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Studying Affect Among the Chinese: The Circular Way

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Past research on Chinese emotion has been plagued by the lack of a measurement map for affective feelings. In this article, I developed a fine-grained circumplex model of affective feelings that is arbitrarily defined by 12 segments. I created twelve 4-item self-report scales to measure affect felt during a clearly remembered moment ($N = 395$), and I cross-validated them twice with affect felt during the current moment (Ns = 269, 302). The structural and psychometric properties of these scales were strongly supported. The CIRCUM-extension procedure (M. Browne, personal communication, June 12, 1999) that places external correlates into the affective space showed that 28 of 28 mood states and 6 of 13 traits were significantly related to affect. External correlates did not clarify which of the affect dimensions were basic. The newly developed scales will serve as a useful tool in assessing affect among Chinese people and as a platform on which to extend the nomological net of affect.

Observers both inside and outside of the Chinese culture have speculated about the emotion of Chinese people (Russell & Yik, 1996; Yik, in press). What in their emotional lives do Chinese people share with all other human beings and what is unique to the Chinese? How do Chinese people describe the emotion they experience, and how is their affective experience organized? The structure of affective experience is the focus of this article, at the heart of which is the enterprise of construct validation (Cronbach & Meehl, 1955). I developed a 12-segment circumplex model to map the affective experience of Chinese people and establish its nomological net by placing other mood scales and trait dimensions within the circumplex space. With this fine-grained model, the relations between affect and other psychological processes can be delineated in a more precise way. Affect can then be described using an entire circumplex structure rather than a few dimensions.

Elucidating the structure underlying affective experience among the Chinese has spearheaded more than two decades of research efforts. Russell (1983) began with the least-adequate pool of 28 emotion-related words (simply through translation of English terms). Subjects were Chinese-speaking residents of Canada, and they provided an indirect measure of similarity through a sorting procedure. Multidimensional scaling resulted in a circumplex model in which emotion-related words fell roughly in a circle, with its axes interpretable as pleasure–displeasure and arousal–sleepiness. Despite this humble beginning, the circumplex has turned out to be robust across changes in method. For example, a similar result was obtained from Hong Kong Chinese in a study in which emotion words were bypassed altogether by using facial expressions shown in photographs (Russell, Lewicka, & Niit, 1989; see also Chan, 1985). Mauro, Sato, and Tucker (1992) found the pleasure and arousal axes when correlations among affect ratings of remembered emotional episodes were subjected to multidimensional scaling. Based on commonly used words for emotions in Chinese, Hamid and Cheng (1996) developed the Chinese Positive Affect and Negative Affect scales. Taken together, these early studies have proffered initial support for the circumplex model as a pragmatic tool to organize affective experience among Chinese people.

In the past decade, various dimensional models have been proposed to characterize the covariations of self-reported 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 affect. Each has achieved psychometric success and inspired a line of active research.

As the names of the principal dimensions of these models suggest, they all seem to capture similar phenomena and are therefore ripe for integration. One proposal is that all dimensions fit within the same two-dimensional space with 45° between the major dimensions (Larsen & Diener, 1992; Russell, 1979; Watson & Tellegen, 1985). Attempts have been made to integrate these dimensional models in English-speaking communities. Results have shown that the models fit comfortably within a two-dimensional space, defined by the bipolar axes of pleasure and arousal (Barrett & Russell, 1998; Carroll, Yik, Russell, & Barrett, 1999; Yik, Russell, & Barrett, 1999). The integration received strong validation when attempts were made to test its generalizability in different languages including Spanish, Chinese, Japanese, and Korean (Yik, 2007, 2009a; Yik, Russell, Ahn, Fernández Dols, & Suzuki, 2002).

Yik and Russell (2003) tested the integration of the dimensional models in two independent samples of Chinese people. Subjects were asked to report their affect for a clearly remembered moment. The dimensional models were mappable onto one another within the integrated space. On the right-hand side of Figure 1 are the pleasant states; on the left-hand side are the unpleasant states. The upper half shows the activated states; the lower half shows the deactivated states. Any specific affective state is composed of different blends of pleasure and arousal. The affect dimensions fall in a circular ordering along the perimeter. This circumplex structure of affective states has received strong empirical support (Remington, Fabrigar, & Visser, 2000).

As shown in Figure 1, the cornerstone constructs were located close to the predicted values: With Pleasant fixed at 0°,

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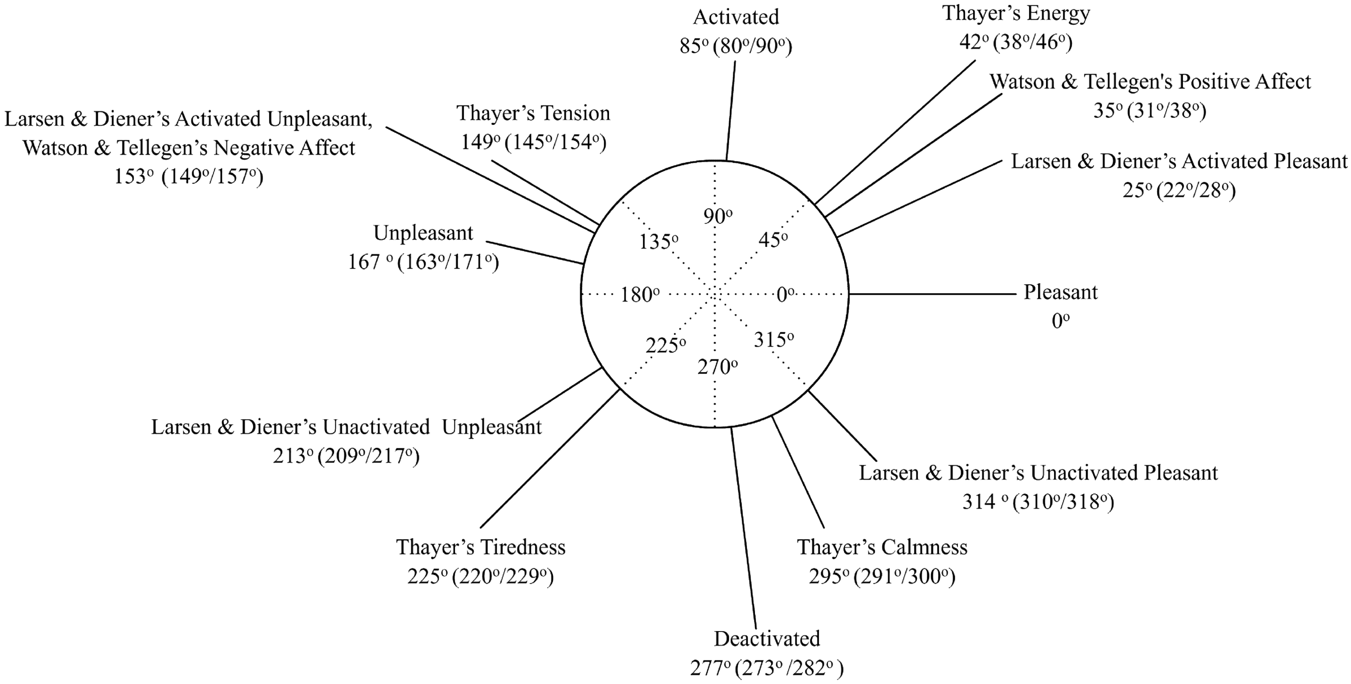

FIGURE 1.—Integration of dimensional models of affect. From Yik and Russell (2003). Figures given are estimates of polar angles with the 95% confidence intervals in parentheses.

Activated was 85° away, Unpleasant was 167° away, and Deactivated was 277° away. The remaining 10 constructs developed by various researchers fell remarkably close to the predicted quadrants. Thayer's (1996) constructs were closer to the vertical axis of activation; Larsen and Diener's (1992) and Watson and Tellegen's (1985) were closer to the horizontal axis of pleasure. Interestingly enough, these affect constructs fell at various angles within the space in Figure 1 and not only in multiples of 45°. Similar results were revealed when parallel analyses were repeated with the constituent items. Taken together, these results challenge the usefulness of the 45° metaphor, but they are consistent with the assumption of a circumplex model such that variables fall at any place along the circumference and that the space is thoroughly bipolar. In this article, I examine how individual items spread throughout the integrated space with new samples, and I attempt to carve out a finer grained structure of affect among Chinese people consisting of 12 segments approximately 30° apart.

In this finer grained descriptive model, the target angle between segments is 30° rather than 45°. The resulting segments provide a level of precision that allows better estimates of affect. Rather than rely on eight segments, I now rely on 12 to tap a person's affect. If these 12 segments were to fit the data well, then presumably the space could be carved up into any number of segments. Indeed, the number of segments is a matter of convenience (or preference). Although I strive for equal spacing in the model, it is not, strictly speaking, a requirement for a circumplex. Although affect is tapped by 12 segments, the model is still parsimonious because in this circumplex model, the 12 segments are reducible to two dimensions (pleasure and arousal).

In developing the descriptive structure, I advance on the state of research in this area on a number of fronts. First, I developed verbal self-report scales to tap the Chinese Circumplex Model of Affect (CCMA) in a large sample, and then I cross-validated the scales' structural and psychometric properties with two independent samples. These scales should stimulate future research on Chinese affect, whose development has been plagued by the lack of comprehensive measurement tools in the last 20 years.

Second, I established the nomological net of the CCMA by relating it to mood scales, including Mehrabian and Russell's (1974) semantic differential scales and Watson, Clark, and Tellegen's (1988) Positive Affect and Negative Affect Schedule (PANAS). The CCMA was also related to trait scales including Costa and McCrae's (1992) NEO Five Factor Inventory (NEO FFI) and Yik and Bond's (1993) Sino-American Person Perception Scale (SAPPS).

Third, I examined the issue of the proper rotation of this descriptive space. Although there is a widespread agreement on the two-dimensional structure of affect, the proper rotation of the axes remains controversial. Pleasure–displeasure (0°–180°) and activated–deactivated (90°–270°) are used in my model (Figure 1); this rotation is one of the viable alternatives, but any other pair of nonredundant axes can mathematically explain the matrix variance equally well. Some scholars have argued that the basic dimensions are at 45° and 135° of Figure 1. These diagonal vectors are approximately what Watson and Tellegen (1985) defined as positive affect and negative affect. Affect dimensions at 45° and 135° are "basic," it is said, because they correlate with the personality dimensions of Extraversion and Neuroticism (Costa & McCrae, 1980; Meyer & Shack, 1989; Tellegen, 1985; Watson & Clark, 1992). On the other hand, other scholars have found that personality correlates did not cluster at 45° and 135° when a greater variety of personality variables were included in the investigation (Yik & Russell, 2001; Yik, Russell, & Steiger, 2009; Yik et al., 2002; see also Larsen &

Diener, 1992). Indeed, some came just as close to the horizontal axis of pleasure–displeasure or to the vertical axis of activation–deactivation. In this article, I reexamine this rotation issue by extending the investigation to the full Big Five model of personality and an indigenous measure of personality. I deployed an entire circumplex model to relate affect to personality variables.

Fourth, I demonstrated the circumplex model to provide a simple but powerful mechanism for charting the relationship between affect and any external variable (i.e., a variable not included within the CCMA), be the variable a mood state or a trait. The principle is that any external variable that correlates with a CCMA segment will correlate with the remaining segments in a systematic way: The magnitude of the 12 correlations rises and falls in a cosine wave pattern as one moves around the circumference (see Stern, 1970; Wiggins, 1979; Yik & Russell, 2004; Yik et al., 2009).

To place an external variable on the circumference, I pressed for service the CIRCUM-extension procedure (M. Browne, personal communication, June 12, 1999). Not only does this procedure allow one to reexamine the idea that external correlates identify the basic axes of affect, its success provides a much needed alternative to the zero order correlations relating one affect dimension and one external variable at a time (e.g., Watson & Clark, 1992). Rather than assume that an external variable correlates with only one segment (e.g., positive affect with Extraversion, negative affect with Neuroticism), researchers are forced to remain open to any location in the CCMA structure. Hence, the structure allows researchers to go beyond the test of the significance of zero order correlations to the estimation of precise angles within the CCMA space. Rather than examine the correlation of that external variable to an existing affect segment, the precise location of that external variable within the entire circle is estimated—even when the location is not currently defined by a measured segment.

To achieve these goals, I conducted three studies, across which participants were asked to focus on a single moment and to report their feelings in that thin slice of time. Moments were sampled in different ways: Participants described how they felt during a clearly remembered moment in Study 1 and during the current moment in Studies 2 and 3. One method is not necessarily superior to the other, but similarity in the results in spite of these methodological differences speaks to the robustness to the CCMA structure.

Study 1: Creation of the CCMA

In Study 1, participants completed an affect questionnaire about their feelings in a thin slice of time. The questionnaires included items that capture different quadrants of a circumplex structure. I then used the data to create scales for a new circumplex structure.

I asked participants to remember a specific moment from the previous day and to describe how they were feeling at that moment. In this way, although the questionnaire was long, the participant focused on a single moment during an ordinary day, specifically a day that did not include participation in this study. This "remembered moments" method is not better than, but complements, the more typical methods, such as the "current mood" method. The method's advantage is that the moments so sampled are likely to be more representative of experiences in the external, nonlaboratory world. Its disadvantage is its reliance on memory. To minimize this problem, participants were asked to select a specific moment that was well remembered, and mealtimes were used as "memoric" anchors (Larsen & Fredrickson, 1999). This method mirrored Kahneman, Krueger, Schkade, Schwarz, and Stone's (2004) Day Reconstruction Method, which was found to yield similar results in reported feelings with those collected with an experience sampling method.

Method

Participants and procedure. Participants were 391 undergraduates (184 men and 207 women) in a university in Hong Kong. Their mean age was 21 years ($SD = 1.32$). They received course credit for their participation. Participants completed the questionnaires in a laboratory. All questionnaires were in Chinese.

Affect questionnaires.

Instructions: The front page of the battery provided general instructions under the title "Remembered Moments Questionnaire." Participants were asked to recall a specific moment from the day before. There were three versions of the questionnaire, each with a different anchoring time. The three anchoring times were "before breakfast," "before lunch," and "before dinner." I randomly assigned participants to one of the three instructions and asked them to record the specific moment on which they were reporting the affect.[1] 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 two versions, the italicized words were replaced with other anchoring times in the day. The instructions then emphasized that all subsequent questionnaires were to be answered with respect to that selected moment of the day before.

Affect Adjectives: Participants completed an affect questionnaire, which was a list of adjectives accompanied by a 5-point Likert scale ranging from 1 (*Not At All*) to 5 (*Extremely*). I took 61 adjectives directly from Yik and Russell (2003) and used them to score the affect dimensions defining the models of Barrett and Russell (1998), Larsen and Diener (1992), Thayer (1996), and Watson and Tellegen (1985). To represent areas within the two-dimensional space that are sparsely populated by items (e.g., affective states that are neutral in pleasure but low or high on arousal), I added 52 new (Chinese) items. Altogether, there were 113 items in the questionnaire.

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[1] All participants specified the moment on which they based to report their affect.

Semantic Differential Scales: The "state" version of Mehrabian and Russell's (1974) semantic differential scales of Pleasure and Arousal was used. Each dimension consisted of six bipolar pairs of adjectives in semantic differential format.

Affect Grid Scales: I modified the Affect Grid (Russell, Weiss, & Mendelsohn, 1989) by converting it into two bipolar rating scales, one on "Extremely Unpleasant versus Extremely Pleasant" and another on "Extremely Sleepy versus Extremely Aroused." For each item, I asked participants to indicate their mood by choosing one of the nine boxes located between each pair of polar opposites.

Data analysis. I submitted correlation matrices for the manifest variables to structural equation modeling using SEPATH in Statistica (Steiger, 1995) and CIRCUM (Browne, 1992). I obtained completely standardized solutions. (Thus, I scaled both latent and manifest variables to a variance of 1.) In SEPATH, many different indexes 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), I used four indexes to assess model fit when data samples were analyzed separately. For Browne's (1992) CIRCUM, I reported only chi-square and root mean square error of approximation (RMSEA).

First, I used the chi-square statistic. 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 such that it can be significant even for models that fit the data relatively well (Bentler, 1990).

Second, I used the adjusted population gamma index (APGI). APGI provides a direct measure of goodness of fit. This index (Steiger, 1989, 1995) is an estimate of the population equivalent of the adjusted goodness-of-fit index (AGFI) 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 I report here may be regarded as a bias-corrected version of the AGFI.

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

Fourth, I used Steiger and Lind's (1980) RMSEA. This index can be regarded as a root mean squared standardized residual. RMSEA is 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.

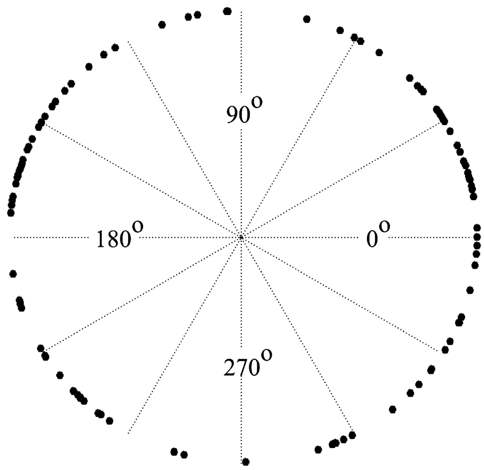

FIGURE 2.—A circumplex analysis of 113 individual items (Study 1, $N = 391$).

Each of these four indexes I used to evaluate the goodness or badness of fit in this study is associated with underlying statistical assumptions. Each has its strengths and weaknesses. In evaluating the reasonableness of the structural models tested here, all four indexes were considered simultaneously. All hypothesized models should be viewed as candidates to understand what the underlying structures are rather than as strictly true or false. Alternative models vary in terms of reasonableness. These four indexes are useful as overall guidelines and best used as indexes that compare nested models. The degree of agreement among the indexes on how well the model fit the data is important.

Results

In the results section, I examine, first, the distribution of the affect adjectives along the circumference of the two-dimensional space; second, I consider the viability of creating 12 adjective scales to characterize a circumplex model; and third, I look at the circumplexity of the newly created affect segments.

Analysis of individual items. Figure 1 shows how the scales tapping the four models fell in a common two-dimensional space; these scales were originally designed to fall 45° apart (Yik & Russell, 2003). With data from Study 1, I placed all items into a two-dimensional space as shown in Figure 2. In all, I ipsatized,[2] intercorrelated, and submitted to exploratory factor analysis 113 items. Based on an unrotated two-factor solution, I created a circular ordering of the items by estimating the angular position for each item using its factor loadings.[3] Even though derived from scales aimed at 45° differences, the items

[2]Affect ratings are always contaminated by the presence of a general factor (Bentler, 1969). Ipsatization removes individual differences in grand means and variances. This procedure is recommended for assessing circumplexity of data (Acton & Revelle, 2004; see Di Blas, 2007; Yik & Russell, 2003). To ipsatize the "satisfied" item, for instance, I deducted an individual's grand mean of all 113 items from that individual's satisfied rating; this difference is divided by the standard deviation of the 113 ratings for the same individual. I ipsatized each rating by 113 items.

[3]In the principal component analysis of the 113 ipsative items, the first 4 eigenvalues were 31.40 (27.79% of the total variance), 11.34 (10.04%), 5.60 (4.96%), and 3.53 (3.13%).

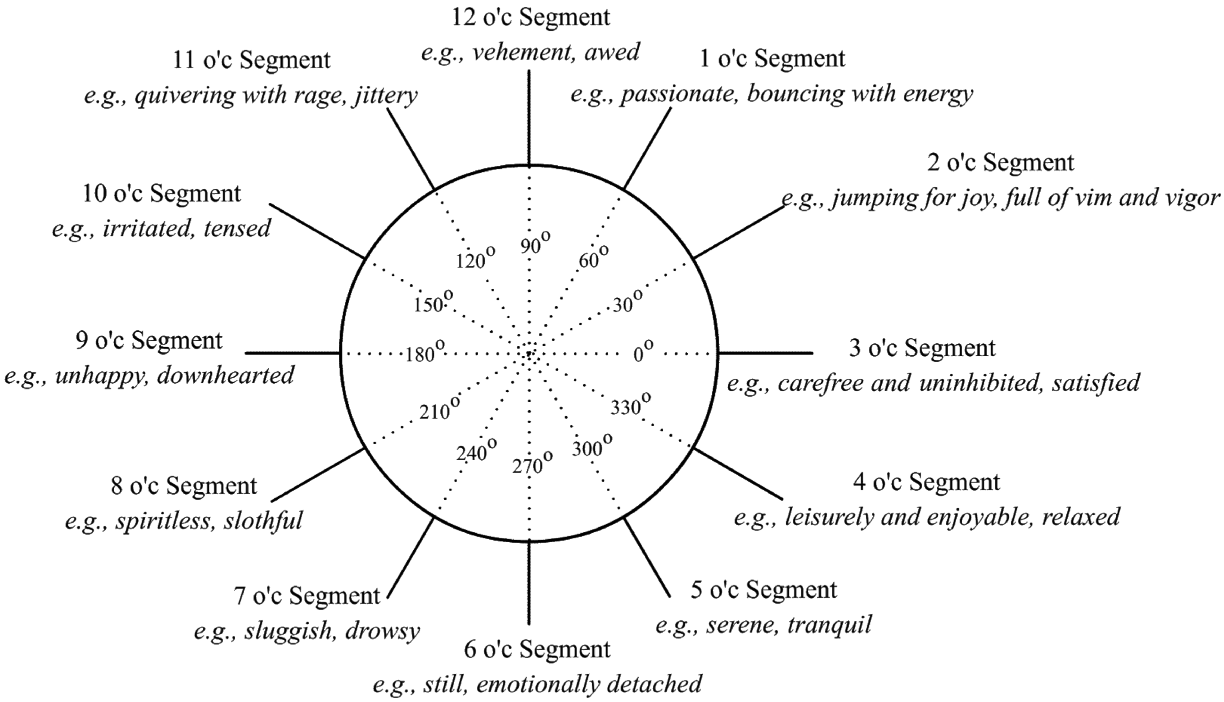

FIGURE 3.—The Chinese Circumplex Model of Affect (CCMA). This figure shows a schematic diagram of the hypothetical locations of the 12 segments.

clearly did not cluster in multiples of 45° and did not reveal a simple structure. Rather, they fell at various angles throughout the two-dimensional space.

Thus, analyses at both the scale level and the item level indicated that slicing the two-dimensional space into multiples of 45° is an arbitrary decision. I next examined the viability of yet another arbitrary decision—slicing the space into 12 segments approximately 30° apart. The target structure is shown in Figure 3.

Creation of 12 segments. Based on the circular order of items shown in Figure 2, I grouped the items into 12 segments (each roughly 30° apart). The process was simultaneously rational (based on the Cartesian space defined by pleasure and arousal shown in Figure 1), empirical (based on each item's position in the analyses of Figure 2), and practical (aimed at four items in each segment, 30° apart). In this process, I retained 48 items (4 items × 12 segments) to define the CCMA.

The clusters of items are shown in the Appendix and Figure 3. Their psychometric properties are given in Table 1. The metaphor of a clock was adopted to label the 12 segments: 1 o'clock (o'c) through 12 o'c. The horizontal axis, pure pleasure or displeasure with no hint of the accompanying level of arousal, is defined by the 3 o'c segment (e.g.,*carefree and uninhibited, satisfied*) and the 9 o'c segment (e.g., *unhappy, downhearted*). The vertical axis, pure activation or deactivation with no hint of the accompanying level of pleasure, is defined by the 12 o'c segment (e.g., *vehement, awed*) and the 6 o'c segment (e.g., *still, emotionally detached*). As Osgood (1966) demonstrated, words tend to convey both valence and arousal. Some emotion words demonstrate primarily pleasure with a secondary implication of arousal (e.g., *jumping for joy* in the 2 o'c segment); others demonstrate primarily high activation with a secondary implication of pleasure (e.g., *bouncing with energy* in the 1 o'c segment). Some emotion words demonstrate primarily deactivation with a secondary implication of pleasure (e.g., *serene* in the 5 o'c segment); others demonstrate primarily pleasure with a secondary implication of deactivation (e.g., *leisurely and enjoyable* in the 4 o'c segment). Although the clusters of items are but a first step, they emerged in a way that clarifies the meanings of words and phrases descriptive of affect among Chinese people and that provides a rationale for further development of its structure.

Placing the 12 affect segments in one affective space.

Variance Explained by the Bipolar Axes: One way to demonstrate whether the 12 segments fit comfortably within the CCMA structure was to treat, in Figure 3, the horizontal axis of Pleasure versus Displeasure (3 o'c to 9 o'c) and the vertical axis of Activation versus Deactivation (12 o'c to 6 o'c) as exogenous variables to predict each of the diagonal bipolar segments, treated as endogenous.[4] I tested a model that specified two latent constructs (Pleasure vs. Displeasure and Activation vs. Deactivation), each indicated by the bipolar measure of the axis, the semantic differential scale, and the affect grid rating. I fixed the correlation between the two latent constructs at .00. The hypothesized model fit the data well: $\chi^2(9, N = 391) = 57.48$; RMSEA = .11; APGI = .91; CFI = .96. I used parameter estimates from this model in defining the parameters on the exogenous side of the structural equation models examined in this section.

In each analysis, I estimated the regression weights of the manifest endogenous variable (e.g., the 1 o'c to 7 o'c bipolar

[4]I ipsatized each affect segment by the 12 scales.

TABLE 1.—Psychometric properties of the 12 CCMA segments.

Affect Segment (Hypothesized Angle)	Study	Variable θ	ζ	α	*M*	*SD*	Skew	Affect Segment (Hypothesized Angle)	Hypothesized Opposite θ	ζ	α	*M*	*SD*	Skew
3 o'c (0°)	Study 1	0°	.90	.88	2.46	1.02	.26	9 o'c (180°)	178°	.89	.91	1.81	.94	1.17
	Study 2	0°	.89	.84	2.04	.89	.89		180°	.88	.88	2.27	.98	.78
	Study 3	0°	.91	.82	2.22	.83	.53		167°	.92	.90	2.15	1.04	.72
2 o'c (30°)	Study 1	32°	.91	.89	2.20	.95	.36	8 o'c (210°)	213°	.92	.82	2.10	.90	.71
	Study 2	38°	.97	.90	1.70	.84	1.27		216°	.96	.82	2.74	1.02	.04
	Study 3	36°	.91	.87	2.08	.85	.69		208°	.94	.81	2.40	.97	.39
1 o'c (60°)	Study 1	60°	.89	.81	1.90	.82	.89	7 o'c (240°)	235°	.79	.83	2.21	.97	.65
	Study 2	65°	.89	.81	1.69	.77	1.20		231°	.84	.83	2.63	1.06	.24
	Study 3	67°	.91	.82	1.91	.82	.89		230°	.87	.80	2.36	.94	.59
12 o'c (90°)	Study 1	93°	.92	.74	1.50	.63	1.34	6 o'c (270°)	276°	.95	.68	2.29	.78	.42
	Study 2	82°	.96	.81	1.54	.70	1.55		284°	.93	.74	2.59	.85	.03
	Study 3	92°	.93	.77	1.72	.74	1.02		267°	.95	.66	2.48	.74	.21
11 o'c (120°)	Study 1	126°	.78	.71	1.28	.48	2.06	5 o'c (300°)	302°	.84	.90	2.53	1.00	.22
	Study 2	110°	.76	.72	1.40	.62	2.23		309°	.92	.89	2.55	1.02	.32
	Study 3	128°	.82	.81	1.49	.72	1.85		299°	.85	.88	2.62	.94	.31
10 o'c (150°)	Study 1	158°	.89	.80	1.74	.82	1.05	4 o'c (330°)	336°	.96	.85	2.73	.95	−.03
	Study 2	155°	.93	.81	2.30	1.00	.56		336°	.96	.86	2.46	.96	.39
	Study 3	148°	.86	.84	2.14	.98	.62		326°	.94	.86	2.60	.87	.16

Note. CCMA = Chinese Circumplex Model of Affect; o'c = o'clock; α = Cronbach's alpha. Study 1, $N = 391$; Study 2, $N = 269$; Study 3, $N = 302$. Possible scores range from 1 to 5 for each affect segment. Both the angle (θ) and the communality index (ζ) were computed in a CIRCUM analysis of the 12 affect segments in each data set.

segment) on the two exogenous constructs (Pleasure vs. Displeasure and Activation vs. Deactivation) and the percentage of variance explained by the exogenous constructs for each endogenous variable. I conducted a separate analysis for each of four off-diagonal, bipolar segments. Results are summarized in Table 2. All segments could be substantially explained by the two bipolar axes. The variance explained ranged from 59% to 83%, with a mean of 71%. The pattern of regression weights was approximately suggested in Figure 3. Results replicated the findings reported in previous studies (Yik & Russell, 2003; Yik et al., 1999, 2009).

Circumplexity of 12 Segments: To portray the full circumplex, I used a structural equation modeling program (CIRCUM; Browne, 1992). Ipsative data are likely inappropriate for CIRCUM analyses, and I therefore used the nonipsative versions of the 12 affect segments (M. Browne, personal communication, September 12, 2002). CIRCUM estimates the angle, theta (θ), on the circle for each variable, as well as a 95% confidence interval for that angle. CIRCUM also provides zeta (ζ), which is a communality index, the square root of the proportion of variance of each variable explained by the CIRCUM model.

In the CIRCUM analysis, I designated the 3 o'c segment as the reference variable (its location was fixed at 0º). I then estimated the locations of the remaining segments relative to 3 o'c. I left the communality estimates of all variables to vary. I did not put constraints on the minimum common score correlation.

The analysis converged on a solution in 22 iterations. Three 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 38 free parameters and 40 degrees of freedom. The data fit the model moderately well: χ^2 (40, $N = 391$) = 236.44; RMSEA = .11. Values of ζ ranged from .78 to .96.

The results are given in Table 1. The four cornerstone segments were located close to the predicted values: With the 3 o'c

TABLE 2.—Predicting affect segments from the bipolar axes.

Affect Segment		Indexes of Fit χ^2	RMSEA (90% CI)	APGI (90% CI)	CFI	Regression Weight Pleasure–Displeasure	Activation–Deactivation	VAF (*SE*)
1 o'c versus 7 o'c	Study 1	163.00	.11 (.09–.13)	.91 (.89–.94)	.91	.48	.65	65% (3.8)
	Study 2	44.24	.05 (.02–.08)	.98 (.95–1.00)	.99	.40	.70	66% (3.9)
	Study 3	76.27	.08 (.06–.10)	.95 (.93–.97)	.96	.40	.72	68% (3.9)
2 o'c versus 8 o'c	Study 1	131.13	.10 (.08–.12)	.93 (.90–.95)	.94	.77	.40	75% (2.6)
	Study 2	59.85	.07 (.05–.09)	.96 (.93–.98)	.98	.68	.50	72% (3.1)
	Study 3	102.95	.09 (.07–.12)	.93 (.90–.96)	.94	.69	.42	65% (3.5)
10 o'c versus 4 o'c	Study 1	172.85	.12 (.10–.13)	.90 (.87–.93)	.92	−.83	.36	83% (2.1)
	Study 2	71.13	.08 (.06–.10)	.95 (.92–.97)	.97	−.77	.42	78% (2.5)
	Study 3	58.28	.06 (.04–.09)	.97 (.95–.99)	.98	−.80	.41	80% (2.5)
11 o'c versus 5 o'c	Study 1	179.72	.12 (.10–.14)	.90 (.87–.92)	.90	−.40	.66	59% (4.1)
	Study 2	47.25	.05 (.03–.08)	.98 (.95–1.00)	.98	−.44	.76	77% (3.1)
	Study 3	62.23	.07 (.04–.09)	.97 (.94–.99)	.97	−.54	.66	72% (3.5)

Note. RMSEA = root mean square error of approximation; APGI = adjusted population gamma index; CI = confidence interval; CFI = comparative fit index; VAF = variance accounted for; *SE* = standard error; o'c = o'clock. Study 1, $N = 391$; Study 2, $N = 269$; Study 3, $N = 302$. χ^2 *df* = 25. All regression weights are significant at the .001 level.

segment fixed at 0°, the 12 o'c segment was 93° away, the 9 o'c segment was 178° away, and the 6 o'c segment was 276° away. Hypothesized polar opposites were located close to the predicted values: The 3 o'c segment was 178° from its bipolar opposite, the 9 o'c segment. The 12 o'c segment was 183° from its bipolar opposite, the 6 o'c segment. Cronbach's alphas for the 12 scales ranged from .68 to .91.

Studies 2 and 3: Cross-Validation and Placing External Variables Within the CCMA

Next I report on two additional studies, each with a similar purpose. I aimed each at cross-validating the 12 newly created segments using the current mood method, with data collected from different samples. I also placed various personality scales within the CCMA structure. Although affect and personality are different concepts, recent research suggests that personality can predict momentary affect (see Yik & Russell, 2001, 2004; Yik et al., 2002). As well, personality correlates have been used to argue for the proper rotation of the axes of the affect space (Meyer & Shack, 1989; Watson, Wiese, Vaidya, & Tellegen, 1999).

Methods

Participants and procedure. In both studies, participants were university undergraduates. In Study 2, $N = 269$ (111 men and 158 women); in Study 3, $N = 302$ (114 men and 188 women). Participants in Study 2 completed a battery of questionnaires concerning current mood using the affect measures. Participants in Study 3 completed two batteries of questionnaires, the first concerning current mood using the affect measures and the second using personality measures. They completed the questionnaires in a large lecture theatre.

Affect measures. In both studies, the questionnaires concerning momentary affect were titled "Mood Scales." Participants described their current feelings using the CCMA scales developed in Study 1. In addition, they also completed the semantic differential scales and affect grid scales used in Study 1.

In Study 2, affect measures also included the 20-item PANAS (Watson, Clark, & Tellegen, 1988). I used it to measure state version of Positive Affect and Negative Affect. Each construct was represented by 10 items, and these items were embedded in the CCMA scales. Responses were made on a 5-point rating scale ranging from 1 (*Not At All*) to 5 (*Extremely*). Cronbach's alphas were .88 for Positive Affect and .83 for Negative Affect.

Trait measures. In Study 3, respondents completed two personality inventories in the following order. The front page of the personality packet provided the instruction to " . . . describe yourself as you are GENERALLY and TYPICALLY."

NEO FFI: The NEO FFI is a 60-item questionnaire designed to measure the Five-factor model of personality (Costa & McCrae, 1992) including Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness. Each factor is represented by 12 items. Responses are made on a 5-point rating scale ranging from 1 (*Strongly Disagree*) through 3 (*Neutral*) to 5 (*Strongly Agree*). Each factor score was the mean of its 12 constituent items. Cronbach's alphas ranged from .54 to .87.

SAPPS: The SAPPS is a 32-item questionnaire designed to measure eight factors of personality including Emotional Stability, Extraversion, Openness to Experience, Intellect, Helpfulness, Assertiveness, Application, and Restraint (Yik & Bond, 1993). Each factor is represented by four bipolar pairs of adjectives. Responses are made on a 7-point rating scale. Each factor score was the mean of its four constituent items. Cronbach's alphas ranged from .55 to .83.

Results

In the results section, I examine, first, the cross-validation of the CCMA structure in the two independent samples; second, I establish the nomological net of the CCMA by placing 41 external correlates onto the circumplex.

Cross-validation of the CCMA structure. Descriptive statistics and alpha coefficients for the 12 CCMA scales are given in Table 1. The alphas ranged from .72 to .90 (Study 2) and .66 to .90 (Study 3). The cornerstone segments fell close to the expected locations within the circumplex. With the 3 o'c segment fixed at 0°, the 9 o'c segment fell at 180° (Study 2) and 167° (Study 3); the 12 o'c segment fell at 82° (Study 2) and 92° (Study 3); and the 6 o'c segment fell at 284° (Study 2) and 267° (Study 3).

To examine the integration of the 12 segments within one common space, I used the two bipolar axes (3 o'c to 9 o'c; 12 o'c to 6 o'c) as exogenous variables to predict each of the off-axes bipolar segments of the CCMA structure. Results for the four structural equation models are summarized in Table 2. All segments could be substantially explained by the two bipolar axes. The mean variance explained was 73% (Study 2) and 71% (Study 3). These results resembled those obtained in Study 1.

Finally, I examined the circumplicial structure of the 12 segments using CIRCUM. The (nonipsatized) data fit a circumplex model well. For Study 2, the fit indexes were $\chi^2(40, N = 269) = 101.55$, RMSEA = .08; for Study 3, the fit indexes were $\chi^2(40, N = 302) = 162.87$, RMSEA = .10. All 12 scales conformed reasonably well to the predicted structure as shown in Table 1.

In summary, the two-dimensional circular space established with Study 1 was replicated by the two new data sets from Studies 2 and 3. The 12 scales were found to be psychometrically sound and were properly aligned along the circumference of the space. Results were nearly identical to those obtained in Study 1, demonstrating strong cross-validation (see also Yik & Russell, 2003).

Placing mood variables into the CCMA space. Next, I turned to the relation of the CCMA to external mood variables (i.e., those not included in the CCMA scales). A substantial association between CCMA and the mood variables was anticipated. Table 3 gives the zero order correlations of mood states and the CCMA segments. As their names imply, the Pleasure scales correlated maximally with the 3 o'c segment; but they also correlated with other affect segments. As predicted by the 45° hypothesis, Positive Affect correlated maximally with the 2 o'c segment (30°) and Negative Affect with the 10 o'c segment (150°), although they correlated significantly with other segments as well. Zero order correlations were not helpful in charting the mood variables onto the CCMA space. Where, then, do the mood variables precisely fall?

TABLE 3.—Concurrent correlations between the CCMA segments and external correlates.

Study	Correlate	12 CCMA Segment											
		3 o'c	2 o'c	1 o'c	12 o'c	11 o'c	10 o'c	9 o'c	8 o'c	7 o'c	6 o'c	5 o'c	4 o'c
	Mood State												
1	Pleasure[a]	0.77	0.71	0.48	0.14	−0.22	−0.63	−0.69	−0.53	−0.32	−0.06	0.22	0.64
1	Arousal[a]	−0.04	0.28	0.39	0.37	0.20	0.17	−0.05	−0.23	−0.31	−0.44	−0.43	−0.26
1	Pleasure affect grid[b]	0.67	0.61	0.42	0.07	−0.28	−0.57	−0.66	−0.46	−0.24	−0.05	0.16	0.56
1	Arousal affect grid[b]	0.26	0.42	0.29	0.16	−0.01	−0.15	−0.22	−0.43	−0.61	−0.26	−0.06	0.17
1	Pleasant[c]	0.92	0.80	0.60	0.24	−0.13	−0.46	−0.54	−0.37	−0.24	0.05	0.29	0.74
1	Unpleasant[c]	−0.53	−0.40	−0.16	0.22	0.50	0.85	0.88	0.60	0.29	0.12	−0.15	−0.45
1	Activated[c]	0.33	0.56	0.47	0.25	0.08	−0.09	−0.20	−0.35	−0.48	−0.11	0.09	0.28
1	Deactivated[c]	0.26	0.05	−0.04	0.01	0.04	−0.05	0.10	0.20	0.33	0.80	0.81	0.47
1	Energy[d]	0.67	0.94	0.77	0.44	0.06	−0.23	−0.40	−0.42	−0.36	−0.06	0.16	0.55
1	Tiredness[d]	−0.41	−0.60	−0.36	−0.11	0.12	0.40	0.48	0.73	0.83	0.32	−0.07	−0.36
1	Tension[d]	−0.45	−0.24	0.01	0.39	0.58	0.92	0.74	0.49	0.28	0.07	−0.20	−0.45
1	Calmness[d]	0.47	0.22	0.02	−0.12	−0.15	−0.35	−0.18	−0.03	0.10	0.55	0.81	0.66
1	Activated pleasant[e]	0.77	0.93	0.75	0.42	−0.00	−0.33	−0.49	−0.41	−0.29	−0.06	0.18	0.60
1	Unactivated unpleasant[e]	−0.43	−0.52	−0.31	−0.03	0.25	0.63	0.72	0.80	0.75	0.41	0.01	−0.34
1	Activated unpleasant[e]	−0.52	−0.36	−0.12	0.24	0.54	0.85	0.79	0.54	0.28	0.09	−0.18	−0.49
1	Unactivated pleasant[e]	0.69	0.45	0.21	−0.03	−0.18	−0.48	−0.36	−0.18	−0.02	0.44	0.72	0.83
1	Positive affect[f]	0.60	0.81	0.76	0.55	0.19	−0.07	−0.25	−0.29	−0.25	0.05	0.23	0.46
1	Negative affect[f]	−0.46	−0.30	−0.05	0.33	0.62	0.88	0.82	0.54	0.29	0.11	−0.17	−0.45
2	Pleasure[a]	0.75	0.57	0.29	0.06	−0.28	−0.68	−0.73	−0.54	−0.31	0.13	0.37	0.62
2	Arousal[a]	−0.04	0.38	0.52	0.53	0.26	0.21	−0.10	−0.40	−0.45	−0.61	−0.50	−0.29
2	Pleasure affect grid[b]	0.64	0.50	0.23	0.01	−0.31	−0.60	−0.66	−0.44	−0.28	0.14	0.31	0.53
2	Arousal affect grid[b]	−0.13	0.25	0.46	0.55	0.42	0.27	0.00	−0.28	−0.27	−0.57	−0.46	−0.26
2	Positive affect[f]	0.57	0.78	0.72	0.57	0.26	0.03	−0.13	−0.23	−0.20	−0.01	0.26	0.44
2	Negative affect[f]	−0.26	0.00	0.33	0.40	0.57	0.81	0.71	0.43	0.28	−0.17	−0.27	−0.34
3	Pleasure[a]	0.72	0.58	0.29	−0.01	−0.36	−0.66	−0.69	−0.50	−0.29	0.02	0.38	0.62
3	Arousal[a]	0.03	0.35	0.51	0.42	0.19	0.19	0.01	−0.24	−0.37	−0.54	−0.46	−0.26
3	Pleasure affect grid[b]	0.65	0.54	0.30	−0.00	−0.35	−0.59	−0.64	−0.38	−0.18	0.04	0.32	0.56
3	Arousal affect grid[b]	−0.05	0.21	0.37	0.39	0.21	0.26	0.09	−0.12	−0.21	−0.40	−0.43	−0.27
	Trait												
3	Neuroticism[g]	−0.35	−0.24	−0.09	0.07	0.11	0.34	0.36	0.33	0.20	0.05	−0.16	−0.25
3	Extraversion[g]	0.18	0.21	0.14	−0.03	−0.12	−0.18	−0.22	−0.22	−0.15	−0.20	−0.08	0.06
3	Openness to Experience[g]	0.01	0.00	0.05	−0.01	−0.04	−0.00	−0.01	−0.00	−0.05	0.01	0.03	0.07
3	Agreeableness[g]	0.03	−0.01	−0.11	−0.18	−0.14	−0.13	−0.10	−0.14	−0.07	−0.02	0.01	0.05
3	Conscientiousness[g]	0.08	0.11	−0.00	−0.03	−0.02	−0.13	−0.20	−0.25	−0.21	−0.19	−0.01	0.04
3	Emotional stability[h]	0.21	0.12	0.00	−0.12	−0.11	−0.26	−0.21	−0.16	−0.04	0.08	0.20	0.26
3	Extraversion[h]	0.12	0.18	0.20	0.04	−0.07	−0.07	−0.10	−0.10	−0.07	−0.13	−0.09	−0.00
3	Openness to Experience[h]	0.12	0.15	0.22	0.09	−0.03	−0.08	−0.02	−0.06	−0.03	−0.06	−0.04	0.06
3	Restraint[h]	0.01	0.05	−0.04	−0.06	−0.07	−0.14	−0.09	−0.06	−0.10	−0.12	0.06	0.04
3	Intellect[h]	0.11	0.10	0.17	0.08	0.04	−0.06	0.01	−0.01	−0.03	−0.07	0.01	0.08
3	Application[h]	0.09	0.08	−0.02	0.02	0.06	−0.09	−0.14	−0.21	−0.18	−0.09	0.08	0.05
3	Assertiveness[h]	0.11	0.09	0.10	0.02	−0.00	−0.09	−0.04	−0.04	−0.04	0.02	0.12	0.09
3	Helpfulness[h]	0.09	0.13	0.06	−0.03	−0.08	−0.09	−0.06	−0.16	−0.12	−0.09	−0.04	0.05

Note. CCMA = Chinese Circumplex Model of Affect; o'c = o'clock. Study 1 ($N = 391$): $rs \geq |.13|$ were significant at the .01 level. Study 2 ($N = 269$): $rs \geq |.16|$ were significant at the .01 level. Study 3 ($N = 302$): $rs \geq |.15|$ were significant at the .01 level.

[a] Mehrabian and Russell (1974). [b] Russell, Weiss, and Mendelsohn (1989). [c] Barrett and Russell (1998). [d] Thayer (1996); [e] Larsen and Diener (1992). [f] Watson and Tellegen (1985). [g] Costa and McCrae (1992). [h] Yik and Bond (1993).

To place the external variables within the CCMA structure, the CIRCUM-extension procedure (M. Browne, personal communication, June 12, 1999) was used. This procedure provides a maximum likelihood estimate of the magnitude of the relation of the external variable to the entire circumplex, and, separately, an estimate of where within the circumplex the external variable falls. Zeta plus (ζ_+) estimates the magnitude of the relation; more precisely, it is a communality index measured by the square root of the proportion of variance of the external variable explained by the CIRCUM model for the CCMA structure. Theta plus (θ_+) estimates the angle within the circumplex for the external variable. Finally, variance accounted for (VAF) estimates the fit of the circumplex model to that external variable.

Results are given in Table 4. Based on Yik et al.'s (2009) analysis, confidence can be placed in CIRCUM-extension results when the estimated magnitude of the relationship (ζ_+) is .15 or greater; for results with lower values, no reliable and meaningful relation could be established. All 28 mood variables, including the 14 from Barrett and Russell (1998), Larsen and Diener (1992), Thayer (1996), and Watson and Tellegen (1985), passed this .15 hurdle. The mean VAF was 86.5% (range = 60%–97%). The mean ζ_+ for the 28 mood variables was .83 (range = .49–1.00); this high value is consistent with the idea that mood measures are closely related but not identical to the momentary affect tapped by the CCMA. The range of values of θ_+ shows that the mood variables fell around the circumference. Figure 4 illustrates the locations of these variables.

TABLE 4.—Placing 41 external variables within the CCMA structure via CIRCUM-extension.

Study	External Correlate	α	θ_+	ζ_+	VAF (%)
	Mood state				
2	Pleasure[a]	0.92	0°	0.88	83
1	Pleasure affect grid[b]	n/a	8°	0.82	80
1	Pleasure[a]	0.90	10°	0.94	83
1	Pleasant[c]	0.94	11°	1.00	96
1	Activated pleasant[e]	0.92	25°	1.00	97
1	Energy[d]	0.89	30°	1.00	97
1	Positive affect[f]	0.86	36°	0.92	97
2	Positive affect[f]	0.88	38°	0.81	94
1	Activated[c]	0.55	38°	0.62	87
1	Arousal affect grid[b]	n/a	40°	0.49	60
3	Arousal[a]	0.67	81°	0.59	72
2	Arousal[a]	0.66	89°	0.67	72
1	Arousal[a]	0.60	89°	0.52	65
3	Arousal affect grid[b]	n/a	96°	0.49	75
2	Arousal affect grid[b]	n/a	100°	0.67	82
2	Negative affect[f]	0.83	148°	0.91	97
1	Tension[d]	0.85	163°	0.97	97
1	Negative affect[f]	0.90	168°	0.99	97
1	Activated unpleasant[e]	0.89	171°	0.96	94
1	Unpleasant[c]	0.87	175°	1.00	95
1	Unactivated unpleasant[e]	0.82	203°	1.00	96
1	Tiredness[d]	0.82	210°	0.89	86
1	Deactivated[c]	0.59	289°	0.77	81
1	Calmness[d]	0.66	317°	0.80	96
1	Unactivated pleasant[e]	0.80	337°	0.92	97
3	Pleasure affect grid[b]	n/a	355°	0.83	84
3	Pleasure[a]	0.91	356°	0.93	82
2	Pleasure affect grid[b]	n/a	358°	0.76	81
	Trait				
3	Application[h]	0.55	17°	0.14	32
3	Conscientiousness[g]	0.82	21°	0.15	03
3	Extraversion[g]	0.77	21°	0.24	44
3	Helpfulness[h]	0.62	21°	0.14	44
3	Openness to experience[h]	0.79	39°	0.18	80
3	Extraversion[h]	0.83	39°	0.18	65
3	Intellect[h]	0.68	42°	0.15	77
3	Neuroticism[g]	0.87	180°	0.44	83
3	Agreeableness[g]	0.60	324°	0.07	00
3	Emotional stability[h]	0.70	336°	0.31	79
3	Openness to Experience[g]	0.54	346°	0.04	37
3	Restraint[h]	0.66	353°	0.06	00
3	Assertiveness[h]	0.58	359°	0.14	82

Note. CCMA = Chinese Circumplex Model of Affect; VAF = variance accounted for; α = Cronbach's alpha; n/a = not applicable. Theta plus (θ_+) estimates the angle within the CCMA structure for each external variable. Zeta plus (ζ_+) is a communality index, the square root of the proportion of variance of each external correlate explained by the CIRCUM model for the CCMA structure. VAF is the amount of variance explained when a series of correlations between each external correlate and the 12 affect segments was fitted to a predefined cosine function.

[a]Mehrabian and Russell (1974). [b]Russell, Weiss, and Mendelsohn (1989). [c]Barrett and Russell (1998). [d]Thayer (1996). [e]Larsen and Diener (1992). [f]Watson and Tellegen (1985). [g]Costa and McCrae (1992). [h]Yik and Bond (1993).

Of particular interest are the converging results of the same constructs measured in the three studies I report here. The semantic differential scale of Pleasure was included in all three studies. The results were similar, although different studies used different recall methods. Values of θ_+ ranged from 0°, 10°, and 356°; values of ζ_+ were high, ranging from .88 to .94. Similar results were obtained for the semantic differential scale of Arousal: Values of θ_+ were 81°, 89°, and 89°; values of ζ_+ ranged from .52 to .67. I assessed Positive Affect in two of the studies, and again the results were strikingly replicated; values of θ_+ were 36° and 38°; values of ζ_+ were .81 and .92. Negative Affect yielded 148° and 168°and values of ζ_+ of .91 and .99.

Placing trait variables into the CCMA space. Table 3 gives the zero order correlations of trait variables and the CCMA segments. As predicted, Neuroticism was maximally correlated with the 9 o'c segment (180°), but it also correlated with other segments. Extraversion was maximally correlated with the 2 o'c segment (30°), but it also correlated with other segments. The zero order correlations were once again not helpful in charting the trait variables onto the CCMA space. Consequently, I mapped the relation of CCMA to the trait variables using CIRCUM-extension.

Table 4 gives the results. Of the 13 traits, only 6 yielded a ζ_+ value of .15 or greater; the mean VAF was 71.3% (range = 44%–83%). The magnitude of relation between CCMA and the trait variables was modest, and the mean value of ζ_+ for the six trait variables was .25 (range = .15–.44). Figure 4 illustrates the locations of the trait variables with a ζ_+ value of $\geq$ .15. Of these six variables, two operationalizations of Extraversion were used, and these scales fell at 21° and 39° (values of ζ_+ were .18 and .24). Similarly, Neuroticism fell at 180°. Emotional Stability, the flip side of Neuroticism, fell at 336°, just 156° away from Neuroticism. The angular differences may reflect genuine differences in the conceptualization of the trait constructs themselves and certainly deserve future research efforts.

As compared with the results of the mood scales, the trait variables bore weaker relations with momentary affect, although the range of values of θ_+ showed that trait variables fell at different locations on the perimeter. The contrast between mood states and trait variables speaks to the debate about the distinction between states and traits (Allen & Potkay, 1981; Zuckerman, 1983).

GENERAL DISCUSSION

Like continental drift, progress is slowly being made in the psychology of affect, moving from divided opinions on what emotion Chinese people experience and how their affective experience is structured to a consensus on a two-dimensional model as a comprehensive descriptive map. A descriptive structure, although necessary in any scientific analysis, is but a first step. The geometric model in Figure 3 is a valuable and heuristic tool for the study of Chinese emotion. The 113 items cannot be completely accounted for by the two dimensions in the circumplex space. The 12 segments represent yet another approximation to map affective experience. I argue that the CCMA describes momentary affect among Chinese people at the most general level. In the decade to come, this model will serve as "the Christmas tree on which findings of stability, heritability, consensual validation, cross-cultural invariance, and predictive utility are hung like ornaments" (Costa & McCrae, 1993, p. 302).

Progress in the Structure of Affect Among Chinese People

To capture momentary affect among Chinese people, a simple but instructive structure was offered: the CCMA as schematically portrayed in Figure 3. The robustness of this structure across three independent Chinese samples is consistent with recent findings that mood and emotion often fit a circumplex quite well (Fabrigar, Visser, & Browne, 1997; Remington et al., 2000; Yik & Russell, 2003; Yik et al., 2009).

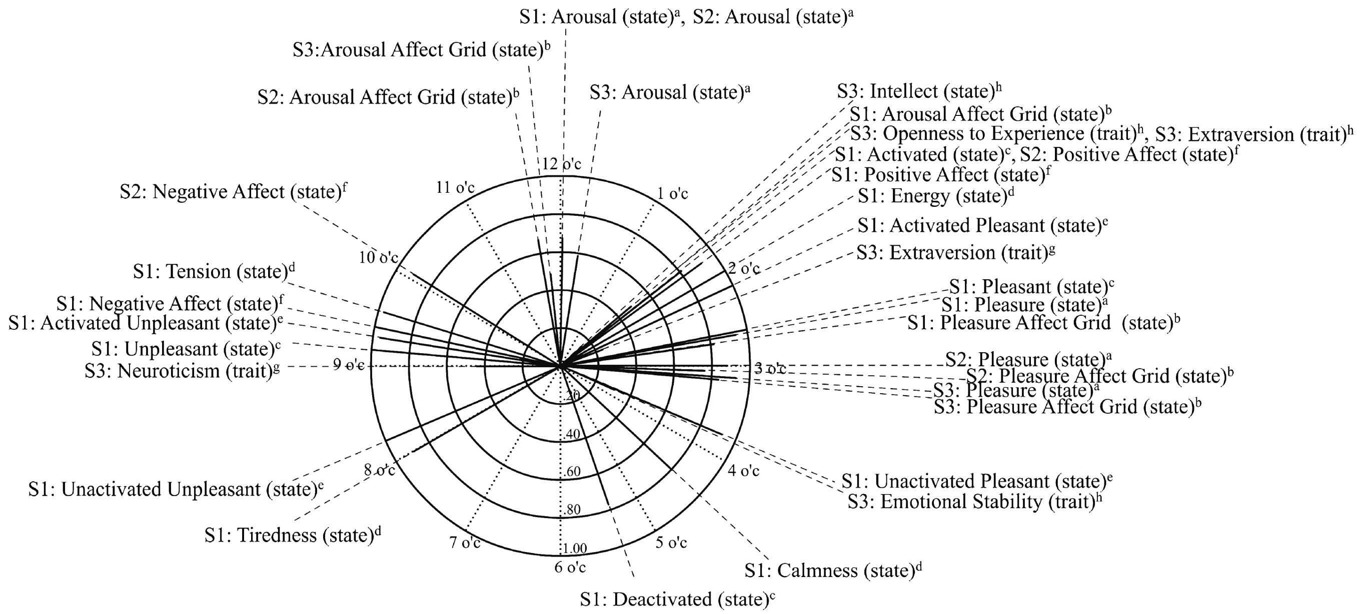

FIGURE 4.—Integrating 34 external correlates within the Chinese Circumplex Model of Affect structure. The angles show the theta plus (θ_+). The length of the solid lines from the center shows zeta plus (ζ_+). S1 = Study 1, $N = 391$; S2 = Study 2, $N = 269$; S3 = Study 3, $N = 302$. [a]Mehrabian & Russell (1974); [b]Russell, Weiss, & Mendelsohn (1989); [c]Barrett & Russell (1998); [d]Thayer (1996); [e]Larsen & Diener (1992); [f]Watson & Tellegen (1985); [g]Costa & McCrae (1992); [h]Yik & Bond (1993).

What is the proper interpretation of the structure? Converging evidence suggests that it is a model grounded on pleasure and arousal. In Figure 3, the horizontal axis captures feelings along the positive (feels good) versus negative (feels bad) valence dimension. From the time of Socrates and Plato, writers have described the role of pleasure and displeasure in human affairs. Pleasure is once again playing a significant theoretical role in psychology (Cabanac, 1995; Kahneman, Diener, & Schwarz, 1999; Russell, 2003). The vertical axis captures the long-standing research tradition that a major dimension of mood and emotion involves activation (e.g., Berlyne, 1960; Cacioppo, Berntson, Larsen, Poehlmann, & Ito, 2000; Cannon, 1927; Schachter & Singer, 1962; Thayer, 1996). In my studies here, activation refers to how aroused one feels, independent of whether that feeling is positive or negative. One can feel activated in a positive (*bouncing with energy*) or negative (*quivering with rage*) way. One can feel deactivated in a positive (*leisurely*) or negative (*sluggish*) way.

One of the key contributions of this article is the development of the CCMA scales in 12 four-item scales. It takes approximately 8 min for participants to complete all 48 items. Because of the structural properties of these 12 affect segments, the resulting scores can be used to estimate a person's location on the two bipolar axes of the circumplex structure (see Wiggins, 1995). From these, researchers can easily project a person's affect onto the circumplex model yielding a precise angular estimate, where there does not need to be a measured segment, in the CCMA structure. Using an entire structure rather than individual variables to represent a person's affect opens the door to a new avenue of assessment. This "short" measure allows researchers to obtain a parsimonious estimate of a person's affect, which is, at the same time, supported by a comprehensive measurement procedure. In the long run, this short measure will prove very useful for continuous assessment of Chinese affect (see Russell, Weiss, et al., 1989).

Rotational Issue

Investigators have long speculated on close ties between predispositions and affect. Recently, some writers have argued that Extraversion (E) and Neuroticism (N) are fundamentally affective in nature (Lucas, Diener, Grob, Suh, & Shao, 2000; Tellegen, 1985; Watson & Clark, 1997). Watson et al. (1999) marshaled evidence that because E and N corresponded to Positive Activation and Negative Activation, these affect dimensions were "basic" axes (approximately 45° and 135°) in the circumplex space in Figure 3. External correlates were proposed to identify the correct rotation within the circumplex model.

What is the proper rotation of the space in this data? Consistent with Larsen and Diener (1992), personality scales in this study fell at different locations along the perimeter of the model in Figure 4, leaving no hint which rotation is more basic than the others. Extraversion fell at the 2 o'c segment (21° and 39°); extraverts tend to be "*jumping for joy*" and are "*full of vim and vigor.*" Openness to Experience and Intellect fell also close to the 2 o'c segment. Neuroticism (and Emotional Stability) came close to the horizontal axis of 3 o'c to 9 o'c. Emotionally unstable people were found to be more likely to experience unpleasant affect, but the affective states are as likely to be activated as deactivated.

This result is inconsistent with previous findings in which Neuroticism was repeatedly found to be correlated with unpleasant activated affect (between 10 o'c and 11 o'c in Figure 4; Watson & Clark, 1992). However, that study did not measure the horizontal axis of Figure 4. My result is consistent with previous studies in which the entire circumplex model has been measured in which Neuroticism fell close to displeasure (Yik & Russell, 2001; Yik et al., 2002). Taken together, the inconsistent findings among the studies underscore once again the importance of a comprehensive affect measurement, one that is grounded on a strong theoretical foundation. My findings also lend support to the argument that personality correlates do not help to resolve the rotational issue, namely, the most basic rotation of the two-dimensional space (Larsen & Diener, 1992).

Just like any other correlational study, these data did not speak to the question of rotation. Thus, the descriptive map in and of itself does not imply that pleasure and arousal cause other affective feelings or even that pleasure and arousal are more basic than other rotational variants. Rather, the choice between competing rotations must be made on the basis of other conceptual considerations. Larsen and Diener (1992) and Reisenzein (1994) have provided conceptual arguments in favor of pleasure and arousal. Nonetheless, my data make one contribution to this debate by showing that a circumplex model defined by pleasure and arousal map affective feelings among Chinese people, and the model integrates Positive Activation and Negative Activation among others.

Limitations and Future Research Directions

The focus of this article is the structure of momentary affect. Affective feelings ebb and flow over the course of a day. To identify a thin slice of time for reporting affect, I relied once on a remembered moments method and twice on a current mood method. The use of each method can be questioned.

To get a broader range of moments, I used a remembered moments method in which participants recalled a clear moment from the day before. Presumably, this new method represents an improvement over the alternative current mood instruction in which participants' current feelings might change from item to item over the course of completing a long questionnaire. The moments so sampled are likely to be varied and representative of experiences outside the laboratory environment. Still, reliance on memory might be a problem. Once memory is involved, it is legitimate to question a person's ability to remember the feelings in that single moment of time that occurred in the past. These momentary ratings may be susceptible to all sorts of retrospective biases that open up the possibility for culturally influenced emotion schemas (Robinson & Clore, 2002; Tulving, 1993) affecting the structure of affect.

To test the robustness of the remembered moments method, I cross-validated the circumplex structure with the more typical current mood method. Perhaps the feelings that exist in the laboratory are milder than what occurs in the nonlaboratory world. In all cases, participants were seated and asked to start the questionnaire. Feelings at such a moment may be restricted in range.

What is reassuring is that a very similar structure and patterns of external correlates emerged across these method variations. Memory is less of an issue in the current mood method; restricted variance is less of an issue in the remembered moments method. Research with more methodological variation is needed to verify the robustness of my conclusions, but the studies I reported here, especially against the background of prior research on mood and emotion, make the CCMA a promising hypothesis and tool (Remington et al., 2000; Diener & Emmons, 1984). Future research should be directed at cross-validating the circumplex structure with different time chunks such as those captured in experience sampling and different time frames (see Kahneman et al., 2004; Russell & Carroll, 1999).

The structure of affect has been assumed to be static across contexts. Some writers have suggested that, rather than static, the structure is dynamic, that is, influenced by the context of assessment (e.g., Zautra, Berkhof, & Nicolson, 2002) or by the cultural background of the respondents (e.g., Bagozzi, Wong, & Yi, 1999). The supportive evidence relies on zero order correlations between two composite scales, variously named Positive Affect and Negative Affect. Such evidence is no more than suggestive. A difference in the zero order correlation between two measured variables has various interpretations and is not the most revealing statistic for questions about the static versus dynamic nature of the affective space.

To test the dynamic structure hypothesis, one proposal is to place the hypothesis in the context of an entire affective structure such as the newly developed CCMA. Rather than relying on the zero order correlations between two affect composite scales, the CCMA opens up the entire space as a testing ground. Will the circumplex structure vary as a function of individual differences variables? Will stressed people yield a different circumplex space than will nonstressed people (see Yik, 2009b)? Will people with a valence or arousal focus yield a different shape of the affective space (see Feldman, 1995)? How about people with different levels of affective differentiation (Terracciano, McCrae, Hagemann, & Costa, 2003)? These are interesting research questions worthy of future research efforts.

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APPENDIX . The English translations of the Chinese Circumplex Model of Affect (CCMA) scales.

Affect Segment	Item
3 o'c Segment (0°)	Carefree & uninhibited, content, satisfied, at ease
2 o'c Segment (30°)	Jumping for joy, full of vim & vigor, vivacious, peppy
1 o'c Segment (60°)	At a high tide of feelings, passionate, encouraged, bouncing with energy
12 o'c Segment (90°)	Stimulated, aroused, vehement, awed
11 o'c Segment (120°)	Quivering with rage, stunned, jittery, shocked
10 o'c Segment (150°)	Irritated, uptight, tensed, anguished
9 o'c Segment (180°)	Unhappy, downhearted, feeling low, grey hearted
8 o'c Segment (210°)	Spiritless, slothful, lethargic, lifeless
7 o'c Segment (240°)	Half awake & half asleep, sluggish, drowsy, immobile
6 o'c Segment (270°)	Still, calm, unhurried, emotionally detached
5 o'c Segment (300°)	Serene, quiet, placid, tranquil
4 o'c Segment (330°)	Even-tempered, leisurely & enjoyable, relaxed, emotionally stable

Note. o'c = o'clock. Copyright 2009 by Michelle Yik. The full instructions together with the items are available from the author on request.