Assessing autonomy, competence, and relatedness briefly - Validating single-item scales for basic psychological need satisfaction

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Abstract

The satisfactions of the psychological needs for autonomy, competence, and relatedness have been established as central components of human well-being, predictive of various positive behavioral and psychological outcomes. However, in many contexts they need to be assessed very briefly, sometimes with just one item. Recent research has shown that well-designed single-item scales of relatively unidimensional constructs can perform surprisingly well. Accordingly, the aim of this project was to create and validate single-item scales for the three needs. In study 1 ($n = 353$, UK), we generated new items based on careful examination of the construct definitions and tested them alongside established multi-item need satisfaction scales. In study 2 ($n = 335$, US), we replicated these results using a shorter time span (need satisfaction yesterday). Study 3 ($n = 327$, UK) compared the performance to a few other brief need satisfaction scales. In all studies, the new single items loaded excellently on respective longer scales and correlated with criterion variables at near identical levels as the longer scales. Given that the performance of the single-item scales was comparable to the established multi-item scales, they are recommended as valid and useful measures of need satisfaction for research context requiring very brief measures.

Keywords: autonomy, basic psychological needs, scale development, self-determination theory, single-item scale

Introduction

The key role of basic psychological needs in human well-being has been increasingly recognized. In particular, Self-Determination Theory (SDT; Ryan & Deci, 2000, 2017) has made a strong empirical case for the existence of three basic psychological needs essential for well-being and optimal functioning of humans: autonomy (self-direction and sense of volition), competence (sense of mastery, accomplishment, and efficacy), and relatedness (sense of mutually caring relationships) (Deci & Ryan, 2000; Vansteenkiste et al., 2020). The satisfaction of these three needs has been shown to be crucially important for motivation and well-being across the world (Chen et al., 2015; Church et al., 2013; Martela et al., 2023; Yu et al., 2018; see also Tay & Diener, 2011), and in contexts ranging from work (Van den Broeck et al., 2016), education (e.g., Jang et al., 2016) and sports coaching (e.g., Curran et al., 2016) to health promotion (Ng et al., 2012). A recent systematic review of meta-analyses on SDT identified 12 meta-analyses specifically focusing on basic psychological needs (Ryan et al., 2022), attesting the fact that hundreds of empirical studies are published annually on the satisfaction of these three needs in various research contexts. Accordingly, a strong case has been made that when broader assessment of personal well-being is made, measures for the three psychological needs should be included (Martela & Ryan, 2021, 2023).

However, there are many contexts in which only very brief measures of need satisfaction are feasible. In nationally representative surveys, large panel studies, and policy contexts, the space is often highly constricted and contested, necessitating the measurement of many constructs with only one item (Allen et al., 2022; Fisher et al., 2016). Daily-diary and experience-sampling studies involving frequent repeated measurement also require significant limitation of survey length to minimize respondent burden and attrition and to maximize

response rates, as do large-scale assessment surveys at work, schools, and other contexts in which answering is voluntary (Fisher et al., 2016; Gogol et al., 2014). Researchers in these situations often face the choice of either omitting a construct or measuring it with only one item.

At the same time there is increased recognition that well-being is more than life satisfaction, and thus its measurement requires the assessment of a broader set of constructs (Huppert & So, 2013; Keyes, 2007; Marsh et al., 2020; Ryff, 1989), including the satisfaction of psychological needs (Martela & Ryan, 2023). To balance the need to have a broad enough set of constructs included while keeping survey length brief, many well-being assessment scales, such as Flourishing Scale (Diener et al., 2010) and Well-Being Profile-15 (Marsh et al., 2020) have opted for the assessment of individual well-being constructs with only one item. Accordingly, there is a clear need for validated and well-functioning single-item measures for psychological need satisfaction, to serve in those contexts in which space and response burden make longer measures unfeasible.

Although traditionally the received wisdom in psychological research was that "other things being equal, a long test is a good test" (Nunnally, 1978, p. 243), more recent research has demonstrated that for relatively unidimensional constructs, well-designed single-item measures can perform surprisingly well, paralleling the performance of longer scales (Allen et al., 2022; Ang & Eisend, 2018; Cheung & Lucas, 2014). However, certain limitations must naturally be acknowledged, such as the inability to estimate internal reliability or standard error (Allen et al., 2022; Loo, 2002), the limited ability to capture various dimensions of a broad construct with a single item (Loo, 2002; Schriesheim et al., 1991), the limited ability to construct latent variables (Kline, 2011; Yuan & Bentler, 2006), and vulnerability to random measurement error (Credé et al., 2012). Although these limitations are significant, they can, to a considerable degree, be

addressed in the validation phase by using alternative methods and ensuring that the construct to be measured is adequately narrow and clearly defined (Fisher et al., 2016; Gogol et al., 2014).

Accordingly, for clearly defined unidimensional constructs such as life satisfaction (Cheung & Lucas, 2014) and job satisfaction (Wanous et al., 1997), single-item measures are often used and even recommended in many situations (Jovanović & Lazić, 2020; Scarpello & Campbell, 1983), as they have recognized benefits such as brevity, ease of use, and global measurement (Fuchs & Diamantopoulos, 2009; Kwon & Trail, 2005). More generally, instead of knee-jerk reactions that either reject single-item measures outright or utilize them without validation, research has finally moved to a stage in which each proposed single-item measure is tested to establish empirically how valid and reliable it is (Fisher et al., 2016; Fuchs & Diamantopoulos, 2009; Matthews et al., 2022).

Given that the individual psychological needs have clearly established and unambiguous definitions, and are relatively narrow in scope, well-designed single-item measures have the potential to capture these constructs quite well. However, whether this actually is so remains to be examined empirically. Given the practical need for single-item scales, the main task of the present article is to develop and validate such single-item measures for autonomy, competence, and relatedness satisfaction by examining their psychometric properties in three studies and comparing their performance with respective longer scales.

Study 1

The aim of this study was to generate potential single items to cover all three needs, to test their psychometric properties, and compare their performance against longer, established scales. The sample was gathered through Prolific and consisted of English-speaking respondents from the UK. The sample was gathered in accordance with the recommendations of the

University Research Ethics Committee of the [blinded for review], and we sought informed consent from all study participants in the online form, aiming for a sample of 320 participants. In total, 354 respondents answered the survey, but we removed one who failed the attention check question, for a final sample of 353. The age range was from 18 to 81, with mean age at 43. Of the participants, 50.4% identified as female, 49.0% as male, with 0.6% as other. Furthermore, 2 months later we invited all participants to answer a brief follow-up survey through Prolific. In total 307 respondents answered this follow-up survey, for a response rate of 87%. The age range was from 19 to 81, with mean age at 44. Of the participants, 48.9% identified as female, 50.5% as male, with 0.7% as other. These demographics did not differ significantly from the first wave.

Measures

Item generation. The two authors discussed the phrasing of the potential items, consulting and building on the definition of each need. The new items were explicitly designed "for the specific purpose of being a global, inclusive single-item indicators of the given construct with high levels of content validity" (Fisher et al., 2016). While previous scale items (e.g., Chen et al., 2015) had been designed to be part of a broader scale, the target was to construct items that alone would be broad enough to cover the essential aspects of the whole constructs. When first drafts of the items had been constructed, feedback from seven researchers, each with expertise in SDT, was asked and received, which led to the refinement of the items. At the end of this process, we reached consensus on items that would both easy to understand and comprehensive enough to cover the constructs. The final versions of the new need satisfaction items were the following:

- I am able to do things that I really want and value in life (Autonomy)
- I can do things well and achieve my goals (Competence)
- I feel close and connected with people whom I care about and who care about me (Relatedness)

Following best practices (Fisher et al., 2016), we wanted to compare the newly generated

items with the best performing items from an existing multi-item scale, in this case the Basic

Psychological Need Satisfaction and Frustration Scale (Chen et al., 2015). The best performing

individual items for each need of that scale were previously identified and recommended as

single-item measures (Martela & Ryan, 2021). These recommended items are:

- I feel that my decisions reflect what I really want (Autonomy)
- I feel confident that I can do things well" (Competence)
- I feel close and connected with other people who are important to me (Relatedness)

Existing scales of psychological needs. To compare the new items with existing scales,

we included the Basic Need Satisfaction and Frustration Scales (BPNSFS; Chen et al., 2015) that

included four items for the satisfaction of each of the three needs, for example 'I feel a sense of

choice and freedom in the things I undertake' for autonomy ($\alpha = .89$), 'I feel confident that I can

do things well' for competence ($\alpha = .91$), and 'I feel that the people I care about also care about

me' for relatedness ($\alpha = .90$), rated on a scale ranging from 1 (not at all true) to 7 (very true).

To provide another comparison, we also included the Balanced Measure of Psychological

Needs (BMPN; Sheldon & Hilpert, 2012) that included 6 items for autonomy (e.g., 'I was free to

do things my own way'), 6 items for competence (e.g., 'I took on and mastered hard challenges'),

and 6 items for relatedness (e.g., 'I felt a sense of contact with people who care for me, and whom I

care for') rated on a scale ranging from 1 (very strongly disagree) to 7 (very strongly agree), (α's

= .81, .85, .80, respectively). The scale was designed to be balanced in the sense of including 3

items for the satisfaction and 3 items for the dissatisfaction of each need (Sheldon & Hilpert,

2012).

Other scales. In addition to need satisfaction, we included standard scales for *satisfaction with life, positive and negative affect, presence of meaning, vitality, depression* and *anxiety.* The scales used and their reliability are described in Supplementary document.

Results

Psychometric properties of the individual items and scales

The means, standard deviations, skewness, and kurtosis of the new individual items and established scales are displayed in Table 1. As can be seen, the means for the single-item scales for autonomy, competence, and relatedness were highly similar to the respective BPNSFS scales and the other respective scales, with only the balanced competence scale and the balanced relatedness scale and the new relatedness item being significantly different from the respective BPNSFS scale.

Table 1

The basic psychometric properties of the new items and existing scales in Study 1

	Mean	Std. Dev	Skewness	Kurtosis
Autonomy (new item)	4.37	1.39	-.47	-.11
Autonomy (BPNSFS; Chen et al. 2015)	4.45	1.18	-.43	.15
Autonomy (BMPN; Sheldon & Hilpert, 2012)	4.37	1.01	-.03	.37
Autonomy (BPNSFS single item)	4.39	1.39	-.69	.47
Competence (new item)	4.67	1.23	-.63	.61
Competence (BPNSFS; Chen et al. 2015)	4.79	1.07	-.62	.62
Competence (BMPN; Sheldon & Hilpert, 2012)	4.55	1.08	-.31	-.08
Competence (BPNSFS single item)	4.74	1.24	-.58	.15
Relatedness (new item)	5.08	1.30	-.95	1.32
Relatedness (BPNSFS; Chen et al. 2015)	5.26	1.11	-1.08	2.29
Relatedness (BMPN; Sheldon & Hilpert, 2012)	4.79	1.08	-.34	.43
Relatedness (BPNSFS single item)	5.13	1.29	-.99	1.64

Convergent validity: Associations of the individual items with respective multi-item scales

The most common method of validating single-item measures is by examining their convergent validity with established multi-item scales (Allen et al. 2022). Accordingly, we examined how well the new items relate to BPNSFS, which, as the most frequently used scale of need satisfaction, can be treated as the current standard of need satisfaction indicators. To start with, we examined the correlations among the new items themselves and with respective BPNSFS scales (Table 2) and the respective BMPN scale (Table 1S in supplementary file). The new item correlated with respective BPNSFS scale at .810 for autonomy, at .797 for competence, and at .884 for relatedness.

A commonly used approach to convergent validity is to conduct a Confirmatory Factor Analysis (CFA), in which the single-item measure and the items of an established scale are set to load on the same latent factor, and the standardized factor loadings can be interpreted as the extent to which the single-item measure correlates with the corresponding latent construct (Fisher et al., 2016; Matthews et al., 2022). Accordingly, we computed a CFA with the BPNSFS need satisfaction items and the respective new need items to examine how strongly the individual items were related to the existing scale.

For autonomy (χ^2 [df = 5] = 46.0, p < .001, CFI = .966, TLI = .932, RMSEA = .153, SRMR = .029), the standardized loading for the new item was .859, which compared favourably to the standardized loadings of the BPNSFS satisfaction items (vs. .765, .820, .839, *.856*) (the previously identified single item in italics). Note that Kenny et al. (2015) recommend caution when using RMSEA with models that have low degrees of freedom, as small degrees of freedom models are biased to produce high RMSEA values. For competence (χ^2 [df = 5] = 33.9, p < .001, CFI = .978, TLI = .956, RMSEA = .128, SRMR = .025), the standardized loading for the new item was .840, which was in the same range as the standardized loadings of the BPNSFS items

(.*826*, 827, 863, .864). For relatedness (χ^2 [*df* = 5] = 2.7, *p* = .721, CFI = 1.000, TLI = 1.003,

RMSEA = .000, SRMR = .007), the standardized loading for the new item was .932, which was

in the same range as the best item from the BPNSFS satisfaction scale itself (vs. .727, .789, .877,

.939). Accordingly, all standardized loadings were excellent, providing convincing evidence that

the new items are measuring the same construct as the established scale.

Discriminant validity: Separation between needs

Given the relatively high intercorrelations between the three needs in previous research,

one important consideration is that the items are able to separate the three needs from each other

– meaning that the items are not too highly correlated with each other (although no clear-cut

criteria exist, often correlations above .70 are seen to evidence substantial overlap, and

correlations above .85 are considered highly problematic in terms of discriminant validity, see

e.g., Van Mierlo et al., 2009). For this purpose, we examined the intercorrelations between the

one-item measures for each need (Table 2, see Table 2S for intercorrelations of BPNSFS single

items). For reference, the needs scales in balanced need scales correlated at .645 (autonomy-

competence), .687 (autonomy-relatedness), and .668 (competence-relatedness).

As can be seen, the needs correlate relatively highly with each other. In two cases (the

correlations of the new competence item with the new autonomy item and autonomy scale) the

correlation is even slightly above .70, which is sometimes taken as an indication of two

constructs being too closely related to each other – however, in this sample also the BPNSFS

autonomy and competence scales correlated with each other at .73. Thus, the correlations

between the needs using new one-item scales were relatively high but not higher than the

correlations between the three needs using established need scales. Furthermore, the single items

always correlated highest with their respective BPNSFS satisfaction scale rather than the scales

for two other needs, with average correlation between congruent pairs at .830 and at .617

between incongruent pairs. We used cocor package for R (Diedenhofen & Musch, 2015) with

Meng et al.'s (1992) method to test the significance of these differences, finding that in each

case, the difference between the congruent vs. incongruent correlation was statistically

significant (see Table 3S). There was not a big difference between the new items and the single

items from BPNSFS satisfaction scales (see Table 2S for the latter).

Table 2

The correlations among new single items and BPNSFS need satisfaction scales in Study 1 and Study 2

	Auto (new)	Comp (new)	Rela (new)	Auto (scale)	Comp (scale)	Rela (scale)
1. Autonomy (New item)		.707	.561	.810	.676	.602
2. Competence (New item)	.619		.558	.727	.797	.572
3. Relatedness (New item)	.510	.520		.618	.504	.884
4. Autonomy (BPNSFS)	.804	.693	.549		.730	.649
5. Competence (BPNSFS)	.647	.870	.558	.727		.550
6. Relatedness (BPNSFS)	.547	.577	.861	.581	.643	
Note. Correlations for Study 1 above diagonal, correlations for Study 2 below diagonal.						
All correlations significant at the < .01 level. new = new item, scale = BPNSFS scale						

Predictive and concurrent validity: Ability to predict theoretically relevant outcomes

Another key way of validating single-item measures is through examining whether they

predict a theoretical outcome with a similar effect size as an established multi-item scale (Allen

et al., 2022; Fisher et al., 2016). Accordingly, we calculated the correlations between the need

indicators and a number of well-being and ill-being indicators previously shown to be related to

need satisfaction, with the expectation that the new single-item scales would correlate with well-

being and ill-being indicators at roughly the same level as the established need satisfaction scales

(Table 3).

Table 3

Correlations of the various need satisfaction scales with selected variables

	Life sat.	Pos. aff.	Meaning	Vitality	Neg. aff.	Depression	Anxiety
Autonomy (BPNSFS)	.697	.744	.800	.748	-.588	-.749	-.425
Autonomy (BMPN)	.563*	.638*	.665*	.618*	-.635	-.694	-.471
Autonomy (New item)	.713	.716	.788	.740	-.557	-.765	-.421
Autonomy (BPNSFS single item)	.667	.695*	.756	.685*	-.536	-.682*	-.372
Competence (BPNSFS)	.574	.672	.688	.708	-.596	-.689	-.510
Competence (BMPN)	.579	.678	.687	.697	-.641	-.762*	-.554
Competence (New item)	.580	.679	.722	.682	-.570	-.712	-.446
Competence (BPNSFS single item)	.471*	.582*	.577*	.629*	-.545	-.608*	-.508
Relatedness (BPNSFS)	.508	.610	.614	.635	-.501	-.610	-.344
Relatedness (BMPN)	.585	.678	.677	.662	-.651*	-.727*	-.484*
Relatedness (New item)	.486	.585	.581	.600	-.492	-.590	-.349
Relatedness (BPNSFS single item)	.500	.607	.608	.607	-.511	-.611	-.365

Note. All correlations signiifcant at the .01 level (2-tailed).

* = The correlation is significantly different from the BPNSFS based on Steiger's Z test (two-tailed)

A look at the Table 3 reveals that the correlations with various measures of the same needs are mainly in the same range, and the single-item measures don't have notably lower correlations with the outcome variables than the multi-item scales. To test this more formally, we followed others (e.g., Fisher et al., 2016; Jovanović & Lazić, 2020) in performing Steiger's Z tests for the difference between two dependent correlations to test whether the correlations obtained by other scales were significantly different from the correlation obtained by the BPNSFS scale as regards seven selected outcome variables (Meng et al., 1992; Steiger, 1980). For autonomy, the correlation obtained with BPNSFS was significantly different in 4 out of 7 variables for BMPN, in 4 out of 7 variables for the BPNSFS single item but it was not significantly different in any case from the new autonomy item. For competence, the correlation obtained with BPNSFS was significantly different in 1 out of 7 variables for BMPN, in 5 out of 7 variables for the BPNSFS single item but it was not significantly different in any case from the new competence item. For relatedness, the correlation obtained with BPNSFS was significantly

different in 3 out of 7 variables for BMPN but it was not significantly different in any case from the new item or from the BPNSFS single item.

Finally, previous research has demonstrated that all three needs typically will independently predict general measures of well-being when simultaneously entered into a regression analysis (e.g., Martela & Ryan, 2016; Sheldon & Niemiec, 2006). Accordingly, we tested whether the single items would replicate this result. Using life satisfaction as the dependent variable (DV), and regressing autonomy, competence, and relatedness on it using the new single items, the standardized coefficients showed that autonomy (.57, $p < .001$), competence (.12, $p = .03$), and relatedness (.10, $p = .03$) all were significant predictors together explaining more than half the variance in life satisfaction (see Table 4). Of note is that the R^2 was .53, which is very similar to when the same analysis was run with full BPNSFS satisfaction scales as measures of needs ($R^2 = .50$). Replicating the same analysis using positive affect, vitality, meaning in life, negative affect, depression, and anxiety revealed that in all cases (except for relatedness as predictor of anxiety), all three needs were significant positive predictors of well-being indicators and significant negative predictors of ill-being indicators (Table 4). It is worth noting that autonomy demonstrated most predictive power as regards the positive outcomes but the same was true also when we conducted the same analyses with full BPNSFS scales. Thus, the single-item need indicators yielded similar results concerning the independent predictive power of each need on indicators of well-being and on most indicators of ill-being as has been previously found using longer measures – and explained roughly similar amounts of variance on each outcome as corresponding longer scales.

Table 4

Regression results of the various need satisfaction scales with selected variables

Criterion variable		R2	(R2 with full BPNSFS scale)	Standardized coefficients		
				Autonomy	Competence	Relatedness
Life satisfaction	F(3, 348) = 129, p < .001	.53	.50	.57, p < .001	.12, p = .03	.10, p = .03
Positive affect	F(3, 348) = 173, p < .001	.60	.61	.41, p < .001	.28, p < .001	.20, < .001
Vitality	F(3, 348) = 194, p < .001	.63	.64	.45, p < .001	.25, p < .001	.21, < .001
Meaning in life	F(3, 348) = 254, p < .001	.69	.67	.51, p < .001	.29, p < .001	.14, < .001
Negative affect	F(3, 348) = 77, p < .001	.40	.42	-.24, p < .001	-.29, p < .001	-.20, < .001
Depression	F(3, 348) = 227, p < .001	.66	.62	-.46, p < .001	-.29, p < .001	-.17, p < .001
Anxiety	F(3, 348) = 34, p < .001	.23	.27	-.18, p = .01	-.26, p < .001	-.10, p = .08

Test-retest reliability

Test-retest reliability coefficients were calculated for each single-item scale using Pearson's *r,* with two months between the two measures. For the new autonomy item reliability was .78, for the new competence item it was .63, for the new relatedness item it was .67, and for the BPNSFS single item for relatedness it was .67.

Brief Discussion

In general, the present results were encouraging and the performance of the new single-item need indicators were often on par with existing multi-item need satisfaction scales. The single items correlated strongly and loaded strongly in a CFA with their respective BPNSFS satisfaction scales and predicted other variables in patterns similar to their respective BPNSFS scales. These results thus provided good initial support for the ability of the single-item measures to capture the psychological needs for autonomy, competence, and relatedness.

As regards the comparison between the newly generated single items and the single items taken from BPNSFS scale, any differences tended to be small, so no strong case could be made for selecting one over the other. Yet, the new autonomy item and the new competence item seemed to perform slightly better than the BPNSFS items, especially in the Steiger's test,

favouring their selection. For relatedness, both items seemed to perform very well, without any remarkable differences, making a selection based on empirics hard. Accordingly, we decided to do the final selections only after Study 2.

Study 2: Daily well-being and need satisfaction

The aim of the second study was to replicate the main results to gain more confidence in them, while focusing on a shorter time scale in the evaluations. Accordingly, for each need satisfaction and well-being variable, we asked participants about how much they experienced it *today*. This had two purposes: First, we saw that it would be important to validate the items also using this shorter time scale as such questionnaires are regularly utilized in psychological research. Second, based on previous research (Martela & Ryan, 2016), we assumed that the intercorrelations between different variables would be lower, due to there being more variance in people's experiences during a single day, making it easier to examine their separateness and individual contributions. Furthermore, we sampled participants from a different country than in the first study, this time focusing on US participants.

The sample was gathered online through Prolific and in accordance with the recommendations of the University Research Ethics Committee of [blinded for review]. Originally 352 English-speaking participants from the US answered the survey but 17 failed the attention check question, for a final sample of 335. The age range was from 18 to 77, with mean age at 38. Of the participants, 49.9% identified as male, 49.0% as female, and 1.2% as other.

Measures

Need satisfaction. To measure needs using single items, we used the same items as in Study 1. Furthermore, we included the Basic Need Satisfaction and Frustration Scales (BPNSFS;

Chen et al., 2015), which included four items for the satisfaction of each of the three needs (α's:

autonomy = .84, competence = .91, relatedness = .91).

Other scales. In addition to need satisfaction, we included standard scales for *satisfaction*

with life, positive and negative affect, presence of meaning, vitality, and *anxiety.* The scales used

and their reliability are described in the Supplementary document.

Results

Psychometric properties and convergent validity

The means, standard deviations, skewness, and kurtosis of the new individual items are

displayed in Table 4S and their correlations with the established longer scales are displayed in

Table 2. The means of the new items were in the same range as the means for the longer scales.

The new single items correlated with corresponding BPNSFS scale at levels above < .80,

indicating that they are measuring the same underlying construct. To establish this more we

conducted a CFA, in which the single-item measures and the items from the BPNSFS

satisfaction scales were set to load on the same latent factor, to examine how strongly the

individual items were related to the whole scale.

For autonomy (χ^2 [df = 5] = 40.7, p < .001, CFI = .962, TLI = .924, RMSEA = .146,

SRMR = .035), the standardized loading of the new item was .894, which compared favourably

to the standardized loadings of the BPNSFS items (.675, .677, *.817*, .827) (the previously

identified single item in italics). For competence (χ^2 [df = 5] = 9.3, p = .098, CFI = .997, TLI =

.994, RMSEA = .051, SRMR = .011), the standardized loading for the new item was .912,

comparing favourably to the BPNSFS items (.791, .841, .883, *.886*). For relatedness (χ^2 [df = 5]

= 2.9, p = .718, CFI = 1.000, TLI = 1.003, RMSEA = .000, SRMR = .007), the standardized

loading for the new item was .907, comparing favourably to the BPNSFS items (vs. .732, .850,

.887, .890). Accordingly, all the standardized loadings of the new items were excellent with respect to the corresponding longer scale, providing convincing evidence that the new items are tapping into the same construct as the established need satisfaction scales.

Discriminant validity: Separation between needs

To examine discriminant validity and the separateness of each need from each other, we examined the intercorrelations between the one-item measures for each need (see Table 6S in supplementary file). The needs correlated relatively highly with each other (ranging from .50 to .69, similar to how the needs as measured with BPNSFS scale correlated with each other (.73 for autonomy-competence, .58 for autonomy-relatedness, and .64 for competence-relatedness).

Predictive and concurrent validity: Ability to predict theoretically relevant outcomes

To assess predictive validity, we calculated the correlations between the need indicators and varied well-being and ill-being indicators to see how similarly to the established scale the new need indicators predicted these theoretical outcomes (Table 5).

Table 5

The correlations of the various need satisfaction scales with outcome variables in Study 2

	Life satisfaction	Positive affect	Negative affect	Meaning	Vitality	Anxiety
Autonomy (BPNSFS)	.679	.672	-.511	.772	.809	-.352
Autonomy (New item)	.652	.670	-.476	.774	.771	-.280
Autonomy (BPNSFS single item)	.610	.619	-.446	.715	.726*	-.298
Competence (BPNSFS)	.668	.672	-.544	.748	.789	-.376
Competence (New item)	.671	.668	-.541	.723	.747	-.407
Competence (BPNSFS single item)	.610	.635	-.507	.668*	.683*	-.366
Relatedness (BPNSFS)	.615	.593	-.460	.670	.652	-.292
Relatedness (New item)	.553	.521	-.373	.617	.577	-.230
Relatedness (BPNSFS single item)	.549	.515	-.368	.608	.605	-.262
Note. All correlations signiifcant at the .01 level (2-tailed).						
* = The correlation is significantly different from the BPNSFS based on Steiger's Z test (two-tailed)						

As can be seen, the individual items correlated with other variables at very similar levels as their respective BPNSFS satisfaction scales. We again used Steiger's Z test to examine whether the single-item correlations differed significantly from the BPNSFS scale correlations as regards the six outcome variables. For autonomy, the BPNSFS single item was significantly different in 1 out of 6 cases but the new item was not significantly different in any case. For competence, the BPNSFS singe item was significantly different in 2 out of 6 cases, but the new item was not significantly different in any case. For relatedness, there were no significant differences in either of the two single items. This shows that the single items for relatedness, the new single item for competence, and the new single item for autonomy all seem to predict various well-being and ill-being indicators at the same levels as their respective BPNSFS scales.

Brief discussion

This study aimed to replicate the results from Study 1 using briefer time frame, experiences today, and a different population sampled from the US. The various psychometric examinations of this study – means, correlations and CFA loadings with BPNSFS scale, the size of correlation with other variables – showed that in all tested respects the single items performed similarly to the corresponding multi-item scales.

Based on an overall look at the empirical results and the content covered by the item wording, we decided to use the new single-item measures for autonomy and competence, as they appeared to perform slightly better in various tests than the corresponding single items derived from BPNSFS. For relatedness, the empirical differences between the two items were minuscule but the BPNSFS item was shorter and thus arguably easier to grasp, making us to choose that as the best single-item measure for relatedness. Final items are displayed in the appendix.

Study 3

The aim of this third study was to replicate the main results from previous studies and to examine test-retest reliability with a shorter interval (sometimes called dependability analysis, see Chmielewski et al., 2016). Based on recommendations (Terwee et al., 2007; Vilagut, 2014) and the availability of relevant comparisons (Krueger & Schkade, 2008; Matthews et al., 2022), we chose a two-week interval as that was seen to strike a good balance between not being too short to be subject to recollection bias but not too long such that substantial changes in well-being would have occurred. Furthermore, in Supplementary document we describe a comparison with two scales that have been used in international comparisons: The items from European Social Survey Personal and Social Wellbeing module (ESS, 2016; Huppert et al., 2009) and the items from Global Flourishing Survey (Gallup, 2021).

The sample was gathered online through Prolific in accordance with recommendations of the University Research Ethics Committee of [blinded for review]. 350 English-speaking participants from the UK answered the survey but 23 failed the attention check question, for a final sample of 327. The age range was from 18 to 82, with mean age at 41. Of participants, 48.9% identified as male, 50.5% as female, and 0.6% as other. Two weeks later we invited all participants to answer a brief follow-up questionnaire through Prolific and obtained responses from 275 (84% response rate). There were no significant demographic differences between those answering at T1 and T2.

Measures

Single-item need scales. To measure needs using single items, we used the new single items for autonomy and competence and the BPNSFS single item for relatedness.

Other scales. We used the same scales as in Study 1 to assess *autonomy* (α = .88), *competence* (α = .91), *relatedness* (α = .89), *satisfaction with life* (α = .92), *positive affect* (α = .94), *negative affect*, (α = .89), *presence of meaning* (α = .93), *vitality* (α = .92), and *depression* (α = .94).

Results

Psychometric properties, convergent validity, and predictive and concurrent validity

The means, standard deviations, skewness, and kurtosis of the various scales are displayed in Table 7S in supplementary file. The means for individual items were in the same range as those for longer scales. The single items correlated highly with their respective BPNSFS scale, over .75 for all three single items (see Table 8S in supplementary file). Next, we calculated the correlations between the need indicators and both well-being and ill-being indicators (Table 9S). Steiger's Z test for the difference between two dependent correlations showed that for autonomy, the single item was significantly different in 1/6 cases. For competence and relatedness, the single item was not significantly different in any cases.

Test-retest reliability

Test-retest reliability coefficients were calculated for each new single-item scale. For the autonomy item it was .73, for the competence item it was .71, and for the relatedness item from BPNSFS it was .70. These were slightly higher than the test-retest reliabilities over two months (as expected) and compare favorably to single life satisfaction items (Krueger & Schkade, 2008) and other single-item measures (Matthews et al., 2022) examined over two weeks.

Brief discussion

The present study demonstrated that the single items had good test-retest reliability, while replicating the results from previous studies by demonstrating that once again they were closely

connected with their respective BPNSFS satisfaction scale (as well as ESS and GFS scales, see supplementary analysis), and correlated at virtually identical levels as respective BPNSFS scales with well-being indicators.

Discussion

The increased use of large panel surveys and intensive longitudinal designs means that "now more than ever, it is essential to ensure that single-item measures are valid and reliable" (Allen et al., 2022, p. 1). Answering this call, in the present article we aimed to develop and psychometrically test single-item measures for the basic psychological needs for autonomy, competence, and relatedness. Together, the results from both studies were highly encouraging, demonstrating that single-item need measures performed surprisingly well. Study 1 asked about need satisfaction in general in a sample from the UK, Study 2 asked about need satisfaction today in a sample from United States. In both studies, the means of the single-item scales were similar to the corresponding longer BPNSFS satisfaction scales, the single items correlated very highly with the corresponding longer scales, and their standardized loadings in a CFA with the longer scale were excellent, thus being very closely aligned with the corresponding longer scales. Furthermore, Study 1 had seven well-being related variables, Study 2 had six such variables. As regards virtually all of these variables, the correlations of the single items and the correlations of the longer scales were highly similar, with their difference not being statistically significant in any case. Study 3 compared the new single items with the scales used in European Social Survey and Global Flourishing Study, finding that the single items performed on an equal level with these scales, and even slightly better on most accounts than the GFS autonomy and competence items. Studies 1 and 3 also examined test-retest reliability, finding it to be fair over 2 months and good over 2 weeks, supporting the expected patterns of reliability. These results thus yield

encouraging support for the notion that these single-item measures can be used to measure psychological needs in various contexts and across varied time spans.

Theoretically, the success of the single-item scales provides evidence for the unidimensionality of the needs for autonomy, competence, and relatedness. Researchers have emphasized that "when a construct is unambiguous or narrow in scope, the use of single items can be appropriate" (Allen et al., 2022, p. 1). The present results suggest that autonomy, competence, and relatedness join the list of constructs, such as life satisfaction, job satisfaction, and self-rated health, that are unambiguous and clear enough to be reliably measured with a single item. As with these other constructs, this does not suggest that more complex and faceted versions of these constructs cannot be developed, but rather that there is a core meaning to each basic need satisfaction that can be substantially captured in a single item. Additionally, the fact that the results were in many respects indistinguishable from the results obtained by longer scales can also help in "normalizing the use of single-item measures within scholarly programs of research" (Matthews et al., 2022, p. 670) – but only in cases in which the constructs are unambiguous and efforts have been made to validate the chosen single items.

These results are not without limitations. First, the single items were only tested in two English-speaking Western countries, US and UK. Given increased interest in cross-cultural comparisons of need satisfaction (e.g., Chen et al., 2015; Martela et al., 2023), much work remains to be done to examine how well the proposed items translate to various languages, how well they can be utilized in such cross-cultural comparisons, and how well the present results generalize to other cultures. As regards other limitations, it must be noted that in many comparisons, BPNSFS satisfaction subscales were used as the standard against which the performances of the single items were measured. It is good to remember that, although

commonly used and widely validated (Ryan et al., 2023) it also is just one scale and not flawless.
"True" need satisfaction is an abstract hypothetical construct, which any given scale attempts to
validly estimate, and thus there is no single objective gold standard. Furthermore, scale
validation is an ongoing process in which one never fully validates a scale but rather
progressively provides more evidence of its functionality (Robins et al., 2001) and thus future
work is needed to test the scale in various context, populations, and research settings, such as
experimental research.

Nevertheless, the present results provide substantial evidence for the reliability and
validity of these proposed single-item measures of basic psychological need satisfaction,
demonstrating that they seem to measure need satisfaction as well as well-established longer
scales. While we still recommend the usage of longer scales when space permits, as they make
possible analytic procedures like constructing latent variables and estimating internal reliability
and standard errors, while making the scale less vulnerable to random measurement error, we see
that the present one-item scales provide a good and reliable way of measuring the satisfaction of
psychological needs for autonomy, competence, and relatedness when space it at premium in a
survey. The possibility to cover basic psychological need satisfaction with only three items
makes possible more comprehensive and holistic assessment of well-being in context where
longer scales would not be feasible. Thus, we encourage their future use in policy context and
other surveys, in which there is space for only one item per construct.

Open Science Statement

Design and analysis transparency: For all three studies, we aimed for a sample size
above 300, to allow for relatively stable correlations. We report all data exclusions, which all

were based on incorrect answer to the inattention check question, which was a criteria we established prior to any data analysis. We report all measures in the study, and all analyses including all tested models in either the main document or in the supplementary document. If we use inferential tests, we report exact p values.

Preregistration: The studies were not preregistered.

Data Accessibility Statement:

The study materials and data for all three studies have been made publicly available at the OSF and can be accessed at: https://osf.io/cq85e/

The analyses were fairly standard and thus a separate code book has not been produced.

Open Data: We confirm that there is sufficient information for an independent researcher to reproduce all of the reported results, including codebook if relevant.

Open Materials: We confirm that there is sufficient information for an independent researcher to reproduce all of the reported methodology.

Appendix: Single-item measures for autonomy, competence, and relatedness

Please read the following items carefully. Using the response scale below, indicate the extent to which you agree or disagree with that statement.

- 'I am able to do things that I really want and value in life.'
- 'I can do things well and achieve my goals.'
- I feel close and connected with other people who are important to me

Response scale: 1 (Very strongly disagree), 2 (Strongly disagree, 3: Disagree, 4: Neither disagree nor agree, 5: Agree, 6: Strongly agree, 7: Very strongly agree

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