DEVELOPMENT AND VALIDATION OF AN INTERNATIONALLY RELIABLE SHORT-FORM OF THE POSITIVE AND NEGATIVE AFFECT SCHEDULE (PANAS)

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This article reports the development and validation of a 10-item international Positive and Negative Affect Schedule (PANAS) Short Form (I-PANAS-SF) in English. A qualitative study (N = 18) and then an exploratory quantitative study (N = 407), each using informants from a range of cultural backgrounds, were used to identify systematically which 10 of the original 20 PANAS items to retain or remove. A same-sample retest study (N = 163) was used in an initial examination of the new 10-item international PANAS's psychometric properties and to assess its correlation with the full, 20-item, original PANAS. In a series of further validation studies (N = 1,789), the cross-sample stability, internal reliability, temporal stability, cross-cultural factorial invariance, and convergent and criterion-related validities of the I-PANAS-SF were examined and found to be psychometrically acceptable.

Keywords: positive affect; negative affect; PANAS; international; cross-cultural; psychometric; scale development; scale validation

Trait affect has long been a key personality construct in applied psychology (Bradburn, 1969; Zajonc, 1980) and is a variable of growing interest in cross-cultural research (Diener, Oishi, & Lucas, 2003). The positive and negative dimensions of trait affect delineated by several scholars (Diener & Emmons, 1984; Watson & Tellegan, 1985) have formed dependent, independent, or control variables in numerous studies within and across diverse cultural settings in several disciplines outside of psychology, from business (Staw & Barsade, 1993) to politics (Levin & Sidanius, 1999). Advancing cross-cultural research on affect requires internationally valid, reliable, factorially stable, and directly comparable measures (Bontempo, 1993). However, cross-cultural research involving trait affect has been limited in regard to valid measures because of two problems. First, the diversity and uneven reliability of measurement scales used has compromised meaningful comparison of much existing research. Second, although psychometrically sound measures of affect exist, notably Watson, Clark, and Tellegen's (1988) Positive and Negative Affect Schedule (PANAS), there are very few well-validated and reliable translations from their original English.

One viable solution in some circumstances to both these problems is, simply, to use original English versions of affect measures, something that is becoming increasingly feasible as larger numbers of people in many countries and in specific populations of research interest become fluent in English. Indeed, this is an expedient that Egloff (1998) appears to have taken in a study of German university students that uses the PANAS. Moreover, it

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is an expedient that is greatly attractive in certain cross-cultural research settings where multiple national and cultural backgrounds can be anticipated and are of specific interest but cannot necessarily be precisely known in advance. For example, research populations in many international firms and governmental bodies often comprise individuals from several countries who, nevertheless, operate organizationally in English. Moreover, university student samples, the mainstay of much cross-cultural psychology research, increasingly comprise students from diverse national backgrounds who nevertheless study in English.

The measure of affect that suggests itself most plausibly as being a useful English cross-cultural metric is the PANAS (Watson et al., 1988), which has been exceptionally well validated and cited in more than 2,000 scholarly papers. However, the full 20-item PANAS has two drawbacks for many cross-cultural settings. First, its emic development in the United States means that it contains some words that either are colloquial to North America or are ambiguous in "international" English, as demonstrated in validation studies (Crawford & Hendry, 2004). Second, although relatively short, the PANAS is still quite long for studies involving numerous other variables or for use with time-constrained populations, such as people in work environments or senior government and business executives, where respondent fatigue and disaffection through lengthy survey instruments need to be avoided. The necessity for a brief measure of affect has been addressed by the development of a truncated form of the PANAS by Kercher (1992). However, this 10-item schedule has been criticized for not encompassing adequately the affect domains of the full PANAS and for including several redundant items that spuriously inflate subscale reliabilities (Mackinnon et al., 1999).

This article seeks to address these problems by developing an international-English short form of the PANAS (a) that is suitable for use with competent but not necessarily native-English speakers and (b) that encompasses as fully and nonredundantly as possible the content domain of the original PANAS while simultaneously minimizing problems of item vagueness and ambiguity.

CONCEPTIONS AND MEASUREMENT OF POSITIVE AND NEGATIVE AFFECT

The cross-cultural universality of an affect structure that broadly divides into negative affect (NA) and positive affect (PA) has been generally established (Almagor & Ben-Porath, 1989). For example, the NA and PA dimensions of Russell's (1980) circumplex model of affect are consistently found to replicate across cultures even when its arousal dimensions have not always emerged clearly (Russell, 1983; Russell, Lewicka, & Niit, 1989). However, comparative cross-cultural research specifically on positive and negative elements of affect has been constrained by the use of differing conceptions of how each affect dimension interrelates and by diverse and nonequivalent measures.

One conception of NA and PA accords with circumplex models in regarding each dimension as opposite poles on a continuum. An early metric of affect incorporating this bipolar conception is Nowlis's (1965) Mood Adjective Checklist (MACL), which contains 36 items that have been used to measure PA and NA as a semantic differential continuum. However, the MACL is off-puttingly long and has been shown to lack internal reliability (Watson, 1988). Bradburn's (1969) much shorter 10-item Affect Balance Scale (ABS) measures affect as a net balance of bipolar NA and PA and has been translated for cross-cultural research purposes into a handful of languages, namely Mexican Spanish (Tran &

Williams, 1994), Cantonese, Vietnamese, and Laotian (Devins, Beiser, Dion, Pelletier, & Edwards, 1997). However, the usefulness of the ABS is limited because it suffers low internal reliability and poor convergent validity with other affect measures (Watson, 1988), and, importantly, has been shown to lack cross-national validity in a 38-nation study (MacIntosh, 1998). Moreover, the ABS has repeatedly been found to reveal two relatively unrelated PA and NA dimensions rather than the single affect construct it was designed to measure (van Schuur & Kruijtbosch, 1995).

Observed empirical unrelatedness of PA and NA measures has lent support to a different affect theory that conceptualizes it as constituting relatively discrete and uncorrelated positive and negative dimensions. Whether or not PA and NA are in fact orthogonal or correlated dimensions has been, and remains, a controversial issue (Feldman Barrett & Russell, 1998; Schmukle, Egloff & Burns, 2002). Diener and Emmons (1984) find that trait affect conforms to a discrete components structure more than does state affect, with this latter appearing to exhibit more of a bipolar structure, although Watson (1988) finds little support for these differences. Warr, Barter, and Brownbridge (1983) find that response format and items used to measure affect appear to influence the relationship between PA and NA, for which Watson (1988) finds some support. Watson et al. (1988) are of the view that PA and NA are broadly independent dimensions of affect and deliberately set out to develop the PANAS as not just as a reliable and brief schedule of affect but as an optimally "pure" means of measuring maximally orthogonal PA and NA dimensions (p. 1064). Although they derive measures exhibiting only "quasi-independence" (p. 1066), the conceptual basis of the PANAS as a measure of mostly discrete and lowly correlating rather than related PA and NA dimensions has met with huge application by researchers and substantial empirical support (DePaoli & Sweeney, 2000; Melvin & Molloy, 2000).

Cross-cultural research on PA and NA has been assisted to some extent by the translation of the PANAS into a limited number of European languages, including Catalan (Fullana, Caseras, & Torrubia, 2003), Dutch (Hill, van Boxtel, Ponds, Houx, & Jolles, 2005), German (Krohne, Egloff, Kohlmann, & Tousch, 1996) Italian (Terracciano, McCrae, & Costa, 2003), Russian (Balatsky & Diener, 1993), and Spanish (Joiner, Sandín, Chorot, Lostao, & Marquina, 1997; Robles & Paez, 2003). However, comparative research involving other cultural settings has been constrained by a lack of validated translations of the PANAS into other languages.

In the absence of such translations, researchers have developed non-English scales of PA and NA in ways that make them not directly comparable with the PANAS. Hamid and Cheng (1996), for instance, used an emic word-generation procedure rather than etic translations from English to generate a Cantonese measure of PA and NA, whereas Yik and Russell (2003) took a more etic approach based on several English affect measures (Feldman Barrett & Russell, 1998; Larsen & Diener, 1992; Watson & Tellegen, 1985) to develop another Cantonese PA and NA measure. In Japan, combinations of other mood scales have been used to develop new Japanese-language measures of PA and NA that are, again, not comparable directly with the PANAS or other affect measures (Ogawa, Monchi, Kikuya, & Suzuki, 2000; Yasuda, Lubin, Kim, & van Whitlock, 2003). For Mexico, Rodriguez and Church (2003) used lexicological procedures to develop new emic Mexican Spanish PA and NA scales.

The use and development of a diverse range of affect measures will, of course, continue to be necessary to advance research in some settings. Certainly, the diverse studies cited above have been useful in confirming that PA and NA appear to constitute universal

dimensions of trait affect. Now that such studies have largely established the ubiquity of affect's positive and negative structure, the use of consistent metrics henceforth would help facilitate cross-cultural research that directly builds on the huge wealth of existing affect studies. Most particularly, given its deliberate aim of maximally assessing orthogonal conceptions of PA and NA constructs and its frequent use in many existing research applications, the development of a short, valid, reliable, and internationally useable English version of the PANAS would greatly facilitate research where cross-cultural comparisons and effects are being investigated and for which adequate and comparable native-language measures either do not exist or would be infeasible to administer.

SHORTCOMINGS OF THE PANAS AND ITS SHORT FORM

THE ORIGINAL PANAS

Watson et al. (1988) developed the PANAS using items from the PA and NA descriptor word clusters detailed by Zevon and Tellegen (1982). The 20-item PANAS with its 10-item PA and NA subscales has been validated in several settings inside and outside of the United States, where it was developed, and has generally been shown to be reliable and consistently reflective of the lowly, albeit significantly, correlating dimensions of PA and NA (DePaoli & Sweeney, 2000; Melvin & Molloy, 2000). However, validation studies using structural equation modeling (Crawford & Hendry, 2004; Crocker, 1997) have found that best-fitting models are achieved by specifying correlations between error in items that come from the same word clusters that formed the item pool from which the PANAS was originally derived (see Zevon & Tellegen, 1982, for descriptors in word clusters). Such item covariances suggest considerable redundancy of the PANAS items closely related to each other in meaning. Unsurprisingly, therefore, Crawford and Hendry's (2004) analyses show clearly that the 10 items composing the NA scale form into five significantly covarying item pairs: *distressed* and *upset*, *guilty* and *ashamed*, *scared* and *afraid*, *nervous* and *jittery*, and *hostile* and *irritable*. They also show that the 10 items of the PA scale form into four groups whose constituent items respectively share variance. Two of these groups contain three covarying items each: *interested*, *alert* and *attentive*, and *excited*, *enthusiastic*, and *inspired*. Two 2-item groups are formed by *proud* and *determined* and by *strong* and *active*. The covariances between the PANAS items revealed by Crawford and Hendry suggest scope for item reduction without seriously attenuating the content domain of the PA and NA scales of the PANAS.

PANAS SHORT FORM

The only reduced form of the PANAS found in the literature is a 10-item version with 5-item PA and NA subscales (Kercher, 1992). Kercher (1992) did not use structural modeling of covariance as a guide to item elimination but used instead the highest loading items in the exploratory factor analyses reported by Watson et al. (1988). In consequence, Kercher's short form of the PANAS necessarily incorporates items that, as Mackinnon et al. (1999) have shown, exhibit a high level of covariance and so, therefore, undesirably diminish content validity while inflating reliability.

Specifically, Kercher's short form PA subscale incorporates three substantially intercorrelated items from one of the Zevon and Tellegen (1982) word clusters used to build the PANAS, *excited*, *enthusiastic*, and *inspired*, plus the items *alert* and *determined*. Her NA

subscale incorporates two pairs of highly correlated items, *distressed* and *upset*, and *scared* and *afraid*, plus *nervous*. Confirmatory analyses performed on Kercher's PANAS short form by Mackinnon et al. (1999) reveal predictable covariances between items with closely similar meanings. Indeed, Kercher (1992) herself highlights the strong covariance between *scared* and *afraid* in postdevelopment confirmatory analyses she performed on her short form. Such item redundancy necessarily results in suboptimal content domain coverage, as noted by Mackinnon et al. (1999).

The full PANAS and Kercher's short form also suffer from items with ambiguous or unclear meanings to both native and nonnative English speakers. One PANAS item, *jittery*, is classified as colloquial in most dictionaries and might be predicted to be little known by nonnative English speakers. Moreover, Mackinnon et al. (1999) found that for an Australian sample the item *excited* in the short form significantly correlates with both PA and NA, suggesting that the word has dual meaning, at least in Australia.

RESEARCH OBJECTIVES AND METHOD

Research was designed to develop from the full 20-item PANAS an internationally useable 10-item version. Following the guidelines for valid, reliable, and equivalent short form development suggested by Stanton, Sinar, Balzer, and Smith (2002) and Smith, McCarthy, and Anderson (2000), a series of qualitative and quantitative studies was undertaken using participants from numerous nationalities and cultures, including countries that have never appeared in literature on affect. The studies aimed to produce a 10-item international PANAS short form that would (a) account for shortcomings highlighted above, (b) reflect items qualitatively assessed to be easy to understand and unambiguous in meaning across different populations of nonnative English speakers, (c) exhibit strong psychometric properties concerning reliability, cross-sample and temporal stability, and convergent and criterion-related validity, and (d) provide evidence of cross-national structural equivalence.

Procedurally, to identify which items to remove or retain, a qualitative and then a quantitative evaluation of items was undertaken. This was then followed by a series of validation studies to examine and establish the psychometric properties of the new PANAS short form. Research was specifically aimed at developing a measure for trait affect.

STUDY 1—QUALITATIVE EVALUATION OF PANAS ITEMS

Two focus groups were conducted to investigate the clarity, ease of understanding, and singularity of meaning of all PANAS items and thereby to provide an initial, qualitative basis on which to identify poorly performing items for possible elimination.

Sample. Focus groups comprised 9 male and 9 female students at an international, English-based university in Japan, who came variously from America, Burma, China, Hong Kong, Hungary, Indonesia, Mexico, Mongolia, the Philippines, Thailand, Tonga, and Vietnam. All were MBA students, average age 28, except 5 business undergraduates each aged 21.

Results. Some items were considered easy to understand but to have multiple meanings. *Excited* was thought to incorporate both positive and negative connotations, the latter being for some participants a meaning that might be interpreted as close to agitated, and

close to importunate for others. There was also some suggestion that *excited* represented a feeling that was intrinsically transient and therefore more relevant to state than trait affect. *Proud* also had a negative connotation, falling somewhere between arrogance and disdain.

Other words were understood primarily in their literal sense and were, consequently, largely shorn of the trait, if not necessarily always the state, affect assumed by the PANAS. The item *strong* was taken in a literal sense and tended to be associated with physical rather than the emotional or character strength intended by the authors of the PANAS. *Interested* also fell into this literal category, being thought to indicate a state and to need an object of application to have meaning. An NA item that was taken literally was *guilty*, which was regarded as indicating technical culpability for a particular misdemeanor, specifically a criminal offense, rather than a general feeling or mood. *Scared* was also regarded as a short-term state in reaction to a given cause rather than a more permanent trait. One item, *jittery*, was found to be not clearly understood by all nonnative English speakers.

It was also pointed out that the question and the interval measure suggested by Watson et al. (1988) were somewhat confusing in that the posed question did not concur with the response wordings. What Watson et al. in effect ask is, "Indicate to what extent you generally feel on average [whatever item]," to which it is not syntactically logical to answer *extremely*, this being one pole label on the 5-point interval measure. It was further remarked that the opposite to the pole label of *very slightly or not at all* used by Watson et al. ought not to be *extremely* but more appropriately should be *a lot* or *often* so as to provide a more natural continuum of extent or prevalence of feeling.

STUDY 2—STATISTICAL EVALUATION OF PANAS ITEMS

A quantitative analytical strategy of using both factor analyses and scale reliability tests was used (a) to examine statistically the wisdom and psychometric feasibility both of eliminating the above seven items found qualitatively to be problematic and (b) to identify objectively a further three items for elimination while simultaneously preserving the content validity of the original PANAS as intact as possible (Haynes, Richard, & Kubany, 1995) and retaining the PA and NA constructs' orthogonality.

Sample. This developmental sample comprised 217 males and 190 females from 38 different countries. In terms of age, 30% were younger than 25, 33% were 25 to 29, and 37% were 30 or older. Some 88% had completed or were still taking undergraduate degrees. The sample constituted a subsample of 517 participants who had completed a questionnaire on entrepreneurial intent and who identified themselves as proficient in reading, writing, and speaking English. The original sample of 517 comprised family and friends of a class of MBA students at an English-based international university in Japan who volunteered to assist with research. As such, the sample perhaps represents the more affluent and educated strata of individuals who might be encountered in numerous multicultural research settings, such as transnational firms, intergovernmental organizations, or university campuses.

Confirmatory and exploratory factor analyses. A confirmatory factor analysis of the full PANAS did not find adequate support for a well-fitting, two-component PA and NA model, suggesting problematic performance of some items. The goodness of fit index

TABLE 1
Factor Loadings of Exploratory Principal Component Analyses of Original Positive and Negative Affect Schedule (PANAS) Items

	Analysis of Full PANAS[b]		*Analysis of 10 Items Selected for Short Form*[c]	
Components[a]	*1*	*2*	*1*	*2*
PANAS items				
Active	**.72**	–.20	**.74**	–.19
Enthusiastic	**.72**	–.10	—	—
Determined	**.70**	–.20	**.77**	–.16
Attentive	**.69**	–.19	**.77**	–.15
Inspired	**.68**	–.13	**.71**	–.10
Strong	**.63**	–.26	—	—
Interested	**.64**	–.03	—	—
Alert	**.60**	–.08	**.70**	–.02
Excited	**.58**	.20	—	—
Proud	**.56**	–.03	—	—
Afraid	–.19	**.73**	–.15	**.75**
Nervous	.00	**.72**	.00	**.76**
Scared	–.06	**.70**	—	—
Upset	–.09	**.66**	–.13	**.68**
Guilty	–.14	**.60**	—	—
Hostile	–.14	**.59**	–.18	**.63**
Ashamed	–.15	**.58**	–.11	**.63**
Jittery	–.03	**.58**	—	—
Irritable	–.01	**.56**	—	—
Distressed	–.04	.28	—	—

SOURCE: Watson, Clark, and Tellegen (1988).
NOTE: $N = 407$. Principal component analyses with varimax rotation. Item loadings above .30 are in bold.
a. Items appear in order of factor loadings of the full PANAS, not the original PANAS item order.
b. Analysis specifies two component solution.
c. Only the 10 best items from the PANAS are included in analysis.

(GFI) was .89, adjusted goodness of fit index (AGFI) was .87, comparative fit index (CFI) was .87, and root mean square error of approximation (RMSEA) was .07, indicating that, by the subjective criteria of fit measures (Bentler, 1988), the PANAS fell marginally short of a well-fitting model. To help identify poorly performing items using this cross-national sample, an exploratory principal component analysis with a varimax rotation was undertaken. Specifying a two-component solution revealed the item *strong* to have a cross-loading above the |.25| cutoff used by Watson et al. (1988) in the construction of the original PANAS (see Table 1), a property that would attenuate the independence of the PA and NA subscales. The items *excited* and *proud* had the lowest loadings on the PA component, perhaps reflective of their unclear meanings revealed in the qualitative study. The lowest loading three items on the NA component were *irritable*, *jittery*, and, with a very low loading of just |.28|, *distressed*.

Item purging. As a first step to reducing the full PANAS, items identified as problematic in the qualitative focus groups were removed, and the reliabilities of the remaining

items of PA and NA subscales were then calculated. The alpha of .82 obtained for the full 10-item PANAS NA subscale was reduced to .74 after the problematic items of *guilty*, *jittery*, and *scared* were removed. The item *distressed* prove to have a low item-total correlation of just .20 and was therefore omitted. This left a choice for one further item removal to be decided between *hostile* and *irritable*. The latter was omitted as its exclusion attenuated reliability the least. The retained five items of *afraid*, *ashamed*, *hostile*, *nervous*, and *upset* had an acceptable alpha of .74 and together represented each of the five word clusters used in the construction of the original PANAS NA subscale, thereby maintaining the breadth of the original content domain coverage.

The reliability for the full 10-item PA subscale of .85 only marginally dropped to .82 after the problematic items identified in focus groups of *excited*, *interested*, *proud*, and *strong* were removed. This small drop in reliability suggested that these items' omission eliminated problematic words that add little to internal reliability. To preserve the original PANAS's content domain as intact as possible, it was necessary to keep the items *active* and *determined*, as these came from different word clusters used by Watson et al. (1988) in the original PANAS's development. Resultantly, one more item needed to be removed from either the pair *alert* and *attentive*, or, alternatively, from the pair *inspired* and *enthusiastic*. Each item was removed in turn to assess attenuation of reliability. The resulting Cronbach's alphas were all very similar at around .80. Consequently, to determine which item to remove, factor analyses of all possible PA item combinations together with the five selected NA items were run to assess which item's removal produced the factor structure with the lowest cross-loadings and thereby the highest degree of overall orthogonality. In the event, the removal of *enthusiastic* produced the best factor structure, with an average item cross-loading of |.12|, and none above |.19|, lower than the |.25| cut-off used by Watson et al. in the construction of the original PANAS (see Table 1). The five selected PA items of *active*, *alert*, *attentive*, *determined*, and *inspired* had an alpha of .80 and comprehensively covered the word clusters used in the original PANAS and so, hence, the breadth of its content domain.

Correlational equivalence. The PA and NA subscales of this reduced short form of the PANAS were slightly more correlated with each other ($r = –.32$, $p < .01$) than the full PA and NA subscales of the full PANAS ($r = –.29$, $p < .01$). However, although these correlations are above the maximum –.23 reported by Watson et al. (1988) in their development of the full PANAS, they are similar to the larger correlations of –.30 and –.35 reported by, respectively, DePaoli and Sweeney (2000) and Crawford and Hendry (2004). The correlations between the short and full form subscales were .92 ($p < .01$) for PA and .95 ($p < .01$) for NA. Mean scores for PA and NA subscales of the short form were, respectively, 19.15 ($SD = 2.77$) and 12.73 ($SD = 3.01$), roughly half the mean scores of 38.39 ($SD = 4.87$) and 25.85 ($SD = 5.16$) found, respectively, for the full PANAS.

STUDY 3—SAME-SAMPLE RETEST

A retest was undertaken with the original development sample for two reasons: (a) to test if the 10-item International PANAS Short Form (I-PANAS-SF; see Appendix) would retain adequate psychometric properties when administered as a standalone schedule independent of the purged items and (b) to examine whether or not the I-PANAS-SF would

TABLE 2
International Positive and Negative Affect Schedule Short Form (I-PANAS-SF) Exploratory Factor Analyses Loadings and Reliabilities for Developmental and Validation Samples

	Positive Affect				*Negative Affect*			
	Developmental Sample	*Validation Sample 1*	*Validation Sample 2*	*Validation Sample 3*	*Development Sample*	*Validation Sample 1*	*Validation Sample 2*	*Validation Sample 3*
Determined	**.83**	**.70**	**.76**	**.75**	–.14	–.18	–.03	–.12
Attentive	**.79**	**.71**	**.75**	**.70**	–.1	–.19	–.08	–.13
Alert	**.71**	**.66**	**.75**	**.59**	.02	.17	.08	.02
Inspired	**.65**	**.65**	**.61**	**.67**	–.05	–.14	–.24	–.05
Active	**.61**	**.66**	**.66**	**.68**	–.33	–.24	–.24	–.24
Afraid	–.07	–.15	–.10	–.08	**.81**	**.77**	**.81**	**.76**
Nervous	–.10	–.11	–.03	–.02	**.74**	**.74**	**.76**	**.75**
Upset	.02	–.05	–.05	–.06	**.72**	**.68**	**.69**	**.71**
Ashamed	–.21	–.19	–.16	–.13	**.63**	**.66**	**.68**	**.67**
Hostile	–.11	–.08	–.09	–.15	**.63**	**.63**	**.59**	**.55**
Cronbach's α	.78	.78	.76	.73	.76	.76	.76	.72

NOTE: Developmental sample 1 $n = 163$; validation sample 1 $n = 444$; validation sample 2 $n = 383$; validation sample 3 $n = 962$. Principal component analyses with varimax rotation. Items are in order of factor loadings for the developmental sample. Item loadings above .30 are in bold.

correlate at a high enough level with the original full PANAS to be assured that it still measured the same PA and NA constructs (Smith et al., 2000).

Sample and procedure. Of the original developmental sample of 407, 302 had agreed to participate in further research. Two months after administering the test questionnaire, these volunteers were sent a retest questionnaire incorporating the new 10-item I-PANAS-SF. In an effort to make the question-stem wording both briefer and more syntactically logical than Watson et al.'s (1988) original, the question was changed to "Thinking about yourself and how you normally feel, to what extent do you generally feel [item]," and the 5-point interval measure was anchored *never* and *always*. Full responses that could with complete certainty be matched with test responses were received from 163 participants.

Exploratory and confirmatory factor analyses. An exploratory principal component analysis with varimax rotation produced a two-factor PA and NA subscale structure (see Table 2), indicating that the items and revised question wording of the I-PANAS-SF successfully tap and reflect the same components of PA and NA of the full PANAS as intended by Watson et al. (1988). Confirmatory factor analysis supported the goodness of fit of a two-factor structure, with GFI being .94, AGFI being .90, CFI being .94, and RMSEA being .066, with a lower bound of .035.

The I-PANAS-SF PA and NA subscales had Cronbach's alphas of, respectively, .78 and .76, indicating adequate reliability. The correlation between the two subscales was –.29 ($p < .01$). The I-PANAS-SF PA subscale had a correlation with the full PANAS PA subscale of .65 ($p < .01$), and the respective NA subscales had a correlation of .59 ($p < .01$). These correlations are similar to the 2-month test-retest reliabilities Watson et al. (1988)

report for the original PANAS, suggesting that the 10-item I-PANAS-SF compares well with the full 20-item original in terms of both correlating with the original full form and temporal stability, both important aspects of short form development (Stanton et al., 2002).

STUDY 4—DIFFERENT-SAMPLE VALIDATIONS

Having found the 10-item I-PANAS-SF's factorial structure and psychometric properties to be acceptable in an initial development sample, it was necessary to test the generalizability of these properties across different validation samples.

Samples and procedure. The 10-item I-PANAS-SF was incorporated into three different survey instruments that were completed by three new and separate samples that were derived in a similar manner to the sample used for the developmental studies above. Each validation sample was entirely independent one from another.

Validation Sample 1 comprised 207 males and 237 females from 52 different countries. In all, 24% were younger than 25 years old, 36% were 25 to 29, and the rest were 30 or older. Validation Sample 2 comprised 181 males and 202 females from 47 countries, and 32% were younger than 25, 22% were 25 to 29, and the rest were 30 or older. Validation Sample 3 comprised 431 males and 531 females from 66 different countries, half being older than 25 years old. More than 90% of all three samples had completed or were still taking undergraduate degrees.

Exploratory and confirmatory factor analyses. Exploratory principal component analyses of the I-PANAS-SF for each of the three validation samples produced two-component PA and NA factor structures with no cross-loadings above the |.25| used by Watson et al. (1988) as an upper bound cutoff in the development of the original PANAS (Table 2). Across the three samples, the mean item loading for NA was |.70|, with the mean cross-loading being |.14|; respective figures for PA were |.69| and |.10|. Scale reliabilities across the three samples prove to be adequate, with their mean Cronbach's alphas being .76 for NA and .75 for PA. Confirmatory factor analyses for each sample and a pooled sample of all three supported the factorial consistency of the I-PANAS-SF, with fit indices averaged across the three samples and for the pooled sample all indicating adequate fit for the two-component PA and NA structure. The degree of orthogonality of the PA and NA subscales was reasonably consistent across the three discrete validation samples, with correlations ranging from –.25 to –.32, in line with the "quasi-independence" of the full PANAS (Watson et al., 1988, p. 1066).

Test-retest reliability. To examine the temporal stability of the I-PANAS-SF, it was included in a follow-up questionnaire sent to 318 volunteers from the 444 Validation Sample 1 respondents. The retest took place 8 weeks after the test and resulted in 143 verifiably matchable responses. The test-retest coefficient of reliability for both the PA and NA subscales turned out to be the same, at .84 ($p < .01$), suggesting acceptable medium-run temporal stability. These retest values are a little higher than the .68 and .71 for PA and NA, respectively, reported by Watson et al. (1988) for an 8-week retest, perhaps reflecting a reduction in temporal variance that results from the elimination of the least well-performing items.

Convergent and criterion-related validity. The convergent validity of the I-PANAS-SF was tested using Diener's (1984) five-item measure of subjective well-being (SWB) and Lyubomirsky and Lepper's (1999) four-item subjective happiness scale using the pooled validation samples. As might be predicted, the PA subscale did indeed correlate positively with both SWB ($r = .33$, $p < .01$) and happiness ($r = .39$, $p < .01$). Moreover, the NA subscale negatively correlated with both SWB ($r = –.33$, $p < .01$) and happiness ($r = –.51$, $p < .01$). Hence, convergent validity was lent support. Partial correlations were also run to control for covariance between PA and NA: PA uniquely correlated with SWB ($r = .26$, $p < .01$) and happiness ($r = .29$, $p < .01$) when controlling for NA; NA uniquely correlated with SWB ($r = –.30$, $p < .01$) and happiness ($r = –.45$, $p < .01$) when controlling for PA. These partial correlations lend further support both to the convergent validity of the I-PANAS-SF and to its ability to measure PA and NA as discrete and lowly correlating constructs.

Establishing criterion-related validity is notoriously problematic because, in Nunnally and Bernstein's (1994) words, "obtaining a good criterion may actually be more difficult than obtaining a good predictor" (p. 96). As the objective of criterion-related validity is to establish whether or not a predictor correlates as anticipated with a variable external to the measurement of the predictor, criterion-related validity was tested using gender and age. Females have been found to score higher on NA and lower on PA than men (Fujita, Diener, & Sandvik, 1991). Hence, each affect scale of the I-PANAS-SF should predictably correlate accordingly with gender as a criterion variable. Age is shown in several studies to correlate positively with PA and inversely with NA (Charles, Reynolds, & Gatz, 2001; Lawton, Kleban, & Dean, 1993). Therefore, it might be predicted that age will correlate positively with the PA subscale but negatively with the NA subscale. In the event, being female was in fact found to be positively but lowly correlated with NA ($r = .06$, $p < .05$), but no significant relationship was found with PA, suggesting only partial support for criterion-related validity using this criterion. Age was found to correlate as predicted with both PA ($r = .11$, $p < .01$) and NA ($r = –.18$, $p < .01$), indicating some degree of criterion-related validity using this criterion variable.

Cross-cultural validity. As a first step to establishing whether or not that the I-PANAS-SF is appropriate for use across cultures, its measurement and factorial structure invariances across native and nonnative English speakers were examined following structural equation modeling procedures suggested by Byrne and Campbell (1999) for cross-cultural measurement research. Simultaneous confirmatory factor analyses of the pooled sample using native or nonnative English speaker as the grouping variable were run using covariance matrices and maximum likelihood estimation in Amos 5.0 (Arbuckle, 2003).

No significant difference between the unconstrained model ($\chi^2 = 336.59$, 68 *df*) and a model constraining measurement parameters only ($\chi^2 = 343.18$, *df* 76) was found ($\Delta\chi^2 = 6.59$, Δdf 8, $p > .05$), indicating cross-group equivalence of the I-PANAS-SF's 10-item parameters. This suggests that, for both native and nonnative English speakers, individual items contribute in the same way toward each subscale. The difference between models constraining structural covariance and not constraining structural covariance was also insignificant ($\Delta\chi^2 = 10.10$, Δdf 11, $p > .05$), indicating cross-group factorial structure invariance. Taken together, these tests indicate both the measurement and factorial equivalence across native and nonnative English speakers of the I-PANAS-SF.

Descriptive statistics for countries with 25 or more cases are shown in Table 3. Also shown in Table 3 are regressions of PA and NA against such countries controlling for age

TABLE 3
Country Descriptives and Regressions

		Positive Affect		*Negative Affect*		*Regressions*			
	n	M	SD	M	SD	*Positive Affect*		*Negative Affect*	
Age						(0.03)	0.06*	(0.03)	–0.12***
Gender						(0.13)	–0.01	(0.14)	0.03
Australia	25	19.16	3.39	10.76	3.36	(0.55)	–0.02	(0.59)	–0.06**
Burma	97	19.09	2.11	13.00	2.70	(0.31)	–0.05†	(0.33)	0.08**
Canada	25	18.76	2.76	12.92	3.67	(0.55)	–0.04	(0.59)	0.03
China	60	18.23	2.13	12.18	2.63	(0.37)	–0.09***	(0.40)	0.00
Hungary	100	18.94	2.71	11.76	2.73	(0.30)	–0.05†	(0.33)	–0.05†
India	39	19.56	2.85	11.72	3.02	(0.45)	0.00	(0.48)	–0.03
Indonesia	162	18.51	2.46	12.98	2.70	(0.25)	–0.11***	(0.27)	0.06*
Japanese	65	17.38	2.82	13.69	3.45	(0.36)	–0.15***	(0.39)	0.09***
Malaysia	76	19.17	2.69	13.21	3.00	(0.34)	–0.03	(0.36)	0.07**
Philippines	88	20.53	2.86	12.88	3.20	(0.31)	0.08**	(0.34)	0.05†
Singapore	58	19.10	2.57	12.62	2.48	(0.38)	–0.03	(0.41)	0.02
Taiwan	60	17.33	2.89	13.78	3.07	(0.37)	–0.14***	(0.40)	0.08***
Thailand	84	19.39	2.63	14.25	2.98	(0.32)	–0.01	(0.35)	0.13***
United Kingdom	29	19.48	2.89	11.21	2.04	(0.51)	–0.01	(0.55)	–0.03
United States	411	19.73	2.58	11.27	2.66	(0.20)	0.00	(0.22)	–0.09**
Vietnam	77	18.26	2.44	12.06	2.73	(0.33)	–0.10***	(0.36)	–0.02
R^2							.08		.10
Adjusted R^2							.08		.09
F statistic							8.10***		10.94***

NOTE: N = 1,789. Regressions are positive affect and negative affect, respectively, regressed on country dummies, age, and gender. Figures in parentheses are standard errors. Constant not shown. Age runs from 15 to 84, divided into 5-year categories. Gender is dummy coded with females 1. Countries with fewer than 25 cases constitute contrast variable.
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

and gender and using countries with fewer than 25 cases as a contrast. Regressions were also run using a dummy variable, coded nonnative English 1, native English 0, while partialing out country effects, age, and gender to see if language in and of itself appeared to explain any significant variance in PA an NA. When this language dummy was added to the models in Table 3, no additional variance was explained for either PA or NA, nor were mediation effects evident through changes in the size or significance of countries' standardized beta coefficients. Although straightforward interpretation of these results is complicated by the potential confounding effects of the country dummies, it would appear that being a native or nonnative English speaker has no significant effect on either PA and NA scores produced by the I-PANAS-SF. As such, the differences evident in country betas and mean scores shown in Table 3 are more likely the product of country-specific factors than the fact of those respondents being native or nonnative speakers per se. Such country differences, if found to be stable, might be the result of variation in affect across cultures or the artifact of culturally specific response styles (Van Herk, Poortinga, & Verhallen, 2004), such as the differential national acquiescence tendencies reported by Watkins and Cheung (1995) or a combination of both. To test the stability of country scores, country samples greater than 50 were randomly split, and student t tests run between the two halves. Of the

11 countries tested, a significant difference was found only for PA for Taiwan ($t = 2.20$, df 58, $p = .059$), suggesting the differential affect scores by country to be broadly stable.

To examine whether or not the I-PANAS-SF is peculiarly susceptible to country-specific effects either in trait or response style, correlations between standardized within-country scores for each affect measure with standardized scores for both SWB and happiness were examined. Following Marshall (1997) and Shaffer, Crepaz, and Sun (2000), scores were standardized using a z-transformation procedure. Correlations between the standardized scores prove to be very similar to those between unstandardized scores, with differences in magnitude of correlation ranging from only .07 to .09, indicating that the I-PANAS-SF is not peculiarly prone to country-specific effects compared to the two convergent criteria variables used.

Standardized within-country affect scores were also correlated with the criterion-related variables of gender and age to assess criterion-related validity with country effects removed. Correlations between age and, respectively, standardized PA ($r = .05$ $p < .05$) and NA ($r = –.11$ $p < .01$) and between gender and standardized PA ($r = .00$ $p > .10$) and NA ($r = .04$ $p < .10$) showed a similar pattern, although slightly lower magnitudes, to correlations for unstandardized affect scores with age and gender, suggesting some indication that the I-PANAS-SF captures individual-level affect largely independent of country effects.

DISCUSSION

LIMITATIONS AND FURTHER RESEARCH

Although the samples used for these studies were large, adequate for the necessary statistical tests undertaken, and included participants from a wide range of cultural backgrounds, the size of individual country samples was in many cases small, and all were convenience rather than probabilistic samples. Consequently, further research with larger and probabilistic country-specific samples will be needed to examine and disentangle potential country-level effects attributable either to trait or to response-style effects, insofar as these can practically be separated (Schimmack, Böckenholt, & Reisenzein, 2002; van de Vijver & Leung, 2000). These developmental and validation studies have also been restricted in the number of variables that have been used for convergent and criterion-related validity tests. Although these tests have demonstrated some convergent and limited criterion-related validity, further research will be needed to examine the validity of the I-PANAS-SF in relation to stress, psychopathology, and other measures used by Watson et al. (1988) in the development of the original PANAS.

CONCLUSION

Putting aside the inevitable limitations and the need for further research that accompany the development of any new metric, the systematic derivation and testing of the I-PANAS-SF would seem to be adequate to the point whereby it can be offered for cross-cultural English-based studies as a brief research tool that is reliable, valid, and efficient as a means of measuring and further investigating PA and NA in the growing number of cross-cultural research settings that require single-language instrumentation.

APPENDIX
The International Positive and Negative Affect Schedule Short Form (I-PANAS-SF) Question, Measure, and Item Order

Question: Thinking about yourself and how you normally feel, to what extent do you generally feel:
Items in order:

- Upset
- Hostile
- Alert
- Ashamed
- Inspired
- Nervous
- Determined
- Attentive
- Afraid
- Active

Interval measure: *never* 1 2 3 4 5 *always*

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