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Affect among Koreans: New Scales and their Structure*

Michelle S. M. Yik†
Hong Kong University of Science and Technology

James A. Russell
Boston College

Chang-kyu Ahn
Pusan National University

This article shows that fundamental aspects of the structure of momentary affect are similar in Korean and Canadian societies. We developed questionnaire scales in Korean in four different formats for assessing momentary affect. Scales can be scored for Feldman Barrett and Russells (1998) Pleasant, Unpleasant, Activated, and Deactivated, Thayers (1996) energetic and tense arousal, Larsen and Dieners (1992) eight combinations of pleasantness and activation, and Watson and Tellegens (1985) Positive Affect and Negative Affect. In a sample of 365 Koreans, the new scales were found to be psychometrically sound and to be interrelated as found with English-speaking Canadians: Dimensions could be integrated into a two-dimensional bipolar affective space.

Key Words : affect, momentary affect, affect scales, structure of affect

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† 교신저자 : Michelle S. M. Yik, Division of Social Science, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong.
E-mail : myik@ust.hk. / Voice : (852) 2358-7815 / Fax : (852) 2335-0014

For theoretical and practical reasons, psychologists are increasingly turning to the study of affect. Affect has been found to be an important factor in research laboratory, clinic, advertising, and workplace. There are two interrelated purposes in the present study. First, we test the generalizability to Koreans of a two-dimensional model of affect developed with English-speaking Canadians. Second, we develop ready-to-use tools to assess affect among Koreans.

The study of affect requires a comprehensive descriptive structure of affective feelings. It is also highly desirable to have the whole or part of such a structure to be a common framework for describing affect across language groups. If such a structure can be found, it would be a valuable unifying tool allowing researchers to compare and contrast affective feelings in different groups. In that way, both universal and language-/ culture-specific aspects of affect can be delineated. The present study is part of a larger cross- cultural project aimed at such a descriptive structure.

In the past decade, various dimensional models have been proposed to characterize the covariations of self-reported momentary affective feelings in English. Major models include Russell's(1980) circumplex, Thayer's (1996) energetic and tense arousal, Larsen and Diener's (1992) eight combinations of pleasantness and activation, and Watson and Tellegen's (1985) positive and negative activation(Watson, Wiese, Vaidya, & Tellegen, 1999). Each has achieved psychometric success and inspired a line of supportive research.

Recently, attempts have been made to integrate these four models. Results have shown that the affective dimensions defining these structural models fit comfortably within a space characterized by two bipolar axes of Pleasure and Arousal. Figure 1 shows an empirical example of that integrated space (Russell, Yik, & Steiger, 2003). On the right hand side are the more pleasant states; on the left hand side the more unpleasant ones. On the upper half are the more activated states; on the lower half the more deactivated ones. Thus, any specific affective state includes different dosages of Pleasure and Arousal. Affective variables can fall at any angle throughout the integrated space of Figure 1. The model is thoroughly bipolar in that any state has a bipolar opposite 180 (away. It is also a circumplex in which affective states fall in a circular ordering along the perimeter. The circumplical nature of affective states has received strong empirical support (Remington, Fabrigar, & Visser, 2000). We do not, however, assume that the structure of Figure 1 captures all of affect. Rather, we propose it as a means of representing affect at the most general level.

One question immediately arises: Is the integrated structure limited to English-speaking societies where it was developed? Prior evidence suggests that the answer is likely to be no. Russell and his colleagues (1983; Russell, Lewicka, & Niit, 1989; Yik & Russell, 2002; Yik, Russell, Oceja, & Fernandez Dols, 2000; Yik, Russell, & Suzuki, 2003) reported cross-cultural replications of the circumplex model in Chinese, Croatian, Estonian, Greek, Gujarti, Japanese, Polish, and Spanish. Watson and Tellegen's (1985) Positive Affect and Negative Affect structure was replicated in Japanese (Watson, Clark, & Tellegen, 1984), Hebrew(Almagor & Ben-Porath, 1989), Spanish (Castillian) (Joiner, Sandín, Chorot, Lostao, & Marguina, 1997), and Tagalog(Church, Katigbak, Reyes, & Jensen, 1999).

The specific question that prompted the present study was whether the integrated space can be generalized to the Korean society. Available evidence does not provide a clear answer to this question. Past studies on Korean emotion terms showed that the affective structures were characterized by multiple factors (e.g., S. H. Ahn, Lee, & Kwon, 1994; Kang & Hahn, 1994; M. Y. Lee & H. C. Lee, 1990). Among these factors, Pleasure was repeatedly revealed in these studies. Arousal was, however, less robust. S. H. Ahn, Lee, and Kwon(1993; see also H. Lee & L. Lee, 1990) conducted four studies on the structure of emotion and concluded that Arousal was a result of item selection bias, although S. H. Lee and S. H. Ahn (1997) found evidence for tiredness(low arousal) when studying everyday emotion terms. The present study was aimed at providing further evidence on the dimensional structure of affect among Koreans with a method that emphasizes actual momentary affective states outside the laboratory. By "momentary affect," we mean affect (whether short or long, whether mild or intense) at a thin slice in time.

In summary, past studies provide support for some aspects of the integrated model of Figure 1, but further investigation is required. The present study used a complementary strategy to those used before. We tested the generalizability of the model of Figure 1 using scales defining the four major structural models cited there. These scales should be valuable in their own right, for example, in pursuing the structural validity of each original model in Korean. Together, they also allowed us to examine whether the scales can be integrated in Korean as they are in Figure 1. We began with an exploratory factor analysis, but our test of the integration of different affective dimensions also relied on confirmatory factor analysis, a powerful tool that estimates relations among variables while minimizing the influence of the errors inherent in measurement.

We began by translating various affect scales from English into Korean with a back- translation method (Berry, 1969). Data were then gathered from a sample of 365 Koreans on their momentary affect at a randomly selected moment. These data were analyzed to examine three issues: (a) the psychometric properties of the translated scales, especially their bipolarity; (b) the relations among these scales; and (c) the ability of the proposed model of Figure 1 to integrate them.

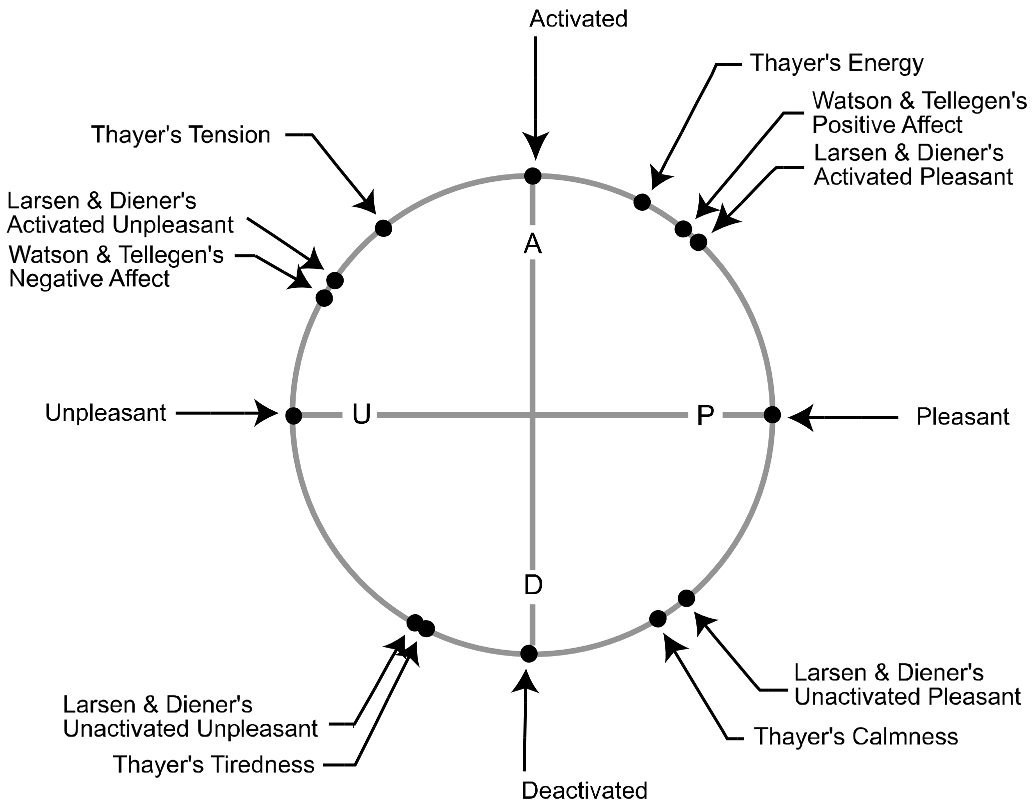

Figure 1. A Circumplex Model of Affect. 14 unipolar affect constructs empirically placed in an integrated two-dimensional space via CIRCUM(Browne, 1992). P=Pleasant, U=Unpleasant, A=Activated, and D=Deactivated. Results are obtained from a study of 535 English-speaking Canadians. Adopted from Russell, Yik, and Steiger(2003).

Method

Procedure

Participants and Procedure

Participants were 365 undergraduates (176 men, 189 women) from Pusan National University. Their mean age was 21.8 years (SD=2.1). (11 did not report their age.) Participation was voluntary. Test administration took place during class time.

Participants first completed an affect questionnaire under the title "Remembered Moments Questionnaire" and then completed questionnaires for other research purposes. All questionnaires were in Korean.

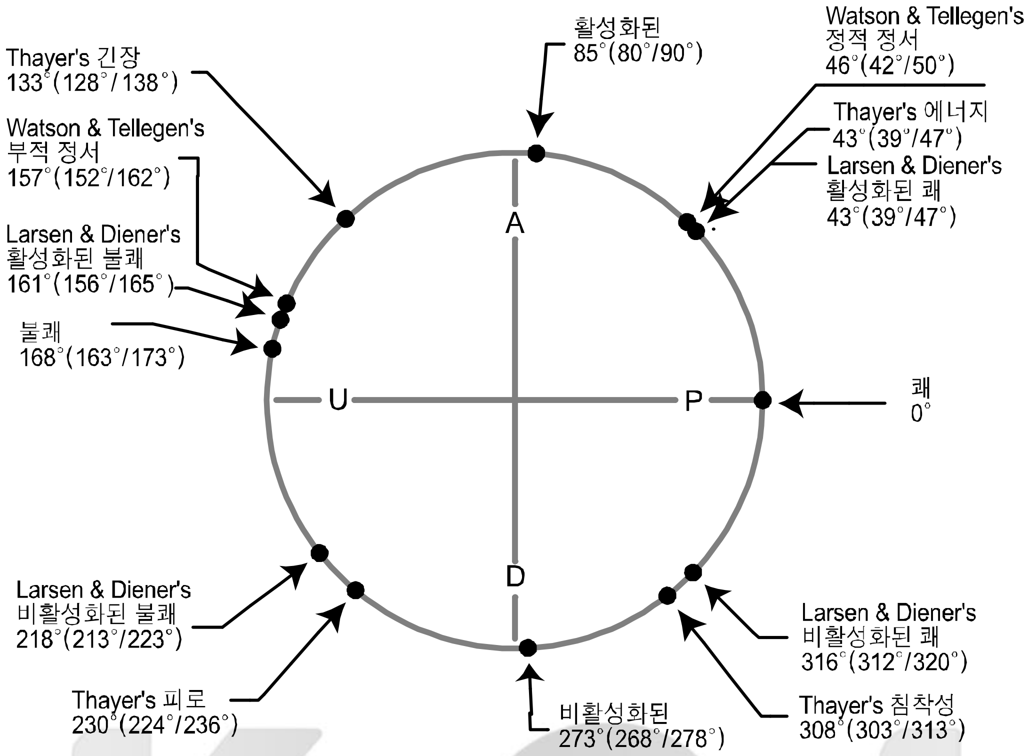

Figure 2. Korean Scales of Momentary Affect. A circumplex representation of 14 unipolar affect constructs via CIRCUM(Browne, 1992). Communality was left free to vary. Figures given are estimates of polar angles with the 95% confidence intervals in parentheses. P=쾌, U=불쾌, A=활성화된, D=비활성화된.

Remembered Moments Procedure

Problem, we asked our respondents to select a moment that was well remembered, and mealtimes were used as memoric anchors.

The front page of the battery provided general instructions under the title "Remembered Moments Questionnaire." There were six versions of the questionnaire, each with a different anchoring time. The six memoric anchors were "before breakfast," "after breakfast," "before lunch," "after lunch," "before dinner," and "after dinner." Participants were randomly assigned to one of the six instructions. For instance, the instructions for one version were as follows:

> " … we need to ask you to remember a particular moment. Please think back to yesterday. Specifically, recall the

time just before breakfast. (If you didn't have breakfast yesterday, simply recall that approximate time of day.)

It is important that you remember a specific moment accurately. So, please search your memory and try to recall where you were, what you were doing at that time, who you were with, and what you were thinking.

Now select a particular moment that is especially clear in your memory. (If you really have no recollection of the time just before breakfast, please search your memory for the closest time that you do recall accurately.)"

In the other five versions, italicized words were replaced. The instructions then emphasized that all subsequent questionnaires were to be answered with respect to that selected moment of the day before. Each participant received only one version of the questionnaire. On average, completion took approximately 25 minutes. Data from all six versions were combined and used in subsequent analyses.

Questionnaires

Participants completed a battery of four questionnaires, each in a different format, in the following order: (a) Semantic differential scales, abbreviated SEM; (b) Adjective format, abbreviated ADJ, which was an adjective list accompanied by a five-point Likert scale ranging from 1 "not at all" to 5 "extremely"; (c) "Agree-Disagree" format, abbreviated AGREE, which was a list of statements with which participants were asked to indicate their degree of agreement, ranging from 1 "strongly disagree" to 5 "strongly agree", and (d) "Describes Me" format, abbreviated DESCRIBE, which was a list of statements, for each of which participants were asked to indicate how well it described their feelings, ranging from 1 "not at all" to 4 "very well".

The SEM format consisted of bipolar measures of Pleasure and Arousal translated directly from Mehrabian and Russell (1974). The remaining three questionnaires were unipolar in format and each questionnaire included translated items from (a) Feldman Barrett and Russell's (1998) Current Mood Questionnaire(CMQ) assessing Pleasant, Unpleasant, Activated, and Deactivated affect; (b) Larsen and Diener's(1992) Activated Unpleasant, Unactivated Unpleasant, Activated Pleasant, and Unactivated Pleasant affect; (c) Thayer's (1996) Energy, Tiredness, Tension, and Calmness; and (d) Watson, Clark, and Tellegen's(1988) Positive Affect and Negative Affect.

Translation

All instructions and scales were translated into Korean by two bilinguals through a back-translation procedure. First, one bilingual translated the English version (Yik, Russell, & Feldman Barrett, 1999) into Korean. Second, another bilingual, who was blind to the English original, translated the Korean version back into English. Discrepancies between the original and the back-translated English versions were reviewed by the authors. Translations were revised until satisfactory before we used them in the data collection.

Preliminary Revision

Pleasant, Unpleasant, Activated, and Deactivated - these four affect constructs are the cornerstones of the two-dimensional space proposed in the present study. Because it was the first time these scales were adopted to Korean, we began by examining the items defining these 14 constituent scales (3 unipolar formats x 4 constructs; plus the 2 semantic differential scales). The purpose was to make sure that the items align with each other as expected - for example, the items for the Pleasant scales should have high correlations with Pleasure scores but low correlations with Arousal scores.

Any revision procedure can be accused of capitalizing on chance. We therefore took steps to minimize this possibility: No items were allowed to switch from one scale to another and therefore items could only be dropped (but not added) in the revision procedure. With these criteria in mind, we found that some revisions were helpful. The three Pleasant scales remained unchanged; the three Unpleasant scales were revised by dropping three items in total. The six Activated and Deactivated scales were revised by dropping seven items in total. The revised affect scales[1] are available from the first author upon request.

Ipsatization

Affect scales are often contaminated by the presence of a general factor interpretable as a response style(Bentler, 1969). We therefore conducted an exploratory factor analysis on the 12×12 correlation matrix for the CMQ scales. There were three factors with eigenvalues greater than 1.00: 4.86, 2.77, and 1.09. The three-factor solution accounted for 73% of the total variance. In the unrotated solution, Factor 1 was interpretable as “Pleasant versus Unpleasant,” and Factor 2 as “Activated versus Deactivated.” Factor 3 appeared to be a general factor with positive loadings from all 12 scales.

Our next step was therefore to reduce the general factor by ipsatizing the data by scales. Ipsatization for this purpose requires that the scales included be balanced for content. (For example, if the adjective scale of “Pleasant” was in the pool, then its theoretical semantic opposite, the adjective scale of “Unpleasant,” would have to be there as well.) This consideration led us to use 12 rather than the full 14 scales in each response format. (Watson and Tellegen’s PA and NA scales were excluded because they lacked semantic opposites.) We

1) The revised affect scales are available from the first author upon request.

ipsatized our data across the 12 scales (4 each from CMQ, Thayer, and Larsen and Diener) within each response format. (So, for example, a participant's score on the CMQ Pleasant scale was ipsatized by subtracting from it the participant's mean on all 12 scales with the same response format and dividing that difference by the participant's SD on all 12 scales.) In this way, we created 36 ipsative scores, 12 for each response format.

With these ipsative data, we re-computed a 12 x 12 correlation matrix for the CMQ scales and submitted it to an exploratory factor analysis. There were now two factors with eigenvalues greater than 1.00: 4.82, 2.81. The substantive content and the(bipolar) nature of Factor 1 and Factor 2 remained the same as those in the preceding EFA using raw scores. The potential third factor had an eigenvalue of .82. This factor was no longer a general factor, yielding positive loadings from five scales and negative loadings from the other seven. Indeed, it was difficult to interpret this third factor. For subsequent analyses, the ipsative scores for all affective dimensions, except those for Watson and Tellegen's (1985) model, were used in estimating measurement models and structural equation models.

Indices of Fit

Correlation matrices for manifest variables were submitted to confirmatory factor analyses and structural equation modeling using SEPATH in Statistica (Steiger, 1995). Completely standardized solutions were reported. (Thus, both latent and manifest variables are scaled to a variance of 1.) For SEPATH, many different indices are available to assess the degree to which a structural equation model fits the observed data. Because most researchers agree that no single measure of fit should be relied on exclusively(Bollen & Long, 1993), we report four indices to assess the degree of model fit.

First, the chi-square statistic was used. This statistic tests the null hypothesis that the hypothesized model reproduces the correlation matrix for the manifest variables. The larger the chi-square, the more the correlation matrix specified by the hypothesized model deviates from the correlation matrix for the manifest variables. The chi-square statistic is dependent on sample size, however, such that it can be significant even for models that fit the data relatively well (Bentler, 1990). Second, we report a point estimate and confidence interval for the Adjusted Population Gamma Index(APGI), which provides a direct measure of goodness-of-fit. This index (Steiger, 1989, 1995) is an estimate of the population equivalent of the AGFI (Adjusted Goodness of Fit Index) proposed by Jöreskog and Sörbom (1984). As a measure of fit, the Jöreskog-Sörbom AGFI has much to recommend it. However, as demonstrated independently by Steiger (1989) and Maiti and Mukherjee (1990), the AGFI is a negatively biased estimator of the corresponding population quantity. Consequently, the AGFI provides a somewhat pessimistic index of the actual quality of model fit in the population. The sample estimate of the APGI we report here may be regarded as a bias-corrected version of the AGFI.

Third, the Comparative Fitness Index (CFI; see Bentler, 1990), which is a normed-fit index that evaluates the adequacy of the hypothesized model in relation to a baseline model, was used. CFI is computed on the basis of the most restricted baseline model(null model) in which all manifest variables are assumed to be uncorrelated (i.e., every variable is an indicator for its own latent construct). Possible values range from 0 to 1, with higher values indicating better fit.

Fourth, Steiger and Lind's (1980) RMSEA, which can be regarded as a root mean square standardized residual, was used. RMSEA is less susceptible to the sample size bias and adjusted for model complexity and is therefore useful in both evaluating the degree of model fit and comparing two nested models. Greater values indicate poorer fit. We report the point estimate and confidence interval for RMSEA.

For Browne's (1992) CIRCUM, we relied on chi-square and RMSEA.

Results

The results are presented in three sections. First, we test the assumption of bipolarity of affective dimensions. Second, we examine psychometric properties of the four structural models. Third, we examine the integration hypothesis of affect constructs originating from different structural models.

Test for Bipolarity

Russell and Carroll(1999) noted a contradiction in previous analyses of bipolarity, which had required unipolar response formats and a correlation of －1. These two requirements cannot be met simultaneously. Even when measurement errors have been completely eliminated, to achieve a correlation of －1 requires a strictly bipolar response format. However, unipolar formats were usually used in research studies. The more strictly unipolar the format, the farther from －1 is the expected correlation between bipolar opposites. Indeed, surprisingly, perfectly bipolar variables assessed with perfectly unipolar response formats are correlated －.47 in error-free data (Russell & Carroll, 1999). Further, ostensibly unipolar formats, such as those used in three out of four of our questionnaires, vary in just how strict they are. Russell and Carroll argued that the type of response format we used is ambiguous, explicitly unipolar but implicitly bipolar, because some but not all participants interpret it as bipolar.

The implication of Russell and Carroll's (1999) analysis is that testing bipolarity is not as straightforward as once thought. One cannot simply calculate a correlation and require that it be close to −1. Testing bipolarity requires a number of additional assumptions, such as that the latent bipolar dimension is normally distributed. With these assumptions, and for the types of unipolar format used here, we suggest the following two-step process:

1. The correlation falls within the range of −.47 to −1.00 (Russell & Carroll, 1999). The closer to −1, of course, the more confident one is of bipolarity. By correlation, here we refer to the correlation estimated by a structural equation modeling procedure that minimizes the influence of errors inherent in measurement.
2. When the correlation is within this range but far from −1.00, then this might be due to participants interpreting the response format as unipolar - an interpretation that would pull the correlation away from −1.00. One sign that participants are indeed interpreting the format as unipolar is that there is a positive skew in the data. Thus, at least one of the variates, and possibly both, show a positive skew(when they are scored, as is done traditionally and as was done here, with the lowest score corresponding to neutral and the highest score to a high degree of the named variable, such as sadness). The more positive skew seen in the two variables, the lower in magnitude is the correlation between them.

This two-step process must be considered tentative. Still, for the kinds of response formats in common use, such rules of thumb may be the best we can do for now.

The six pairs of hypothesized bipolar opposites (two each from Feldman, Barrett, & Russell, Thayer; and Larsen & Diener) were subjected to a test of bipolarity. Relevant statistics are given in Table 1. For instance, consider Pleasant and its hypothesized bipolar opposite, Unpleasant. The correlation between Pleasant and Unpleasant was estimated to be −.92(by a confirmatory factor analysis) and fell within the predicted range. Indeed, it was substantial in magnitude. Pleasant showed negative skew in all three formats, but Unpleasant showed positive skew much greater in magnitude than the negative skew of Pleasant. Therefore, by both criteria, Pleasant and Unpleasant are clearly consistent with the bipolarity assumption. The remaining five pairs passed the test of bipolarity as well: The estimated latent correlations fell within the range of −.81 to −1.00. Skew tended to be positive; where negative, it was lower in magnitude than the positive skew of the other variate. Converging results for the bipolarity assumption were evident in Figure 2 displaying

Table 1. Statistics for a Test of Bipolarity with Affect Scales

Format	Variable	Skew	Hypothesized Opposite	Skew	
Horizontal Axis					
ADJ	Pleasant	.44	Unpleasant	1.09	
AGREE	Pleasant	.49	Unpleasant	.77	
DESCRIBE	Pleasant	.48	Unpleasant	.69	.92
Vertical Axis					
ADJ	Activated	.56	Deactivated	.10	
AGREE	Activated	.25	Deactivated	.28	
DESCRIBE	Activated	.12	Deactivated	.02	1.00
Thayers Constructs					
ADJ	Energy	.00	Tiredness	.10	
AGREE	Energy	.16	Tiredness	.44	
DESCRIBE	Energy	.15	Tiredness	.32	.81
ADJ	Tension	.92	Calmness	.31	
AGREE	Tension	.56	Calmness	.22	
DESCRIBE	Tension	.71	Calmness	.19	.89
Larsen and Dieners Constructs					
ADJ	Activated Pleasant	.21	Unactivated Unpleasant	.35	
AGREE	Activated Pleasant	.03	Unactivated Unpleasant	.38	
DESCRIBE	Activated Pleasant	.37	Unactivated Unpleasant	.34	.86
ADJ	Activated Unpleasant	.99	Unactivated Pleasant	.44	
AGREE	Activated Unpleasant	.60	Unactivated Pleasant	.32	
DESCRIBE	Activated Unpleasant	.64	Unactivated Pleasant	.36	.88

Note. ADJ=Adjective format; AGREE=Agree-Disagree format; and DESCRIBE=Describes Me format. indicates the latent correlation between the hypothesized opposites in a confirmatory factor analysis, each variable indicated by three scales with different response formats. All coefficients are significant at .001 level.

results from the CIRCUM analysis. The six pairs of hypothesized opposites were approximately 180°apart.

Individual Measurement Models

In this section, we examine the ability of the various affect scales to assess the original four structures from which the scales were developed. To examine how well each of the four structural models accounted for the data, we used confirmatory factor analysis, with each latent construct indicated by three scales with different (unipolar) response formats. For all confirmatory factor models, the following parameters were estimated: (a) factor loading between each manifest variable and its intended latent construct, (b) error term associated with each manifest variable, and

Table 2. Indices of Fit for Measurement Models

Model	χ^2	df	RMSEA (90% CI)	APGI (90% CI)	CFI
CMQ Constructs					
Model with correlated constructs	233.28	48	.10 (.08 / .11)	.89 (.86 / .92)	.93
Model with correlations between constructs fixed to zero	974.67	54	.17 (.16 / .18)	.70 (.66 / .73)	.66
Thayers Constructs					
Model with correlated constructs	237.80	48	.10 (.08 / .11)	.89 (.86 / .92)	.94
Model with correlations between constructs fixed to zero	991.07	54	.18 (.17 / .19)	.68 (.64 / .71)	.71
Larsen & Dieners Constructs					
Model with correlated constructs	192.66	48	.09 (.07 / .10)	.91 (.88 / .94)	.96
Model with correlations between constructs fixed to zero	1078.28	54	.21 (.20 / .22)	.59 (.56 / .62)	.71
Watson & Tellegens Constructs					
Model with correlated constructs	9.23	5	.05 (.00 /.10)	.98 (.94 / 1.00)	1.00
Model with correlations between constructs fixed to zero	61.69	6	.15 (.12 / .19)	.84 (.76 / .90)	.97

Note. RMSEA=Root Mean Square Error of Approximation; APGI=Adjusted Population Gamma Index; CFI=Comparative Fit Index. Ipsative scores were used in all models, except Watson & Tellegens where raw scores were used.

(c) correlations between latent constructs.

Table 2 gives indices of fit for all measurement models. For each hypothesized model, we estimated a corresponding comparison model where the correlations among all latent constructs were fixed to .00. This comparison model thus posits orthogonal unipolar factors. Let us take CMQ as an example. The hypothesized model fit the data significantly better than did a comparison model:

Chi-square change (6, N=365)=741.39, p <.001, and RMSEA changed from .10 to .17. In all analyses, the comparison model was noticeably worse than the hypothesized model. The RMSEA for the hypothesized models ranged from .05 to .10 and appeared to favor no one model here over another. In addition, all were considered adequate to proceed. We believe there might be two reasons that the RMSEA values are not lower. First, as stated by Steiger (1998), when the variables are highly correlated, as in the present study, the weighting function may tend to produce higher discrepancy function values than when the correlations are low, yielding relatively high RMSEA. Second, all of the models here were being tested with preliminary translations. None had the advantage of being honed through repeated item selection.

Specific parameters[2] for one of the measurement models - that for CMQ - are given in Table 3. As expected, factor loadings were substantial and statistically significant, indicating that the manifest variables are reasonable indicators of their intended latent constructs. The latent constructs were related in the way expected: Pleasant was related highly and negatively with Unpleasant (－.92); Activated related highly and negatively with Deactivated (－.99). The remaining off-diagonal coefficients were moderate or small, ranging from －.16 to －.11. When the analyses were repeated allowing the errors for the same response format to be correlated, some of the correlations were quite substantial indicating that ipsatization does not eliminate all systematic error. Nonetheless, we report the simpler (without correlated errors) models here to minimize capitalizing on chance correlations. In any case, the patterns of latent correlations among the affect variables was robust regardless of the analytic techniques adopted.

The Full Two-Dimensional Affective Space

We now turn to our hypothesis of a common two-dimensional space underlying all the affect scales examined here. In the following, we adopted two ways to test such a space.

Structural Equation Models

One way to demonstrate the common space shared by these affect constructs of different origins was to use the bipolar axes(viz., Pleasure

2) Parameter estimates for other measurement models are available from the first author upon request.

Table 3. Measurement Models for CMQ Scales: Confirmatory Factor Analysis

Construct	Format	Pleasant	Unpleasant	Activated	Deactivated
			Standardized Factor Loading		
Pleasant	ADJ	.88*			
Pleasant	AGREE	.95*			
Pleasant	DESCRIBE	.82*			
Unpleasant	ADJ		.85*		
Unpleasant	AGREE		.88*		
Unpleasant	DESCRIBE		.89*		
Activated	ADJ			.53*	
Activated	AGREE			.58*	
Activated	DESCRIBE			.61*	
Deactivated	ADJ				.68*
Deactivated	AGREE				.58*
Deactivated	DESCRIBE				.62*
			Interfactor Correlation		
Pleasant		---			
Unpleasant		.92*	---		
Activated		.15	.11	---	
Deactivated		.16	.12	.99*	---

Note. ADJ=Adjective format; AGREE=Agree-Disagree format; DESCRIBE=Describes Me format.
* $p \leq .01$.

and Arousal) as exogenous variables to predict the remaining affect constructs, as endogenous variables. We could then test the prediction that the two axes explain most of the reliable variance in all other constructs.

To specify the exogenous side, we began with a confirmatory factor model(which we call Model 1) with two latent constructs, corresponding to the bipolar axes of Pleasure and Arousal. Each latent construct was indicated by the bipolar versions of its three scales with different response formats. The semantic differential scale of Pleasure was specified to load only on the Pleasant versus Unpleasant construct; the semantic differential scale of Arousal to load only on the Activated versus Deactivated construct. Loadings for other manifest affect scales were estimated. The latent correlation between the two axes was fixed to .00. Model 1 fit the data well: chi-square(20, N=365)=71.76, RMSEA=.09(90% CI=.07/ .11), APGI=.94(90% CI=.91/.94), and CFI=.97. The resulting parameter estimates represent possibly the best representation of the axes of Figure 1 and thus were used to define the exogenous side in subsequent analyses.

In the next series of analyses, we used the parameter estimates from Model 1 to define the exogenous side of structural equation models predicting each of the remaining affect constructs, treated as endogenous. In each analysis, we estimated (a) factor loading between a manifest variable and the endogenous construct, (b) regression weights of the endogenous construct on the exogenous constructs, (c) percentage of variance explained by the exogenous constructs for each endogenous construct. In total, we examined 10 structural equation models (four from Thayer, four from Larsen and Diener, and

Table 4. Affect Constructs Explained by the Pleasant versus Unpleasant and Activated versus Deactivated Axes

Construct	Indices of Fit				Regression Weights		
	chi-square	*RMSEA* (90% CI)	*AGFI* (90% CI)	*CFI*	Pleasant versus Unpleasant	Activated versus Deactivated	Variance Explained (SE)
Thayers constructs							
Energy	167.61	.07 (.06 / .09)	.94 (.92 / .96)	.97	.70	.62	87.8 (2.5)
Tiredness	147.64	.07 (.05 / .08)	.95 (.93 / .97)	.97	.41	.58	50.0 (4.5)
Tension	166.18	.07 (.06 / .09)	.94 (.92 / .96)	.97	.75	.52	84.3 (2.6)
Calmness	163.13	.07 (.06 / .08)	.94 (.92 / .96)	.96	.73	.47	76.0 (3.6)
Larsen & Dieners constructs							
Activated Pleasant	154.50	.07 (.05 / .08)	.95 (.93 / .97)	.97	.71	.57	81.8 (2.9)
Unactivated Unpleasant	170.06	.07 (.06 / .08)	.94 (.92 / .96)	.96	.68	.48	69.9 (3.5)
Activated Unpleasant	163.52	.07 (.06 / .09)	.94 (.92 / .96)	.97	.94	.18	91.7 (1.8)
Unactivated Pleasant	116.84	.05 (.04 / .07)	.97 (.95 / .98)	.98	.81	.43	83.8 (2.6)
Watson & Tellegens constructs							
Positive Affect	149.84	.07 (.05 / .08)	.95 (.93 / .97)	.97	.60	.52	62.9 (3.7)
Negative Affect	184.08	.08 (.06 / .09)	.94 (.91 / .95)	.96	.88	.21	81.6 (2.2)

Note. *df* for 2 = 58. All regression coefficients are significant at .001 level.

two from Watson and Tellegen). Results are summarized in Table 4.

All hypothesized models fit the data well with a mean RMSEA of .07. Affect constructs were substantially explained by the two axes. The mean variance explained was 77% (range=50% to 92%). The pattern of relations between the exogenous variables and the endogenous variable was approximately as expected in Figure 1. Consistent with results obtained in English, the four structures can be comfortably integrated into a two-dimensional space (Russell, Yik, & Steiger, 2003; Yik, Russell, & Feldman Barrett, 1999).

CIRCUM.

Another way to examine the common space was to portray the full representation of all constructs simultaneously within a two-dimensional space. To do so, we used a structural equation modeling program (CIRCUM) developed by Browne (1992) to examine how well our data conformed to a circumplex structure. This program provides fit indices and angular position for each input variable (see Fabrigar, Visser, & Browne, 1997; Remington, Fabrigar, & Visser, 2000 for details). Ipsative data are likely inappropriate for CIRCUM analyses and we therefore used the non-ipsative versions of the scales (Michael Browne, personal communication, September 12, 2002).

This analysis uses the unipolar affect scales. (The semantic differential scales were not used in this analysis.) First, a score was created for each of the 14 unipolar constructs by summing the z-scores of its three scales with different response formats. A 14 x 14 correlation matrix was then computed with the resulting sums and was submitted to the maximum likelihood estimation using CIRCUM. Pleasant was designated as the reference variable(its location was fixed at 0°). The locations of other variables were then estimated relative to Pleasant. The communality estimates of all variables were left free to vary. No constraints were put on the minimum common score correlation.

The analysis converged on a solution in 22 iterations. Four free parameters were specified in the correlation function equation; additional free parameters did not improve the model fit. The final model had a total of 45 free parameters and 60 degrees of freedom.

Results are shown in Figure 2. The four cornerstone variables(Pleasant, Unpleasant, Activated, and Deactivated) were located close to the predicted values: With Pleasant fixed at 0°, Activated was 85° away, Unpleasant was 168° away, and Deactivated was 273° away. Hypothesized bipolar opposites were located close to the predicted values: For example, Activated was 188(from its bipolar opposite, Deactivated. Constructs developed by various investigators fell remarkably close to what we see in Figure 1.

Nevertheless, the circumplex model fit the data only moderately well: chi-square (61, N=365)=442.22, RMSEA=.13 (90% CI=.12/.14). The circumplex too is but an approximation. One explanation to account for the marginal levels in the fit indices is that CIRCUM is not able to estimate systematic error in the present data sets. Present and past findings show that affect scales can include substantial amounts of systematic as well as random error (Green, Goldman, & Salovey, 1993). Removing the systematic errors may be necessary to pinpoint the underlying structure. Another (complementary) possibility is that additional substantive dimensions account for some of the variance in the original affect scales. Still another possibility currently being explored in our laboratory is non-linear relation between manifest and latent variables (Carroll, Russell, & Reynolds, 2001).

Discussion

A research program on affect requires the development of the measuring instruments and their use in developing hypotheses, often in the form of structural models. In this study, we took the expedient of borrowing instruments and structures already developed for English-speaking people, namely Russell's(1980) circumplex of Pleasure and Arousal, Thayer's(1996) energetic and tense arousal, Larsen and Diener's(1992) eight combinations of pleasantness and activation, and Watson and Tellegen's(1985) positive and negative activation(Watson, Wiese, Vaidya, & Tellegen, 1999). Given scales that were only slightly revised after translation, we were able to begin the study of our proposed integrated model in Korean with a head start. Nevertheless, all the scales and structures that we developed in this article must be subjected to further psychometric development with other Korean samples.

The present findings lend support to the viability of the model in Figures 1 and 2 as an integration of various dimensional models for momentary affect in Korean. To compare the Korean results (Figure 2) with those in English (Figure 1), one can simply superimpose the two figures on top of each other. It becomes immediately obvious how similar the empirical placements of the affect variables are. The locations of the variables agree very well with the original authors' conceptualizations: For instance, Thayer (1996) defined his Energy scale as pleasant activation and it indeed fell in the pleasant activated quadrant in Figure 2; Larsen and Diener's (1992) Activated Unpleasant fell in the unpleasant activated quadrant.

The present study adopted the "imposed-etic" approach (Berry, 1969; Church & Katigbak, 1989; Yik & Bond, 1993) in which translations of scales originating from Canada were administered to a sample of Korean respondents. This approach emphasizes similarities across languages/cultures and can be blind to indigenous constructs or processes. Given the richness of the emotion lexicon of Korean, the possibility remains that additional affect dimensions or even different structural models would emerge with more indigenous input items. Such additional dimensions or different structural models would complement rather than contradict our model (Figures 1 and 2), which emphasizes what is common across languages. Put differently, results obtained in the present study represent a first step towards studying the structural model of affect in the Korean language. Here affect was studied at a broad general level high in the affect hierarchy, and further studies are much needed to examine more specific affective dimensions at a lower level in the hierarchy. We suspect that cultural differences will be more obvious the lower one goes in that hierarchy (see Bond, 1993; Russell & Yik, 1996).

In addition to studying the structure of affect, a huge number of tasks remain. One of our goals in the present study was therefore to provide ready-to-use, psychometrically sound affect measures for use in Korean. We end here by noting that these scales provide a brief and efficient means of capturing affect for Korean-speaking respondents. Completing all 44 scales takes about 25 minutes. In basic research on structural relations between affect and other psychological variables (e.g., Yik & Russell, 2001; Yik, Russell, Ahn, Fernández Dols, & Suzuki, 2002) in which measurement errors must be minimized and parameters estimated with maximal precision, it is possible to use all 44 scales. In many research problems, however, it would be more practical to use one of the three response formats. Alternatively, one could use multiple response formats but only some of the affect variables. (See Green, Goldman, and Salovey, 1995, for a discussion of the advantages of multiple response formats.)

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한국인들의 정서 척도 및 구조

Michelle S. M. Yik
Hong Kong University of Science and Technology

James A. Russell
Boston College

안 창 규
부산대학교 교육학과

이 논문은 한국사람이나 카나다 사람이나 순간적으로 느끼는 정서구조의 기본적 측면은 동일하다는 것을 보여준다. 순간정서를 평가하기 위해서 네 개 양식의 척도가 개발되었고, 각 척도는 Feldman, Barrett 및 Russell(1998)의 쾌, 불쾌, 활성화, 비활성화, Thayer(1996)의 에너지와 긴장, Larsen과 Diener(1992)의 쾌와 활성화의 여덟 개 조합, 그리고 Watson과 Tellegen(1985)의 긍정적 정서와 부정적 정서를 포함하고 있다. 365명의 한국인의 표집에서 새로운 척도는 심리 측정적으로 영어문화권의 카나다 인에서 나타난 것과 관련성이 있었다. 다시 말해서 새 척도의 정서 차원은 이차원적 양극 정서 공간으로 통합될 수 있었다.

주요어 : 정서, 순간정서, 정서구조, 정서척도