DEVELOPMENT AND VALIDATION OF A BRIEF MEASURE OF THE THREE PSYCHOLOGICAL NEEDS UNDERLYING INTRINSIC MOTIVATION: THE AFS SCALES

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According to self-determination theory, intrinsic motivation arises from three psychological needs: self-determination, competence, and relatedness. In the present article, the authors describe the development of a brief, reliable, valid, and easy-to-administer measure of each of these psychological needs. (A fourth scale to measure tension is included.) Normative data, coefficient alphas, and evidence for factorial and external validity for each of the Activity-Feeling States (AFS) scales are provided. Further, predictive utility for the AFS scales is demonstrated by showing that each scale predicts both self-report and behavioral measures of intrinsic motivation.

According to Deci and Ryan's (1985b) widely researched self-determination theory, intrinsic motivation arises from three innate psychological needs: self-determination, competence, and relatedness. Self-determination, the need to experience choice in the initiation and regulation of one's behavior, reflects the desire to have one's choices rather than environmental rewards and pressures determine one's actions. Competence, the need to be effective in one's environmental transactions, reflects the desire to exercise one's capacities and skills and, in doing so, seek out and master optimal challenges.

Relatedness, the need to establish close emotional bonds and attachments between persons, reflects the desire to be emotionally connected to and interpersonally involved with significant others in warm relationships. Empirical studies confirm that each of these three psychological needs underlies intrinsic motivation by showing that whenever events affect the individual's experience of self-determination, competence, or relatedness, systematic changes in intrinsic motivational outcomes occur (e.g., for self-determination, see Deci & Ryan, 1987; for competence, see Vallerand & Reid, 1984; for relatedness, see Grolnick, Ryan, & Deci, 1991).

Surprisingly, few scales exist that quantify these three psychological needs. Deci and Ryan (1985a) designed a measure for autonomy; Harter (1982) developed a measure for competence (for children); and Wellborn and Connell (1987) constructed a measure for perceived relatedness to peers (for children). Unlike the focus of the present investigation, these measures all assess psychological needs as traitlike dispositional characteristics of the person. The concern of this article, however, centers on constructing a measure that is sensitive to the extent to which environmental events nurture versus frustrate each need over a relatively short period of time. From the authors' point of view, the extent to which a person experiences a psychological need at any given time depends not only on person factors but on environmental factors as well (e.g., situational circumstances such as a deadline that undermines self-determination or praise that nurtures competence). That being the case, the present article conceptualized the experience of a psychological need as a relatively ephemeral one and undertook the task of developing and validating an instrument to assess self-determination, competence, and relatedness as transitory, statelike experiences.

Development of the Activity-Feeling States (AFS) Scales

Much of the authors' previous research has examined how situational variables affect experiences of self-determination, competence, and relatedness (e.g., Reeve, Olson, & Cole, 1987). Throughout this research, questionnaires were used that featured a broad and representative sample of words descriptive of these three experiences. Once those descriptors that best represented each experience were identified, the program of research sought to measure each psychological need as economically and nonintrusively as possible. Through efforts to develop brief scales, unidimensional measurement was made a top priority. Therefore, structural equation modeling techniques such as LISREL (e.g., Jöreskog & Sörbom, 1989) were employed. In structural equation modeling, each latent construct (e.g., teaching effectiveness) is represented by a set of indicators (e.g., student evaluations, teaching awards won). Using fewer than three indicators for a latent variable tends to produce problems with improper solutions, such as a failure to converge or negative error variance estimates (Bollen, 1989), whereas using

additional indicators tends to produce multiple, rather than single, latent factors (e.g., as the number of indicators increases, so does the likelihood that multiple latent factors will emerge) (Judd, Jessor, & Donovan, 1986). For these reasons, each Activity-Feeling State (AFS) scale features only three or four items (i.e., indicators).

In addition to the scales for self-determination, competence, and relatedness, a fourth scale for tension was added. Although tension is not a psychological need, it was considered to be relevant because tension serves as an emotional marker of internal motivations that are antagonistic to intrinsic motivation (Ryan, Koestner, & Deci, 1991). In laboratory studies, tension correlates negatively with intrinsic motivation but positively with anxiety-related internal motivations, such as ego-involvement, frustration, and the Zeigarnik effect (see Ryan et al., 1991).

Based on these earlier findings, a 13-item measure was developed (AFS scales) made up of separate 3- or 4-item scales to assess self-determination, competence, relatedness, and tension. The name and individual items for each scale are as follows:

1. Self-Determination—free, offered choice what to do, I want to do this, and my participation is voluntary;
2. Competence—capable, competent, and achieving;
3. Relatedness—involved with friends, part of a team, and brotherly/sisterly; and
4. Tension—pressured, stressed, and uptight.

The AFS scales use the response stem, "Activity X makes me feel" (e.g., "Solving SOMA puzzles makes me feel"), with a 1-7 response scale (*strongly disagree* through *strongly agree*) for each of the 13 items. Totals for each scale are computed by averaging the relevant 3 or 4 items.

Reliability and Validity of the AFS Scales

Participants, Activities, and Normative Data

Table 1 shows the means and standard deviations for each AFS scale across five samples of undergraduate students engaged in experimental tasks frequently used in the intrinsic motivation literature. Each participant in the five samples was tested individually, and following a performance phase with the experimental task, completed the AFS scales and a self-report measure of intrinsic motivation. Further, each experimental session (except the anagrams) included having the subject participate in a postexperimental, free-choice session, in which he or she was given the opportunity to reengage or not reengage in the target activity (to assess the traditional behavioral measure of intrinsic motivation) (Deci, 1972).

Table 1
Means, Standard Deviations, and Coefficient Alphas for Each AFS Scale Across Five Samples

Experimental task	Self-Determination			Competence			Relatedness			Tension		
	M	SD	α	M	SD	α	M	SD	α	M	SD	α
SOMA												
Sample 1 (N = 162)	4.60	1.18	.61	3.97	1.40	.88	1.73	1.02	.74	3.54	1.57	.85
Sample 2 (N = 60)	4.65	.97	.60	4.38	1.48	.89	1.98	1.21	.82	3.91	1.71	.88
Happy Cubes												
Sample 1 (N = 120)	4.51	1.00	.53	5.01	1.33	.93	2.22	1.20	.83	3.39	1.47	.82
Sample 2 (N = 104)	4.81	1.15	.69	4.61	1.22	.90	2.44	1.13	.63	3.65	1.60	.94
Anagrams												
Sample 1 (N = 74)	3.78	1.20	.62	4.73	1.42	.89	2.74	1.33	.73	4.55	1.62	.88

Note. Possible range for each scale mean is 1 to 7.

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The three experimental tasks were SOMA, Happy Cubes, and anagrams. SOMA, a spatial relations puzzle, has seven separate pieces that interlock to build complex solution shapes. For the 162 SOMA solvers, each participant worked individually on a single solution for 10 minutes. For the 60 SOMA solvers, each participant solved a series of four solutions ($M = 18.5$ minutes; $SD = 6.4$). Happy Cubes, another spatial relations puzzle, features eight hinged metallic blocks that manipulate into complex solution shapes. For the 120 Happy Cubes solvers, each participant solved a series of six solutions for 22 minutes. For the 104 Happy Cubes solvers, each participant solved a series of five solutions ($M = 18.0$ minutes, $SD = 3.3$). Anagrams are familiar words that have their letters rearranged to test whether or not a person can decipher the hidden word (e.g., oorlf = floor). For the 74 anagram solvers, each participant solved a booklet of 25 moderately difficult five-letter arrangements ($M = 13.6$ minutes; $SD = 7.6$).

Reliability

To estimate the internal consistency of each scale, Cronbach's alpha coefficients were computed for each sample and are displayed in Table 1. Across these studies, the mean and range (shown below in parentheses) of the coefficient alphas were as follows: Self-Determination, .61 (.53 to .69); Competence, .90 (.88 to .93); Relatedness, .75 (.63 to .83); and Tension, .87 (.82 to .94). The obtained estimates of internal consistency reliabilities for the Competence, Relatedness, and Tension scales were considered to be acceptable, although the reliability for the Self-Determination scale was low. The relatively low coefficient alpha for the Self-Determination scale may reflect the underlying multidimensionality of the construct itself (including a sense of choice and an internal perceived locus of causality, as well as the experiences of freedom, personal volition, and voluntarism versus coercion).

Factorial Validity

Intercorrelations among the scales. In addition to substantiating that each scale measures only a single underlying construct, a second concern was whether the AFS scales assess four distinct constructs. As a preliminary step toward addressing this question, mean interscale correlations were computed across the five samples listed in Table 1. These correlations are important because the extent to which the scales are highly intercorrelated argues against interscale discriminant validity. The mean interscale correlations were modest, except for the high correlation between Self-Determination and Competence. The matrix of mean interscale correlations for the four AFS scales was as follows: Self-Determination with Competence ($r = .44$); Self-Determination with Relatedness ($r = .18$); Self-Determination with Tension

($r = -.19$); Competence with Relatedness ($r = .19$); Competence with Tension ($r = -.15$); and Relatedness with Tension ($r = .01$).

Factor analyses. Exploratory factor analyses on the 13 items of the AFS scales in each of the five data sets (from Table 1) revealed a four-factor solution (based on eigenvalues > 1). In each factor analysis, oblique rotation was used (because the scales have modest intercorrelations), and all items with factor loadings ≥ .30 were plotted. Without exception, each item loaded highly and uniquely on its representative factor.

A more powerful technique of testing factorial validity involves confirmatory factor analysis (CFA). CFA tests the adequacy of the proposed four-factor measurement model by generating maximum likelihood parameter estimates and an overall χ^2 value using LISREL VII (linear structural relations; Jöreskog & Sörbom, 1989) analyses. To assess whether the overall fit was good enough to support the four-factor model, the goodness-of-fit index (GFI) generated by LISREL was used. The GFI has a possible range from 0 to 1, and although there is not universal agreement on what constitutes a "good" fit, a value of .90 or greater for the GFI is considered acceptable (Marsh, Balla, & McDonald, 1988).

Two CFAs were conducted using the two largest sample sizes (i.e., the 162 SOMA solvers and the 120 Happy Cubes solvers). In each CFA, individual items were constrained to load only on the factor that they were designed to measure. The results of the CFA for the sample of SOMA solvers indicated that the hypothesized factor structure fit the data well (GFI = .90), although the model did not reach statistical nonsignificance, $\chi^2 = 128.1$, $df = 59$, $p <$ .001. The results of the CFA for the sample of Happy Cubes solvers also indicated that the hypothesized factor structure fit the data well (GFI = .90), although again, the model did not reach statistical nonsignificance, $\chi^2 = 94.1$, $df = 59$, $p < .01$. Inspection of the maximum likelihood parameter estimates generated for each CFA showed that, except for the parameter linking "my participation is voluntary" with the Self-Determination latent factor in the second sample, all individual parameter estimates (between each item and its corresponding latent factor) were large and statistically significant, $p < .001$.

Predictive Validity

One purpose of the AFS scales is predictive utility in empirical studies of intrinsic motivation. The research reported in this section summarizes the efforts to use each scale to predict outcome measures of intrinsic motivation, using both self-report and behavioral measures. The self-report measure typically contains items asking how interesting and enjoyable the target activity is perceived to be. The behavioral measure involves the surreptitious assessment of the individual's playing time with the target activity during a

postexperimental session in which he or she has the free choice to reengage or not reengage in the activity.

Table 2 shows the correlation coefficients between each AFS scale and the self-report and behavioral measures of intrinsic motivation. Overall, the correlations between the Self-Determination, Competence, and Relatedness scales show strong relationships with both the self-report (13 of 15 correlations are significant) and behavioral (9 of 12 correlations are significant) measures. The correlations between the Tension scale and the measures of intrinsic motivation are less consistent (self-report measure) or nonexistent (behavioral measure).

The utility of the AFS scales depends not only on the extent to which each scale correlates with intrinsic motivational outcomes, but further, on the extent to which each scale makes a unique, independent contribution to predicting intrinsic motivational outcomes. To estimate each scale's unique predictive power, partial correlations were computed between each scale and a composite measure of intrinsic motivation. For this composite measure, scores for the self-report and behavioral measures of intrinsic motivation were standardized and then averaged together. In computing the partial correlations, the extent to which each scale uniquely predicted intrinsic motivational outcomes was tested after the variance attributable to the other two scales was first removed. Table 2 shows these partial correlations (for Self-Determination, Competence, and Relatedness) across the five samples. Of the 15 possible partial correlations, 10 were significant, which largely confirms that the individual scales do explain unique variance in intrinsic motivational outcomes.

External Validity

Correlations with measures of choice, perceived performance, peer relatedness, and ego involvement. To show each scale's external validity, the correlations were examined between each AFS scale and measures of related constructs. For the sample of 162 SOMA solvers, scores on the AFS Self-Determination scale were correlated with scores on Ryan's Perceived Choice scale (from the Intrinsic Motivation Inventory) and a four-item measure of internal perceived locus of causality (IPLOC; e.g., "I was pursuing my own goals"). The AFS Self-Determination scale correlated significantly with both measures: perceived choice, $r(162) = .41$, $p < .01$; IPLOC, $r(162) = .57$, $p < .01$.

For the AFS Competence scale, each of the four data sets involving puzzle solving included Olson's (1985) measure of perceived performance on a postexperimental questionnaire ("Overall, would you say your performance was a success, a failure, or something in between?"). The correlation between the AFS Competence scale and the measure of perceived performance

Table 2
Zero-Order and Partial Correlations Between Each AFS Scale and Outcome Measures of Intrinsic Motivation

Experimental task	Self-Determination			Competence			Relatedness			Tension	
	SRIM	BIM	pr	SRIM	BIM	pr	SRIM	BIM	pr	SRIM	BIM
SOMA											
Sample 1 ($N = 162$)	.62**	.34**	.38**	.61**	.27**	.25**	.07	.21**	.14	-.16*	.09
Sample 2 ($N = 60$)	.63**	.41**	.51**	.43**	.18	.06	.26*	.15	.13	-.43**	-.14
Happy Cubes											
Sample 1 ($N = 120$)	.61**	.20*	.33**	.66**	.20*	.38**	.25**	.29**	.20*	.09	-.04
Sample 2 ($N = 104$)	.40**	.07	.19	.41**	.26**	.32*	.32**	.34**	.33*	-.33**	-.09
Anagrams											
Sample 1 ($N = 74$)	.58**	n/a	.35**	.69**	n/a	.56**	.23	n/a	-.09	-.22	n/a

Note. SRIM = self-report measure of intrinsic motivation; BIM = behavioral measure of intrinsic motivation; pr = partial correlation coefficient with composite measure of intrinsic motivation.
*$p < .05$; **$p < .01$.

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consistently approximated a value of .60: $r(162) = .68, p < .01$; $r(60) = .61$, $p < .01$; $r(120) = .60, p < .01$; and $r(104) = .53, p < .01$.

For the AFS Relatedness scale, one data set included both it and Wellborn and Connell's (1987) Peer Relatedness scale. The Peer Relatedness measure asks how relaxed, ignored, happy, mad, bored, and important the respondent feels when he or she is with classmates. The AFS Relatedness scale correlated moderately with this Peer Relatedness scale, $r(38) = .48, p < .01$.

For the AFS Tension scale, Ryan's Perceived Tension scale (from the Intrinsic Motivation Inventory) and a three-item measure of ego-involvement (e.g., "I felt pressured to prove my competence") were included for the sample of 162 SOMA solvers. For the sample of 120 Happy Cubes puzzle solvers, a measure of perceived stress was included. The AFS Tension scale correlated significantly with each measure: perceived tension, $r(162) = .69$, $p < .01$; ego involvement, $r(162) = .50, p < .01$; and felt stress, $r(120) = .65$, $p < .01$.

Conclusion

The AFS scales, administered as a brief and easy-to-administer instrument, were designed to quantify the psychological needs of self-determination, competence, and relatedness as relatively ephemeral experiences that are sometimes nurtured by, and other times frustrated by, environmental events. Psychometrically, the individual scales are internally consistent, largely uncorrelated, show high factorial validity, and correlate as expected with measures of related constructs. The utility of the AFS scales is demonstrated by showing that each scale predicts intrinsic motivational outcomes. Thus the AFS scales are offered as an efficient, nonintrusive, reliable, and valid measure of the three psychological needs that give rise to intrinsic motivation: self-determination, competence, and relatedness.

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