individual subscale scores at Step 3. Because the individual beta coefficients for the six individual subscales may not be trustworthy due to their multicollinearity with the RAI, in this model we only examined the change in R^2 at Step 3, reasoning that the absence of a significant increase in explained variance would suggest that the RAI measure captures all the relevant predictive variance of the individual scales that compose it. This was the case for all the

Table 14. Results of Multiple Regression Analyses in the Combined Sample (N = 1,547).

	SWB	SWLS	PA	NA	ASC	StC
Step 1, ΔR^2	.006	.006	.019***	.013**	.014**	.019***
Model 1 (indices based on the multilevel model)						
R^2 adjusted	.135***	.069***	.129***	.106***	.175***	.214***
Step 2, ΔR^2	.134***	.068***	.114***	.096***	.165***	.199***
β, B (linear term)	.406***	.290***	.352***	−.321***	.407***	−.325***
β, C (intercept)	−.018	−.004	.129***	.141***	.197***	.410***
Model 2a (indices based on observed scores with weighted RAI)						
R^2 adjusted	.135***	.069***	.130***	.106***	.168***	.209***
Step 2, ΔR^2	.134***	.067***	.115***	.097***	.158***	.194***
β, RAI, weighted	.406***	.288***	.348***	−.327***	.412***	−.328***
β, Mean	−.014	−.003	.125***	.132***	.135***	.384***
Model 2b (indices based on observed scores with unweighted RAI)						
R^2 adjusted	.129***	.063***	.122***	.109***	.167***	.201***
Step 2, ΔR^2	.128***	.061***	.107***	.100***	.157***	.186***
β, RAI, unweighted	.411***	.285***	.346***	−.344***	.425***	−.323***
β, Mean	.005	.011	.142***	.117***	.154***	.368***
Model 3 (individual subscales)						
R^2 adjusted	.136***	.069***	.130***	.109***	.184***	.226***
Step 2, ΔR^2	.136***	.070***	.118***	.102***	.175***	.213***
β, intrinsic	.173***	.140***	.194***	−.081*	.046	−.059
β, identified	.105**	.064	.103***	−.085*	.216***	−.063
β, positive introjection	.022	−.007	.046	−.021	.144***	.190***
β, negative introjection	−.132**	−.070	−.027	.201***	−.020	.274***
β, external	−.056	−.021	.005	.107**	−.062	.115**
β, amotivation	−.168***	.138***	−.136***	.125***	−.163***	.210***
Model 4 (incremental validity)						
R^2 adjusted	.136***	.069***	.130***	.109***	.184***	.226***
Step 2 (RAI weighted + Mean), ΔR^2	.134***	.067***	.115***	.097***	.158***	.194***
Step 3 (six subscales), ΔR^2	.003	.003	.002	.005	.017***	.018***

Note. For the sake of brevity, the results for dummy variables are not included. The full results are available upon request. SWB = subjective well-being; SWLS = Satisfaction With Life Scale; PA = Positive Affect; NA = Negative Affect; ASC = authorship/self-congruence; StC = susceptibility to control; RAI = Relative Autonomy Index.
*$p < .05$. **$p < .01$. ***$p < .001$.

well-being measures. For the trait autonomy measures, adding the six individual motivation scores produced a minor increment in explained variance (roughly 10%, compared with the proportion of variance explained by the RAI and Mean at Step 2). To rule out the possible effects of measurement error, we also tested a version of Model 4 using latent score estimates of the six subscales. The results were nearly the same with only negligible (less than 0.5%) differences in the amount of variance explained.

We also performed regression analyses using combined scores for autonomous motivation (INTRI + IDENT + IJPOS) and controlled motivation (IJNEG + EXTER + AMOT) as predictors of the dependent variable. The R^2 in all cases was exactly the same as that obtained for unweighted RAI and the Mean, indicating that these two scoring approaches extract the same variance from the six subscales (indeed, mathematically, these two pairs of indices can be transformed into each other using a simple linear transformation). However, in many cases, the regression coefficients for both autonomous and controlled motivation scales were significant and similar in magnitude (although oppositely signed), suggesting that each of these dimensions captures variance associated with both autonomy and acquiescence (i.e., the "quantity" of motivation). In contrast, the RAI more often emerged to be the only significant predictor of dependent measures, suggesting that this scoring approach results in a better separation of the two types of variance.

General Discussion

In this research, we first evaluated the many different measures of the RAC in existence, hoping to thereby derive a C-RAI that is in theory usable within any and every motivational domain (i.e., academics, relationships, health care, parenting, work, sport, etc.). We reasoned that such a consensually accepted measure might be valuable because it would facilitate the comparison of research findings across different behavioral domains and different research questions. We began by conducting a thorough content analysis of all of the items contained within nearly all existing RAI scales. By considering all possible pairs of items, we isolated the core words and concepts which recur across those scales, created short paraphrases to represent those concepts, and built new inventory items around those paraphrases. We believe the resulting 24-item measure (see the appendix) may represent a substantial contribution to the SDT literature, although the measure needs to be tested in more different domains beyond achievement. One possible limitation of the measure is that the brief paraphrases derived from our content analyses may not contain enough descriptive information to fully evoke or tease out participants' actual motivations. Another possible limitation is that they may not contain enough domain-specific information to be widely applicable without modification. We hope that other researchers will help in this evaluation.

As an even larger contribution, however, the current research reaffirmed the validity of the RAC. The RAC is perhaps the most essential part of SDT because it integrates all of the forms of motivation identified by the theory and locates them with respect to each other on a single underlying continuum as postulated by SDT's organismic integration mini-theory (Deci & Ryan, 1990; Ryan & Deci, 2017). The RAC concept enables human beings to be conceptualized as evolving systems, hopefully moving through stages of development toward greater maturation and self-ownership (Chandler & Connell, 1987; Sheldon, 2014). The RAC also enables 20th-century motivation theories to be organized along the same developmental sequence, referencing first operant conditioning factors, then psychodynamic factors, then cognitive-developmental factors, then psychosocial and existential factors (Sheldon, Cheng, & Hilpert, 2011). The RAC concept has proven to be very generative and is referenced in hundreds if not thousands of studies. Still, the RAC concept should not be taken as doctrine, and Chemolli and Gagné (2014) were correct to try to test the concept anew, using new kinds of statistical tests. However, we believe they were incorrect in their interpretations of some crucial results, and thus in our research, we set out to take a new look.

Hierarchical cluster analyses and CFAs found good support for the six-subscale structure of the new C-RAI, while supporting the second-order simplex structure among these factors that is postulated by SDT (see Figure 4). MDS analyses of the final 24-item set also provided clear support for the RAC, as the concepts could be lined up in the order sequence predicted by SDT, both at the 24-item level (Figure 3) and at the six-subscale level (Figure 4). In other words, despite the widely varying semantic content across the 24 items representing widely varying theories and conceptions of motivation, their predicted theoretical location with respect to each other was confirmed using several different methods, in several different samples, both American and Russian. We also found the same pattern in different PLOC datasets published earlier for different domains (work, sports), indicating that this empirical structure is not dependent on a specific domain or instrument (at least as long as a simplex-like pattern is found).

We found that angular coordinates of items and scales were in line with theoretical predictions about their positions on the RAC, which is also usually projected onto the first dimension of the MDS models. Is the second MDS dimension substantively meaningful? This question is difficult to answer (Roth et al., 2006). Theoretically, it might be construed as a "self-consciousness" dimension (introjection involving self-conscious emotions vs. lack of ego awareness in intrinsic motivation and amotivation) or as a "self-control" dimension (in the sense that introjection involves overcoming internal resistance, whereas amotivation and intrinsic motivations are enacted without a conscious effort). However, it is also possible that the second dimension is a methodological artifact with no substantive meaning. For example, Davison (1977) analyzed the factor structure of responses to stimuli when those responses are known to fit a metric, unidimensional unfolding model. He found that PCA yielded a semicircular, two-factor structure, in which "the variables are ordered along the semi-circle according to their positions on the stimulus dimension" (Davison, 1977, p. 524; see also Eckblad, 1980). The fact that in our data, polar coordinates of items and scales showed better correspondence with theoretical predictions than did the scores on any of the two dimensions taken separately, suggests that Davison's pattern might be in evidence here as well. However, additional research is called for.

In Study 3, we investigated the typical shapes of individual profiles and did not find any typical patterns with two peaks at both ends of the continuum (which would be expected if there were two independent processes of autonomous and controlled motivation). Some of the empirical profiles were not well differentiated, but mostly the profiles were consistent with a single-peak hypothesis. This suggests that a single "point" on the continuum describing the predominant motivation type can be found for many, if not all, individuals. This point is captured by the linear term (B) of the quadratic function, which emerged to be essentially the same as RAI. However, the advantage of RAI is its parsimony: It is based on observed scores and requires no complex modeling. RAI can be meaningfully calculated in any dataset where the semicircular pattern is found using MDS or PCA.

Although mathematically three parameters are necessary to describe the variety of individual profiles, empirically we found the quadratic term (A) to be redundant. Its high correlation with the intercept (C) was consistently reproduced across our six independent samples, suggesting that RAI and the Mean score (essentially equivalent to the two other parameters of the model) may capture fairly well the two most important aspects of individual profiles: elevation (which can be interpreted as the strength of motivation) and location of the peak (the predominant motivation type).

Indeed, the hierarchical regression analyses showed that the predictive validity of RAI and the Mean was nearly as high as that of the B and C parameters and that of the six individual subscales in combination.

We also comparatively tested several methods of scoring and testing the RAI, hoping to show that it is both justifiable and efficient to create a single RAI to represent the overall state of a person's motivational system (which, again, is the common research practice that was questioned by Chemolli & Gagné, 2014). We found that an unweighted RAI score indeed predicted well-being and trait autonomy more consistently than any of the six subscales taken singly. We found that applying a typical weighting scheme to the RAI did not much improve prediction; that is, when forming the RAI composite, giving greater weight to the subscales closer to the extremes of the continuum only marginally improved the association of RAI with SWB or trait autonomy. This is in line with the suggestions of Wainer (1976), who advocates using equal weights, as they are based on less complex assumptions. We view the issue of "which method is better" as an open question; indeed, in some instances, using a weighted RAI may be more theoretically justifiable, or may better predict outcomes, as in some cases herein. For instruments with an equal number of autonomous and controlled motivation scales (like the C-RAI), a combination of unweighted RAI and Mean score can be construed as a linear transformation of two indices of autonomous and controlled motivation, as suggested by some researchers (Koestner, Otis, Powers, Pelletier, & Gagnon, 2008; Vansteenkiste, Zhou, Lens, & Soenens, 2005; Williams, Grow, Freedman, Ryan, & Deci, 1996). However, RAI and the Mean are better at separating the variance related to the quality of motivation (autonomy) from that related to its quantity (strength).

Our research also demonstrated the robustness of the new C-RAI with respect to the mean level of motivation evidenced by the participant. One potential criticism of the RAI difference score approach, alluded to earlier, is that participants can get the same RAI score with very different subscale scores. In other words, people with large and small quantities of motivation are treated the same by the difference score approach. The present research found that the sum ("quantity" of motivation) had some associations with both positive and negative well-being, but that these effects were considerably smaller than the effects of the C-RAI ("quality" of motivation). The strongest and most consistent association involving the "quantity" variable was its positive association with the "susceptibility to control" facet of the IAF, suggesting that quantity may work against quality and thus should be removed from measures of motivational quality. This is precisely what the difference score procedure of the RAI does.

It is worth noting that our procedure in this article, of entering both RAI and the Mean motivation score into the regression equations predicting the outcomes, is unconventional because the Mean is rarely examined in SDT research. We did it here primarily to demonstrate the independence of RAI effects from mean response-level effects (which may be associated with acquiescence bias and/or extreme response bias; Paulhus, 1991; Paulhus & Vazire, 2007). In our view, researchers could choose to use only the RAI score in their research (as is typical) or they could choose to use both. Using both is mathematically equivalent to using both a controlled motivation and an autonomous motivation score together, a practice which is sometimes followed in the literature (Williams et al., 1996). However, in the latter case, the "quantity" dimension continues to be included within both the autonomous and controlled motivation composites. We believe the use of RAI plus Mean to be more justifiable because it separates the "quality" from the "quantity" of motivation, allowing their effects to be examined independently.

Finally, our research demonstrated robustness of the new C-RAI to cultural differences. In all studies, we included both American and Russian participants, using a full translation/back-translation procedure to convert English into Russian and back. We then used measurement equivalence analyses to show that the items functioned in the same way across the cultures, although the occasional lack of scalar invariance suggests that item means may not always be directly comparable across cultures. Also, C-RAI correlated about .30 with SWB in both types of cultural samples, supporting SDT's claim that autonomy is a universal need within any and every cultural group (Deci & Ryan, 2000). Although further work is required to validate the C-RAI in further languages and cultures, we see no compelling reason to believe that equivalence will be lacking elsewhere. Again, the paired-item paraphrase approach used to create the C-RAI has the effect of rendering key SDT motivation concepts into the simplest possible language, which should thus be simplest to translate and understand around the world.

Considering Each Form of Motivation Separately

Amotivation. According to SDT's organismic integration theory, amotivation differs categorically from the other motivations because in the case of amotivation, behavior is taking place without an intention (Ryan & Deci, 2000a). The person acts, but does not know why, and does not expect to be successful. The amotivation items within the C-RAI well-reflect this conception of the amotivation. However, it is worth pointing out that the current analyses show that amotivation is *not* categorically distinct from the five forms of motivation examined, because it could be located on the same continuum as the others, with no discontinuity. But perhaps this was expectable because the mere occurrence of behavior indicates that at least some motivation is present, even if the person feels confused or helpless with respect to that behavior.

External motivation. One important discussion issue involves the fact that the new C-RAI does not include an item referencing money, which would typically be considered as a facet of external motivation, and perhaps even the prototypical example of external motivation (Deci & Ryan, 1985). The relevant item that was derived from our paired comparison technique was "*. . . because X helps (or will help) me get money or some other reward*." However, we excluded this item from our later analyses because it fell into the identified motivation cluster, where it clearly did not belong, theoretically. We suggest that this occurred for several possible reasons. First, we were primarily assessing academic motivation within these studies (e.g., motivation to attend classes, study for a major, and to be responsible). Academic motivation is complex because it is unpaid work (in fact, students pay in order to be able to do it), yet it is nevertheless important for student's future pay. Obviously, future pay is an essential good for student's future lives and, if achieved, would be a reliable indicator that the student has met with some degree of success in life. A second and related reason for the ambiguity is that money is cognitively complex and has many different meanings for people, ranging from being a legitimate source of pride and value, to a mere symptom of craven materialism. Thus, it may not be possible to measure money motivation effectively with just one item (unfortunately, we were limited to just one item by our procedure of only analyzing the content of existing RAI scales). A third possible reason for the mislocation of this item is that the time framing of the money motivation question may be critically important. If the question had been specifically formulated as "going to class helps get money now," it may have performed more as expected (i.e., students currently going to class *because they are currently being paid to go* may have different outcomes from students who are instead *paying* to go to class in hopes of being better paid *in the future*).

It is also worth noting that of the various existing RAI scales that we surveyed (see the appendix), only the Work Motivation Scale contained money items. Thus, for example, "for the money" is not a typical reason a person enters a romantic relationship, or parents a child, or engages in recreational activity. Thus, it is possible that the money item we identified would function as expected only if it were only used to assess paid work and nothing else. In sum, researchers may want to consider using a 25- rather than a 24-item version of the C-RAI, by including Item V05 in the scale (see the appendix). This would make the C-RAI even more comprehensive. However, researchers should be aware that it may not fall with the other external motivation items.

Notably, Gagné et al. (2015) found confirmatory factor analytical support for two kinds of external motivation, one involving material incentives and the other social incentives, with the latter located closest to introjection. Similarly, Roth et al. (2006) found support for a conformity-based (social) form of external motivation, which could be located between material external motivation and introjection. Theoretically, these findings make sense because conformity is the beginning of the process by which people begin to police themselves from within. However, these distinctions did not emerge within the C-RAI, perhaps because our initial content analysis turned up more interpersonal than material reward kinds of items.

Introjected motivation. Our analyses differentiated introjected motivation into two different subtypes, consistent with the Assor et al. (2009) distinction between striving to approach self-worth versus striving not to lose self-worth. Our analyses also confirmed Assor et al.'s finding that approach-introjection (herein termed *positive introjection*) lies between avoidance-introjection (here termed *negative introjection*) and identification on the RAC. Thus, we strongly recommend that researchers assess both positive and negative forms of introjected motivation, so that findings concerning introjected motivation cannot be dismissed as perhaps being due to negative item content biases. It is also noteworthy that positive introjected motivation was located on the positive (autonomous motivation) side of the RAC, indicating that self-esteem motivation may not be as toxic as it is sometimes portrayed as being (i.e., Crocker & Park, 2004). Although identified and intrinsic motivations may be more "pure" exemplars of self-determined motivation, self-esteem motivation is probably healthy on average, unless perhaps it too strongly reflects unresolved ego-wounds from the past.

Identified motivation. Examination of the four C-RAI identification items indicates that this prototypical form of internalized motivation is not about having made the choice oneself, nor is it about feelings of satisfaction, identity, or just "wanting" to. Instead, the items concern valuing the behavior, and believing that it is important. This echoes other SDT research showing that perceived choice is not the most important thing; people are willing to let others choose for them, as long as they feel that the choices are valuable. Indeed, the "truest" identifications may come with a feeling that one has no choice in the matter, if one is to be an individual of integrity. For example, a well-known climate scientist working for economic change feels he has no choice but to reduce his carbon footprint, given how important he believes this is at the global scale. Thus, what matters for him is not his having personally chosen the behavior (he cannot but do otherwise), but rather his believing that the behavior is of critical importance.

Intrinsic motivation. Although some researchers have proposed various subtypes of intrinsic motivation (i.e., motivation to know, to accomplish, to be stimulated; Vallerand et al., 1992), only one type emerged within the current research, characterized by enjoyment and interest. Again, however, we only worked with the item content of conventional, widely used RAI measures. Future research could attempt to clearly identify subtypes of intrinsic motivation, just as additional subtypes of external motivation might be sought. However such research is conducted, we believe that all motivational subtypes should be empirically locatable on the RAC as shown herein via MDS, hierarchical clustering, and CFAs, and that their data-based locations should be meaningful theoretically. We suspect that the different subtypes of intrinsic motivation mentioned above would not fall at different locations on the RAC but would instead clump together in about the same location. This would make the choice of whether to use the single C-RAI intrinsic motivation scale, versus a more differentiated set of intrinsic motivation scales, dependent on the specific purpose of the research.

In conclusion, our research has provided powerful new support for SDT, by validating SDT's RAC concept which integrates all major forms of motivation into a single picture. Our research has also provided a potentially powerful new measure of the quality of a person's motivation, one that can be fruitfully applied to assess any behavioral or role domain (i.e., work, recreation, worshipping, parenting, coaching, exercising, learning, etc.) and which can be used to compare far-flung findings in the SDT literature. Our research has also shown that it is valid and efficient to use a single RAI score to assess the overall quality of a person's motivation, potentially increasing parsimony in the field of motivation research. We hope that the present study helps to resolve the inconsistencies in the past research using PLOC measures and serves as an example of methods to identify the empirical RAC structure within any dataset.

Appendix

The initial 35 Relative Autonomy Index (RAI) items derived from inductive content analysis of most existing RAI scales, using the constant comparison paraphrase technique. All of the initial 35-item paraphrases below are grouped with their intended subscale, as designated by scale authors. Eleven items were eliminated in the search for coherent subscale sets via cluster and principal components analyses, leaving 24 final items. The 11 deleted items are listed at the end of their respective subscale sets, in italics.

Why Do You Do X?

Amotivated:
AMO1: . . . I once had good reasons for doing X, but now I don't
AMO2: . . . Honestly, I don't know why I do X
AMO3: . . . I'm not sure, I wonder whether I should continue doing X
AMO4: . . . I used to know why I do X, but I don't anymore
External:
EXT1: . . . because important people (i.e., parents, professors) will like me better if I do X
EXT2: . . . because if I don't do X, others will get mad
EXT3: . . . because I'll get in trouble if I don't do X
EXT4: . . . because I don't have any choice but to do X
EXT5: . . . because I want to gain praise or other rewards from important people
EXT6: . . . because X helps (or will help) me get money or some other reward
EXT7: . . . because I feel that I have to do X
Negative introjection:
IJN1: . . . because I would feel guilty if I didn't do X
IJN2: . . . because I would feel ashamed if I didn't do X
IJN3: . . . because I would feel like a failure if I didn't do X
IJN4: . . . because I don't want to feel bad about myself
Positive introjection:
IJP1: . . . because I want to feel proud of myself
IJP2: . . . because I want to prove to myself that I am capable
IJP3: . . . because X boosts my self-esteem
IJP4: . . . because I want to feel good about myself
IJP5: . . . because I feel like an important person when I do X
Identification:
IDE1: . . . because I strongly value X
IDE2: . . . because X is personally important to me
IDE3: . . . because it is my personal choice to do X
IDE4: . . . because X is meaningful to me
IDE5: . . . because X will help me achieve something important
IDE6: . . . because I want to do X
IDE7: . . . because X is personally satisfying to me
IDE8: . . . because X is a part of my identity
IDE9: . . . because I understand the importance of X
Intrinsic:
INT1: . . . because I enjoy X
INT2: . . . because X is fun
INT3: . . . because it is a pleasure to do X
INT4: . . . because X is interesting
INT5: . . . because X is exciting
INT6: . . . because X is challenging

List of existing RAI scales consulted (some from the self-determination theory [SDT] websites were never published):
Academic Self-Regulation Questionnaire (SRQ-A)
Prosocial Self-Regulation Questionnaire (SRQ-P; Ryan & Connell, 1989)
Treatment Self-Regulation Questionnaire (TSRQ; Williams, Grow, Freedman, Ryan, & Deci, 1996)
Learning Self-Regulation Questionnaire (SRQ-L)
Exercise Self-Regulation Questionnaire (SRQ-E)
Religion Self-Regulation Questionnaire (SRQ-R)
Friendship Self-Regulation Questionnaire (SRQ-F)
Academic Motivation Scales, college version (AMS-C; Vallerand et al., 1992) Situational Motivation Scale (SIMS; Guay, Vallerand, & Blanchard, 2000)
Work Extrinsic and Intrinsic Motivation Scale (Tremblay, Blanchard, Taylor, Pelletier, & Villeneuve, 2009)
Motivation at Work Scale (Gagné et al., 2010)

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