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RESEARCH PAPER

Culture and the Structure of Affect: A Bifactor Modeling Approach

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Abstract This paper tested the impact of culture on the basic structure of affect. It examined positive affect and negative affect at three levels of activation in the U.S. and China. It used a well-suited tool, the bifactor model, to separate the common variance shared by all types of affect from the variance unique to each. The findings indicate that the structure of affect is different cross-culturally. In the U.S., the most fundamental dimension is defined by moderate activation of positive affect and negative affect, which is the largely bipolar dimension of pleasure-displeasure, whereas in China, it is defined by moderate activation of positive affect only, which is pleasure. In both cultures, negative affect across levels of activation forms another important dimension. Beyond these basic dimensions, secondary dimensions are also identified in both cultures: high activation positive affect, low activation positive affect, and low activation negative affect. They form relatively weak unique factors, independent of the two basic dimensions, suggesting that they are largely mixtures of the basic dimensions.

Keywords Culture · Positive affect · Negative affect · Pleasure-displeasure · Affect activation · Well-being · Bifactor model

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1 Introduction

Affect is central to human cognition, motivation, and well-being, as every aspect of human life is filled with affective experiences. Understanding the basic dimensions of affect thus has important theoretical and applied implications. For instance, positive affect and negative affect have been proposed as core domains for organizing research on psychopathology, treatment, prevention, and basic research at the National Institute of Mental Health (Insel et al. 2010). One critical issue is whether culture affects the fundamental dimensions of affect. This subject has been debated for more than a decade and is still a key question to the study of affect cross-culturally. One view argues that positive affect and negative affect form a bipolar dimension universally (Yik 2007). The other view proposes that the relation between positive affect and negative affect is culturally bound (Bagozzi et al. 1999; Scollon et al. 2005). In particular, people from the Aristotelian Western cultural tradition may experience positive affect and negative affect as opposites, given that they are conceived as oppositional categories. In contrast, Eastern thought of dialectic philosophies may lead to the experience of affect in a harmonious way and thus individuals can experience positive affect (PA) and negative affect (NA) simultaneously.

However, existing research on this controversy has two major limitations. First, the debate has been centered primarily on the valence of affect (i.e., the relation between PA and NA), even though the affective space is defined by other dimensions as well such as activation. Composite scores of PA and NA were often created by averaging a diverse collection of terms that varied along the dimension of activation, which creates a potential confound between the impact of valence and of activation. It is possible that the relation between PA and NA may change depending upon the level of activation. It is also possible that relation between PA and NA may vary depending upon cultural contexts. Thus, valence, activation, and culture may interact in determining the magnitude as well as the direction of the relation between PA and NA. Second, the study of affect has been hindered by lack of proper statistical tools to represent the complex relations among different types of affect. Specifically, the existing methods, such as correlations, regression analysis, and conventional confirmatory factor analysis, cannot separate two important sources of variation: commonality shared by different types of affect and the unique variance specific to each type (i.e., High PA, Moderate PA, Low PA, High NA, Moderate NA, and Low NA).

The present investigations were conducted to address these limitations in previous research. Specifically, the aim of this paper is two-fold: (a) to test the competing views on the basic structure of affect cross-culturally. To examine whether the relations between PA and NA would change depending on the level of activation, we sampled a full range of affective experiences by crossing affective valence (i.e., positive and negative) with different levels of activation (i.e., high, moderate, and low). We conducted two studies in China, a more collectivistic oriented culture, and two studies in the United States, a more individualistic oriented culture. And (b) to separate the commonality shared by all types of affect from the variances unique to each, we used a well-suited statistical tool, the bifactor model, to study the structure of affect. The general factor(s) in the bifactor will likely capture the basis dimensions of affect, whereas the group factors will likely represent the secondary dimensions of affect.

We first present different views on how culture affects the relation between PA and NA, and then introduce various perspectives on a broader but important issue that goes beyond PA and NA, which is the basic structure of affect. Finally, we present how bifactor model

can provide a viable statistical tool for testing the fundamental dimensions of affect cross-culturally.

1.1 Culture and the Experience of Positive and Negative Affect

Can you experience happy and sad at the same time or does it depend upon your cultural origin? Researchers have engaged in heated debate regarding this issue. One view argues that PA and NA are bipolar opposites of one continuum and this nature of bipolarity is culturally universal (Yik 2007). However, the other view proposes that the relation between PA and NA is influenced by culture. Specifically, PA and NA should be more independent in East Asia than in North America (Bagozzi et al. 1999; Schimmack et al. 2002; Scollon et al. 2005).

The researchers with the cultural view argue that PA and NA are not intrinsically related to each other. Rather, their relation is dictated by the dominant cultural tradition of the person experiencing the affect. People from different cultural traditions may think and therefore experience affect differently. In particular, people from the Aristotelian Western cultural tradition tend to experience PA and NA as opposites, as they are conceived as oppositional categories like day and night. One is either happy or sad but not both. Therefore, individuals from the West are likely to perceive the experience of happiness in opposition to the experience of sadness. This should lead to a strong negative correlation between PA and NA.

In contrast, Eastern thought may lead to the experience of affect in a dialectic way and thus individuals can experience PA and NA as compatible. Specifically, one unique feature of Asian philosophies is its dialectic nature (Peng and Nisbett 1999). Dialectic philosophies do not necessarily consider opposites as contradictory. In contrast, the opposites can exist harmoniously. Consequently, the dialectic way of thinking can impact how people experience opposing affect (e.g., happiness and sadness). In particular, dialectic thinking is more accepting of the idea that opposing affect may coexist. Therefore, dialectic cultures should produce weaker negative correlations between PA and NA. In other words, PA and NA should be less negatively related in dialectic East-Asian cultures than in cultures without dialectic philosophies.

Initial support for the cultural hypothesis comes from comparisons of the relation between ratings of PA and NA (Bagozzi et al. 1999). Participants from East Asia (China and South Korea) and North America (the U.S.) reported the frequency of general feelings (i.e., on average over a long period of time). As expected, PA and NA were negatively correlated in the U.S., whereas they were less negatively or even positively correlated in China and Korea. Hence, these findings suggest that Americans seem to experience PA and NA as bipolar opposites, but East Asians appear to experience these emotions in a more harmonious fashion.

In a large scale cross-cultural examination of the bipolarity thesis, researchers (Schimmack et al. 2002) extended previous investigations by analyzing data from 38 different nations that included several Asian dialectic cultures, as well as Western cultures. Participants were asked to report how often they experienced four pleasant emotions (joy, contentment, affection, and pride) and four unpleasant emotions (sadness, fear, anger, and guilt) during the past month. The multilevel analysis revealed that there was no association between the frequency of PA and frequency of NA in East Asia (average $r = -.04$), but there was a negative correlation in the Western countries (average $r = -.23$), supporting the cultural view on the relation between PA and NA.

Other researchers (Scollon et al. 2005) replicated this pattern using the experience sampling methodology. They examined the relation between PA and NA in five cultures by requesting participants to provide reports of affect every day for seven consecutive days. To compute affect frequency, data were aggregated over different occasions of 7 days. This approach made it possible to study the structure of both momentary and trait affect. For momentary affect, although the correlation between the composite score of PA and of NA (i.e., scores of PA and NA that differ on the activation level were averaged to form one single score for PA and one single score for NA) was negative in all five samples, the magnitude was weaker in East-Asian samples (average $r = -.31$, for East-Asian Americans and Japanese) than in other samples (average $r = -.41$, for European Americans and Hispanic Americans). The difference was even more pronounced between single measure of happiness and sadness ($r = -.22$ in East-Asian samples vs. $r = -.39$ in European and Hispanic Americans). Cultural difference also emerged for the ratings of trait affect in terms of frequency as well as intensity of experiencing an affect. Specifically, PA and NA were positively correlated in Asian samples ($r = .27$ for frequency and $r = .26$ for intensity) but uncorrelated in non-Asian samples ($r = .03$ for frequency and $r = .03$ for intensity).

A similar pattern was obtained with a different measure in a cross-cultural comparison (Kitayama et al. 2000). Participants from the U.S. and Japan reported how frequently they experience different types of PA (e.g., friendly feelings, ashamed) and NA (e.g., pride, angry). The correlations between PA and NA were mostly negative in the U.S., but mostly positive in Japan.

Further supporting evidence comes from a recent study conducted in the U.S. and China (Spencer-Rodgers et al. 2010). Participants completed the PANAS (Watson et al. 1988) by indicating their feelings in the past few weeks. There was a strong negative correlation between PA and NA among Euro-Americans ($r = -.61$), but no association among Chinese ($r = -.02$). This study further found that the possible mechanism, dialecticism, mediated the cultural difference in emotional complexity, which is the tendency to experience the co-occurrence of PA and NA.

Competing evidence, however, was also found in a study that examined the relation between PA and NA in five different cultures (Yik 2007). Participants were asked to remember an emotional moment and to report how they felt at that moment. The study included four East-Asian (two Chinese, one Japanese, one South Korean) and four Western samples (three North American, one Spanish). Participants rated PA and NA with three different response formats. Substantial negative correlations were found between PA and NA for all five cultures (r ranges from $-.51$ to $-.86$). However, a re-examination of Yik's data revealed that Asian dialectic thinking moderated the relation between PA and NA. Although PA and NA were also negatively correlated with each other in East-Asian countries, the magnitude was significantly smaller compared to the Western samples (Schimmack 2009).

In the present investigations, we propose a potential confound that could help address the inconsistent findings in the literature. As stated earlier, previous research only considered the role of valence, but failed to take into account the role of another important dimension, which is the activation level of affect. It is possible that the relation between PA and NA changes depending upon the activation level of affect. Further more, the relation between PA and NA could vary depending upon cultural contexts. To go beyond the relation between PA and NA, a major purpose of this paper is to test the influence of culture on the basic structure of affect. To accomplish this goal, it is important to review different perspectives on the fundamental structure of affect.

1.2 Views of the Structure of Affect

Researchers have engaged in heated debate regarding the fundamental dimensions of affect for several decades (Barrett and Russell 1999; Larsen and Diener 1992; Reisenzein 1994; Russell 1980, 2003; Stanley and Meyer 2009; Thayer 1989; Watson and Tellegen 1985), and the debate still continues (Yik et al. 2011).

Several different perspectives have been proposed, notably a one-dimensional view, two-dimensional views, and a three-dimensional view. The earlier one-dimensional view argues that the pleasure-displeasure dimension is the only basic structure of affect (Titchener 1908).

As research progressed, a two-dimensional model emerged and this is the model that has gained most of the attention in the field. Although different ways of interpreting the model exists, it seems that these various notations and conceptual framework share the same basic two-dimensional structure (Barrett and Russell 1999; Yik et al. 1999). The original pleasure-activation model is rooted in the work of Wundt (1912) and Schlosberg (1941). Most recently it is represented by Russell (1980), Larsen and Diener (1992), and Reisenzein (1994). Based on this perspective, the structure of affect is comprised of two basic bipolar dimensions: a pleasure-displeasure dimension and a general activation dimension (e.g., Barrett and Russell 1999; Reisenzein 1994; Yik et al. 1999; Barrett and Russell 1999). Pleasure-displeasure (or valence) refers to the hedonic nature of affective experience, whereas activation pertains to a sense of mobilization or energy, which is represented by a continuum ranging from sleep (at the low end), to drowsiness, relaxation, alertness, hyperactivation, and, finally, excitement (at the high end). The two dimensions are hypothesized to be orthogonal. This model proposes that other dimensions, such as tense and energetic arousal are mixtures of pleasure-displeasure and general activation. The two-dimensional model implies that correlations among the descriptors of core affect are expected to form a two-dimensional space and all other affective experiences can be placed on the two dimensional circumplex (e.g., Barrett and Russell 1999).

Another view acknowledges the presence of pleasure-displeasure and general activation, but defined the core feature of affective structure in terms of valence, that is PA and NA, and these two dimensions are expected to form relatively independent dimensions (Watson and Tellegen 1985). The positive and negative affect scale was developed (PANAS, Watson et al. 1988) based on this theoretical proposal. However, PANAS only assesses high activation PA and NA and has become arguably the most widely used affect instrument.

Others use a different set of dimensions that are assumed to be a 45° rotation of pleasure-displeasure and general activation. These dimensions are called energetic-tired arousal and tense-calm arousal, and are assumed to be the basic dimensions and to be orthogonal to each other (Thayer 1989). This model entails that pleasure-displeasure and general activation are mixture of energetic arousal and tense arousal.

Integrating these different views, the Larsen and Diener model (1992) divided the affective space into eight octants with four axes: pleasant-unpleasant, high-low activation, activated pleasant affect (i.e., excited)-unactivated unpleasant affect (e.g., tired), and activated unpleasant affect (e.g., jittery)-unactivated pleasant affect (e.g., calm). The latter two axes largely represent the energetic arousal and tense arousal concept (Thayer 1989).

The three-dimensional model proposes that affective experiences are mixtures of six basic feelings. Specifically, some of the feelings were considered mutually exclusive so that they were represented as three bipolar opposites, namely pleasure-displeasure,

tension-relaxation, and arousal-calmness. More recently, researchers argue that all three dimensions are basic affect dimensions, which are independent from each other (Schimmack and Grob 2000). That is, energetic and tense arousal are basic dimensions that cannot be reduced to mixtures of pleasure-displeasure and an orthogonal activation dimension, and similarly, pleasure-displeasure is not a mixture of energetic and tense arousal.

Recently, a more fine-grained circumplex model was developed (Yik et al. 2011). It attempts to integrate various dimensional models by representing the intercorrelations among the affective experiences in a circle. In the previous circumplex model, the eight octants (i.e., pleasure-displeasure, activation-deactivation, energy-tiredness, and tension-relaxation) are equally spaced within a two-dimensional structure. In this refined model, the concept of core affect is represented by a detailed descriptive structural model with more narrowly defined dimension. Finer distinctions are made between similar yet slightly different domains, such as "serene" as deactivated pleasure and "tranquil" as pleasant deactivation. This perspective argues that the entire circumplex structure, rather than a few dimensions, can be used to describe and assess the core affect. The circumplex model attempts to complement rather than compete with the dimensional perspective on affect, which focuses on identifying a simple structure as a means of characterizing the underlying dimensions of affective experiences.

Which dimensions reflect the basic components of affective experiences? At the center of the debate is the issue of which pair of axes reflect the fundamental, basic dimensions of affect. Empirical evidence suggests that a two-dimensional model often does not adequately represent the intercorrelations among the descriptors of core affects (Watson et al. 1999). Researchers argue that further dimensions are needed to provide a complete description of affective experiences (Reisenzein 1994; Barrett and Russell 1999; Watson et al. 1999). To test the three-dimensional model, researchers sampled affective items that reflect the three bipolar dimensions: pleasure-displeasure, awake-tiredness, and tension-relaxation (Schimmack and Grob 2000). Although it fit the data better than the two-dimensional model, the three-dimensional model per se did not fit the data adequately. Two possibilities remain: one is that the existing models do not represent the core features of affect and therefore new theories are needed to better capture the centrality of affect. Alternatively, the conventional statistical models cannot adequately represent the complex relations among the dimensions. The major goal of the present investigations is to use an alternative statistical approach, the bifactor model, to test the competing hypotheses regarding the fundamental dimensions of affect and to further examine whether the structure of affect would vary in different cultural contexts.

1.3 The Present Study: Bifactor Modeling of Affect

The bifactor model is well-suited for testing constructs that are comprised of multiple related yet distinct dimensions (Chen et al. 2006, 2012, 2013; Reise et al. 2007; Reise 2012). The bifactor model is comprised of one general factor that accounts for the commonality shared by different dimensions. Over and beyond the general factor, there are multiple group factors, each of which accounts for the unique influence of each dimension. Drawing on Spearman's (1927) concept of intelligence, for example, intelligence includes multiple related domain specific abilities such as verbal, spatial, mathematical, and analytic. The general factor will capture the general intelligence (i.e., the Big G) that is shared by the domain specific abilities. On the other hand, the group factors will account for the

unique variance of domain specific abilities, such as verbal, spatial, mathematical, and analytic, over and beyond the general intelligence.

The bifactor model may thus provide a promising solution to the longstanding debate regarding the basic structure of affect in that it has central advantages over traditional methods in the study of affect. First, the bifactor model can clearly separate the common variance shared by all types of affect from the variance unique to each type. The general factors will account for the commonality shared by different dimensions of affect, and the group factors will account for the unique influence of each dimension over and above the general factor. Conceptually, the general factors will likely capture the basic dimensions of affect, whereas the group factors will represent the secondary dimensions of affect.

Second, the bifactor model can be used to identify a dimension that may no longer exist, after taking into account the common variance shared with other dimensions. It is possible some dimensions of affect do not have unique variance once their shared variance with other dimensions is partialled out.

If pleasure-displeasure is the only basic dimension of affect (Titchener 1908, one-dimensional model), pleasure and displeasure should form a strong general factor, whereas all other dimensions should form relatively weak group factors, given that the variance should be explained largely by the general factor.

If the structure of affect is comprised of two orthogonal bipolar dimensions of pleasure-displeasure and general activation, whereas other dimensions, such as tense and energetic arousal, are mixtures of the two basic dimensions (e.g., Barrett and Russell 1999), then pleasure-displeasure and activation should form two strong and orthogonal general factors.

If the energetic arousal and tense arousal model (Thayer 1989), which is the 45° rotation of pleasure-displeasure and general activation model, captures the structure of affect, tense arousal and energetic arousal should form two orthogonal general factors.

If all three dimensions, pleasure-displeasure, tension-relaxation, and arousal-calmness, are essential to affective experiences (Wundt 1912), they are expected to form three bipolar factors.

Cross-culturally, if the structure of affect is equivalent, the basic dimensions identified by the bifactor model should be similar across different cultural contexts. On the other hand, if the structure of affect is subject to cultural influence, the basic and secondary dimensions revealed by the bifactor model should be different cross-culturally.

2 Method

2.1 Participants

Two studies were conducted in the U.S., one with a college sample (Study $1_{U.S.}$) and another with a non-college sample (Study $2_{U.S.}$). Study $1_{U.S.}$ included 1083 U.S. undergraduate introductory psychology students (686 women) at a medium sized Mid-Atlantic region university. They completed the study to fulfill their course research credit requirement. Their mean age was 18.67 (*SD* 1.95); 75.8 % were European American, 4.6 % African American, 10.5 % Asian American, 3.8 % Hispanic American, 1.7 % other, and 3.6 % chose not to answer the question. Study $2_{U.S.}$ included 523 (312 females) non-college U.S. participants from M-Turk who received a small monetary reward for taking part in the study. Their mean age was 34.57 (SD 12.94) and ranged from 18 to 75 years

old. The vast majority (77.1 %) of the participants were White/Caucasian, 7.8 % were Black not of Hispanic origin, 5.7 % were Asian, 4.4 % were Hispanic, .8 % were Black of Hispanic origin, .6 % were Native Hawaiian or Pacific Islander, and 2.8 % were other, unknown, or chose not to answer.

Two studies were also conducted in China, with both college samples (Studies 1_{China} and 2_{China}). Study 1_{China} included 465 undergraduate students (330 women) at a university in Northern China, and they received course credit for taking part in the study. Their mean age was 19.61 (SD 1.33). Study 2_{China} included 472 undergraduate students (357 women) at a university in Southern China. Their mean age was 19.70 (SD 1.11)

2.2 Affect Measures

Affective items were selected to measure PA and NA across a full range of activation, including low, moderate, and high levels of activation. Items were also selected to measure the six octants of the affect space (Larsen and Diener 1992) and represent tension-relaxation and arousal-calmness. Some researchers have argued that affective experiences should be described as pleasant, unpleasant, activated unpleasant, unactivated pleasant, rather than positive and negative, given that pleasant affect can be disruptive and unpleasant affect can be adaptive (Larsen and Diener 1992; Thayer 1989). We adopted the terminology of PA and NA for ease of presentation.

There is a general consensus regarding the descriptors of core affect. For example, researchers from the valence × activation camp list alert, excited, elated, happy, pleasant, contented, serene, relaxed, calm as examples of core affects along the dimension of activation for positive affect, and list fatigued, lethargic, depressed, sad, unpleasant, upset, stressed, nervous, and tense as examples of core affects along the dimension of activation for negative affect (Barrett and Russell 1999). These items overlap with the selection of pleasant, unpleasant, awake, tired, relaxed, and tense by the energetic and tense arousal camp (Steyer et al. 1994).

All measures were translated from English to Chinese by a bilingual psychologist. To ensure the measures represent the corresponding affect of Chinese, the Chinese version of the measures was discussed between the bilingual and a native Chinese psychologist. Finally, the Chinese version of the measures was back translated by another bilingual psychologist. Any discrepancies were resolved through discussion between the two bilingual psychologists.

2.2.1 High Activation Positive and Negative Affect

High PA and NA were assessed using the scales from PANAS (Watson et al. 1988). The Positive Affect scale consists of *active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud,* and *strong*. The Negative Affect scale consists of *afraid, ashamed, distressed, guilty, hostile, irritable, jittery, nervous, scared,* and *upset*. To measure trait affect, partcipants were asked to rate "*in general*" the extent to which they had felt each of the affects. The response scale ranged from 1 to 5 as follows: 1 (*very slightly or not at all*), 2 (*a little*), 3 (*moderately*), 4 (*quite a bit*), and 5 (*very much*). Cronbach's alpha for High PA was .85 and .90 for Study $1_{U.S}$ and Study $2_{U.S}$; .84 and .82 for Study 1_{China} and Study 2_{China}. Cronbach's alpha for High NA was .87 and .93 for Study $1_{U.S}$ and Study $2_{U.S}$; .85 and .89 for Study 1_{China} and Study 2_{China}.

2.2.2 Moderate Activation Positive and Negative Affect (Pleasure and Displeasure)

The adjectives were selected from the literature that captured moderate activation affect (e.g., Carroll et al. 1999; Russell and Caroll 1999; Watson et al. 1999; Yik et al. 1999). Moderate PA was measured by ten adjectives: *happy, joyful, delighted, pleased, glad, pleasant, satisfied, content, cheerful*, and *gratified*. Moderate NA was assessed by ten adjectives: *sad*, *gloomy*, *blue*, *depressed*, *unhappy*, *discontent*, *disappointed*, *dissatisfied*, *low-spirited*, and *unpleasant*.

To measure trait affect, participants were asked to rate "in general" the extent to which they had felt each of the affects. Cronbach's alpha for Moderate PA was .92, and .95 for Study $1_{U.S}$ and Study $2_{U.S}$; .90 and .88 for Study 1_{China} and Study 2_{China}. Cronbach's alpha for Moderate NA was .94 and .96 for Study $1_{U.S}$ and Study $2_{U.S}$; and .90 and .93 for Study 1_{China} and Study 2_{China}.

2.2.3 Low Activation Positive and Negative Affect

The adjectives were selected from the literature that captured low activation affect (e.g., Carroll et al. 1999; Russell and Caroll 1999; Watson et al. 1999; Yik et al. 1999). Low PA was measured by ten adjectives: *calm, at ease, at rest, comfortable, peaceful, placid, relaxed, serene, tranquil,* and *restful*. Low NA was assessed by ten adjectives in Study $1_{U.S.}$: *bored, dull, droopy, drowsy, exhausted, fatigued, lethargic, sleepy, sluggish, and tired*. In all other studies, "bored", "dull" and "droopy" were replaced by "worn out", "weary", and "drained".

To measure trait affect, participants were asked to rate "in general" the extent to which they had felt each of the affects. Cronbach's alpha for Low PA was .85 and .91, for Study $1_{U.S}$ and Study $2_{U.S}$; .85 and .81 for Study 1_{China} and Study 2_{China}. For Low NA, the alpha was .85 and .95 for Study $1_{U.S}$ and Study $2_{U.S}$; .91 and .92 for Study 1_{China} and Study 2_{China}.

3 Results

3.1 Preliminary Analysis

Before testing the competing hypotheses, preliminary analysis was conducted to examine the correlations among different dimensions of affect, and the results are presented in Table 1.

3.1.1 Positive Affect

The correlations among the three levels of PA were similar in the U.S. and China. Moderate PA (e.g., happy) and High PA (e.g., excited) were strongly correlated in the two cultures. Low PA (e.g., peaceful) was strongly related to both High PA and Moderate PA in the two cultures. These strong correlations among the three levels of PA suggest that they are expected to form a strong general factor of PA in both cultures.

Table 1 Correlations among high, moderate, and low activation of positive and negative affect

	High PA	Mod PA	Low PA	High PA	Mod PA	Low PA
High PA	1	.81/.80	.64/.69	−.01/−.01	−.11/−.08	−.09/−.02
Mod PA	.79/.82	1	.73/.74	−.18/−.17	−.26/−.27	−.20/−.16
Low PA	.56/.62	.68/.78	1	−.21/−.13	−.20/−.18	−.19/−.11
High NA	−.23/−.26	−.45/−.38	−.40/−.46	1	.85/.91	.78/.84
Mod NA	−.42/−.44	−.63/−.60	−.42/−.57	.84/.85	1	.80/.87
Low NA	−.41/−.42	−.48/−.41	−.39/−.38	.67/.63	.74/.66	1

Note Correlations for the two U.S. samples are presented at the lower triangle, and correlations for the two Chinese samples are presented at the upper triangle

High PA = High Activation Positive Affect, Mod PA = Moderate Activation Positive Affect, Low PA = Low Activation Positive Affect, High NA = High Activation Negative Affect, Mod NA = Moderate Activation Negative Affect, Low NA = Low Activation Negative Affect

3.1.2 Negative Affect

The correlation patterns among the three levels of NA were also similar in the U.S. and China. There was a strong correlation between Moderate NA (e.g., sad) and High NA (e.g., nervous) in the two cultures. Low NA (e.g., tired) was also strongly related to both High NA and Moderate NA in the two cultures. Again, these strong correlations among the three levels of NA suggest that they are expected to form a strong general factor of NA in both cultures.

3.1.3 Positive Affect and Negative Affect

The correlation patterns between PA and NA were different in the U.S. and China. High PA and High NA were moderately inversely correlated in the U.S. ($r = -.23$ and $-.26$) but were unrelated in China ($r = .01$ and $-.01$). Moderate PA and Moderate NA were strongly inversely correlated in the U.S. ($r = -.63$ and $-.60$), but were only moderately correlated in China ($r = -.26$ and $-.27$). Low PA and Low NA were moderately inversely correlated in the U.S. ($r = -.39$ and $-.38$), but were only weakly correlated in China ($r = -.19$ and $-.11$).

These results suggest that in the U.S., PA and NA are more independent at the high and low activation levels, but more related at the moderate activation level. However, in China, PA and NA are completely independent at the high activation level, and somewhat related at the low and moderate activation levels.

3.1.4 Energetic-Tired Arousal

The energetic-tired dimension was measured by High PA (e.g., enthusiastic and strong) and Low NA (e.g., drowsy and fatigued). The negative correlation was moderately strong in the U.S. ($r = -.41$ and $-.42$), but was zero in China. These results suggest that the energetic and tired arousal form two related yet distinct dimensions, rather than a bipolar dimension, in the U.S, but form two independent dimensions in China.

3.1.5 Tense-Relaxed Arousal

The Tense-Relaxed Arousal dimension was measured by High NA (e.g., distressed and jittery) and Low PA (e.g., calm and peaceful). The negative correlation was moderately strong in the U.S. ($r = -.40$ and $-.46$), but was small in China ($r = -.20$ and $-.13$). These results suggest that the tense and relaxed arousal also form two related yet distinct, rather than one bipolar, dimension in the U.S., yet they are more distinct than related in China.

These results in the U.S. are consistent with the Western literature that energetic-tired and tense-relaxed tend to form four factors, although they are expected to be two bipolar dimensions (Thayer 1989).

3.2 Testing of the Competing Models

To examine the competing hypotheses regarding the core features of affect, a series of models were tested. Analysis was conducted using Mplus software 5.0 (Muthén and Muthén 1998–2009). Given that the models involve 60 items, parcels were created by aggregating two items at a time to make the model more parsimonious and stable (Little et al. 2002). For example, High PA was measured with ten items. Before testing the models, the ten items were simplified into five parcels. Specifically, the 1st and 2nd items were combined into parcel 1, the 3rd and 4th items into parcel 2, and so forth. These parcels served as the indicators of the latent variables.

We used three conventional model fit indices to evaluate model fit. The recommended cut-off points are .08 for RMSEA (Browne and Cudeck 1993), .08 for SRMR (Hu and Bentler 1999), and .95 for CFI (Hu and Bentler 1999). However, a cut-off point of .90 CFI was used in this study because compared to other fit indices, such as RMSEA, CFI tends to perform poorly when the number of indicators per factor is large (e.g., Kenny and McCoach 2003). In this sample, the maximum number of variables per factor is 30, and thus a less stringent standard of .90 was used for CFI. The fit statistics are presented in Table 2.

3.2.1 One-Dimensional Model

The one-dimensional model proposes that pleasure-displeasure is the only basic dimension of affect (Titchener 1908). The one-factor model did not fit the data in both cultures.

3.2.2 Two-Dimensional Valence × Activation Model

The Two-Dimensional Model argues that the structure of affect is comprised of two orthogonal bipolar dimensions of pleasure-displeasure and general activation. Other dimensions, such as tense and energetic arousal are mixtures of pleasure-displeasure and general activation (e.g., Barrett and Russell 1999). To test this hypothesis, a bifactor model with two orthogonal factors was tested: a bipolar factor with PA across activation levels at one end and NA across activation levels at the other end, and another bipolar factor with three levels of activation across the continuum. This model did not fit the data in both cultures.

Table 2 Summary of fit statistics

Tested model	χ^2	df	RMSEA (CI)	SRMR	CFI
Studies $1_{U.S.}$ and $2_{U.S.}$					
One-dimensional model	8992.93	405	.140 (.137–.143)	.119	.628
	7926.78		.188 (.185–.192)	.154	.554
Two-dimensional model—positive affect + negative affect	4765.75	404	.100 (.097–.102)	.073	.811
	4193.80		.134 (.130–.138)	.088	.775
Two-dimensional model—valence + activation	4376.79	376	.099 (.097–.102)	.059	.827
	3751.63		.131 (.127–.135)	.067	.800
Two-dimensional model—energy + tense	4715.16	170	.157 (.153–.161)	.230	.585
	3598.73		.196 (.191–.202)	.289	.623
Three dimensional model	8301.53	403	.135 (.132–.137)	.122	.658
	6528.39		.170 (.167–.174)	.175	.637
Six-factor model	3074.86	390	.076 (.074–.079)	.060	.893
	1477.50		.073 (.069–.077)	.049	.936
Second-order model	3899.52	399	.090 (.088–.093)	.094	.872
	2428.42		.099 (.095–.102)	.144	.880
Bifactor model	2124.01	362	.067 (.064–.070)	.050	.924
	1190.36		.067 (.062–.071)	.055	.951
Modified bifactor model	2177.96	372	.067 (.064–.070)	.050	.922
	1280.78		.069 (.065–.073)	.061	.946
Studies 1_{China} and 2_{China}					
One-dimensional model	5196.75	405	.160 (.156–.164)	.218	.505
	4893.30		.154 (.150–.158)	.215	.577
Two-dimensional model—positive affect + negative affect	1833.75	404	.087 (.083–.092)	.077	.852
	1783.05		.085 (.081–.089)	.088	.870
Two-dimensional model—valence + activation	1609.38	374	.084 (.080–.089)	.043	.873
	1449.86		.078 (.074–.082)	.038	.899
Two-dimensional model—energy + tense	2765.51	170	.182 (.176–.188)	.267	.494
	2899.91		.185 (.179–.191)	.282	.509
Three dimensional model	5892.91	403	.172 (.168 –.176)	.239	.433
	4814.39		.153 (.149–.157)	.215	.584
Six-factor model	1379.43	390	.074 (.070–.078)	.068	.898
	1525.00		.079 (.075–.083)	.080	.893
Second-order model	2257.61	399	.100 (.096–.104)	.188	.808
	2441.87		.104 (.101–.108)	.190	.808
Bifactor model	1247.20	375	.071 (.067–.075)	.062	.910
	1401.67		.076 (.072–.081)	.080	.903

Note RMSEA = Root Mean Square Error of Approximation, CI = Confidence Interval, SRMR = Standardized Root Mean Square, CFI = Comparative Fit Index

3.2.3 Two-Dimensional Energy × Tense Rotation Model

The Two-Dimensional Rotation Model proposes that the energetic arousal and tense arousal, which is the 45° rotation of pleasure-displeasure and general activation, are the two basic dimensions of affect (Thayer 1989). If that is the case, tense-relaxed arousal and energetic-tired arousal should form two orthogonal factors. However, such bifactor model did not fit the data in both studies. One critical reason for the lack of model fit is because energetic and tired arousal tend to form two distinct dimensions, rather than a bipolar factor,

as the negative correlation was moderately strong in the U.S. ($r = -.41$ and $-.42$) and with zero correlation in China ($r = -.09$ and $-.01$). Similarly, tense and relaxed arousal form two distinct, rather than one, dimensions, as the negative correlation was moderately strong in the U.S. ($r = -.40$ and $-.46$) and was weak in China ($r = .20$ and .13).

3.2.4 Positive Affect and Negative Affect Model

For model comparison purposes, a two-factor model was also tested with PA and NA, across three levels of activation, as the factors. This model did not fit the data in both cultures. There was a moderately strong negative correlation between the two factors in the U.S. ($r = -.62$ and $-.59$), but a small positive correlation in China ($r = .22$ and .17).

3.2.5 Three-Dimensional Model

The Three-Dimensional Model proposes that pleasure-displeasure, tension-relaxation, and arousal-calmness form three basic dimensions of affect. We tested a three-factor model consisting of moderate activation Pleasure-Displeasure, Awake-tired, and Tense-relaxed. This model did not fit the data in both cultures. As discussed earlier, one major issue for the lack of fit is that neither tension-relaxation nor arousal-calmness forms a bipolar dimension.

3.2.6 The Refined Circumplex Model

This model argues that affective experiences could be represented by more fined subtle dimensions (Yik et al. 2011). We started with the six domains proposed in the literature (i.e., pleasure-displeasure, tension-relaxation, and arousal-calmness). For model comparison purposes, we also tested a six-factor model, a seconder-order model with the six domains as the lower-order factors, and a bifactor model based on the six-domains.

3.2.6.1 Six-Factor Model The six factors were comprised of High PA, High NA, Moderate PA, Moderate NA, Low PA, and Low NA. This model fit the data on the borderline in both cultures.

3.2.6.2 Second-Order Model Based on the six-factor model, a second-order model was formed with High PA, High NA, Moderate PA, Moderate NA, Low PA, and Low NA as the six lower-order factors. Even with correlated disturbances of High PA with Moderate PA, and High NA with Moderate NA, it did not fit the data in both cultures.

3.2.6.3 Bifactor Model The cultural differences in the correlations between PA and NA suggest that the structure of the bifactor model would differ in the U.S. and China. The model fitting procedure is then presented separately for the two cultures.

3.2.6.3.1 Bifactor Model: U.S. Samples (Fig. 1) The initial bifactor model was constructed based on the intercorrelations among the six types of affect. The bifactor model consisted of one general factor that captures the commonality shared by all six types of affect (i.e., High PA, Moderate PA, Low PA, High NA, Moderate NA, and Low NA). It also included two second layer general factors: general PA across activation levels and general NA across activation levels, given the strong correlations among the affect of same valence. In addition, it included two group factors: Low PA and Low NA, given that Low

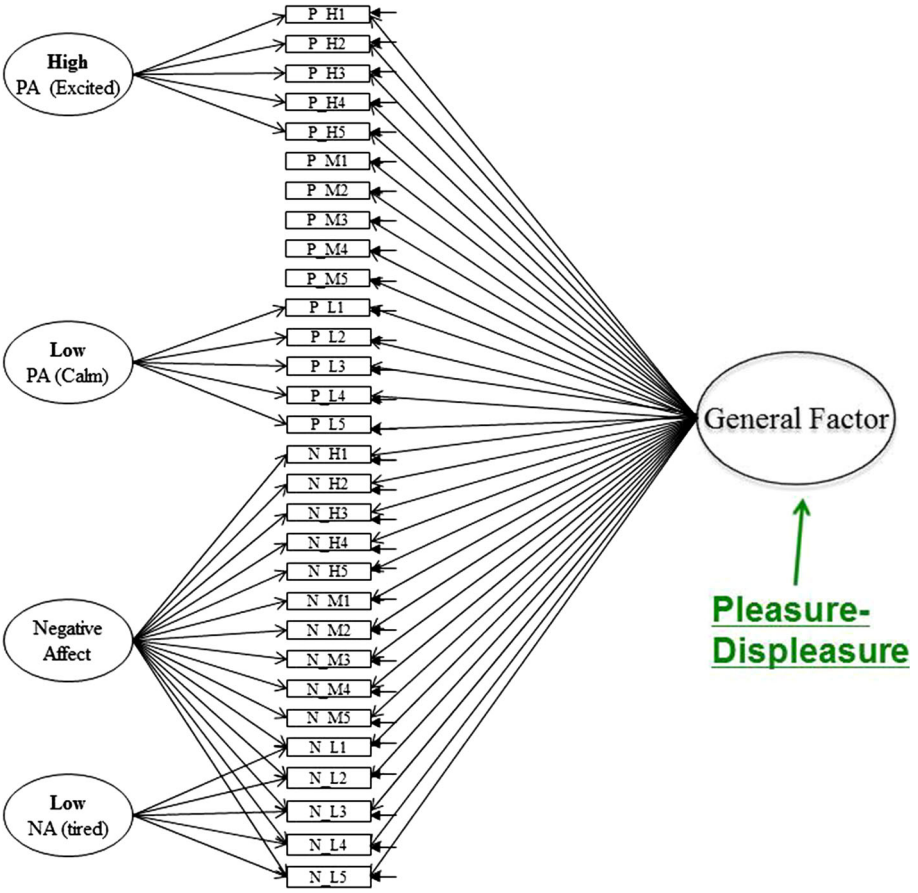

Fig. 1 Bifactor model of affect in the U.S

PA had lower correlations with other types of PA, and Low NA had lower correlations with other types of NA. This model fit the data adequately in both studies. However, Moderate PA and Low PA had nonsignificant loadings on the general factor of PA. The bifactor model was then modified by removing these trivial loadings, which resulted in one general factor of Moderate PA–NA (i.e., pleasure-displeasure), one second layer general factor of NA (across activation level), and three group factors: High PA, Low PA, and Low NA. This model fit the data adequately in the two U.S. samples.

As can be seen from Table 3, the pattern of factor loadings on the general factor suggests that Moderate PA and NA defines the general factor, given that Moderate PA (pleasant affect) had the strongest loadings on the general factor, followed by Moderate NA (unpleasant affect). These results also suggest that Moderate PA–NA are largely, but not completely, bipolar. This is because both types of affect loaded strongly on the general factor but the strength of the relations differed. The general factor can thus be identified as a largely unidimensional factor, defined by moderate activation of PA–NA (pleasant-unpleasant affect).

In addition to a strong general factor (Moderate PA–NA), there was a strong group factor of NA across activation level. Finally, the group factors of Low PA and Low NA were moderately strong. However, the group factor of High PA was relatively weak.

3.2.6.3.2 Bifactor Model: Chinese Samples (Fig. 2) The bifactor model was also constructed based on the intercorrelations among the six types of affect. The bifactor model consisted of one general factor that captures the commonality shared by all six types of affect. However, the NA items are expected to have low loadings on the general factor, given the near zero and small correlations between PA and NA. For this reason, a second layer general factor of NA across activation levels was included. The model also included two group factors: Low PA and Low NA, given that Low PA had lower correlations with other types of PA and Low NA had lower correlations with other types of NA. As in the U.S. model, High PA was included as a group factor for model comparison purposes. This model fit the data adequately in both studies.

As can be seen from Table 3, the pattern of factor loadings on the general factor suggests that Moderate PA (pleasant affect) alone, rather than Moderate PA–NA (pleasant and unpleasant affect), defines the general factor, given that Moderate PA had the strongest loadings on the general factor. In addition to a strong general factor, there was a strong general factor of NA across activation level. The group factors of High PA, Low PA, and Low NA were weak.

These results indicate that the structure of affect is different cross-culturally. In the U.S., the most basic dimension is defined by Moderate PA–NA (pleasure-displeasure), whereas in China, the most basic dimension is defined by Moderate PA (pleasure) only, as revealed by the general factor. The emergence of NA (across all activation levels) as a strong factor suggests that NA is also a basic dimension of affect in both cultures. High PA, Low PA, and Low NA are likely secondary dimensions in both cultures. This is because these group factors, derived from the unique variance independent of the two basic dimensions, are either weaker or substantially weaker, compared to the basic dimensions, suggesting that these dimensions are mostly mixtures of the basic dimensions.

4 Discussion

The major purposes of this paper are to test the influence of culture on the fundamental dimensions of affective experiences. Specifically, it integrates research involving two debates on affect. The first one regards whether the relation between PA and NA would differ depending upon the cultural context. However, the major limitation facing this debate is that it has been centered primarily on the valence of affect, even though the affective space is more complex than valence. The second controversy pertains to a broader issue on the fundamental dimensions of affect in general. However, the major drawback facing this debate is that culture has not been considered as a possible key factor. In this paper, we connected these two lines of research by extending the first debate from the relation between PA and NA to the broader issue of the basic structure of affect and by introducing culture as a key factor into the second debate.

A common challenge facing both debates is that there is lack of an adequate statistical model that could be used to represent the complex relations among different types of affect. The bifactor model seems to provide a promising solution to this longstanding issue. As stated earlier, the existing methods cannot separate two important sources of variation: commonality shared by different types of affect and the unique variance specific to each type of affect. This is a central issue in identifying the fundamental dimensions of affect from the secondary dimensions. The bifactor model is well-suited for this purpose as the general factors can capture the common variance shared by different types of affect, and

Table 3 Standardized factor loadings of affect based on a bifactor model

Parcels	General factor (pleasure-displeasure)	Negative affect (across activation)	High activation positive affect	Low activation positive affect	Low activation negative affect
PA_H1	.59/.62 (69/.64)		.40/.35 (.25/.11)		
PA_H2	.55/.55 (.62/.52)		.53/.50 (.30/.11)		
PA_H3	.81/.77 (.70/.68)		.06/.35 (.28/.47)		
PA_H4	.61/.77 (.69/.65)		.33/.29 (.23/.33)		
PA_H5	.61/.71 (71/.68)		.34/.28 (.35/.27)		
PA_M1	.83/.89 (.77/.71)				
PA_M2	.84/.85 (.79/.78)				
PA_M3	.82/.91 (.84/.83)				
PA_M4	.80/.94 (.81/.79)				
PA_M5	.77/.83 (.78/.73)				
PA_L1	.49/.62 (.56/.47)			.03/.54 (.35/.30)	
PA_L2	.52/.66 (.63/.64)			.43/.47 (.24/.15)	
PA_L3	.69/.71 (.58/.60)			.65/.47 (.57/.51)	
PA_L4	.35/.74 (.69/.72)			.43/.46 (.42/.31)	
PA_L5	.50/.79 (.54/.55)			.71/.30 (.48/.36)	
NA_H1	−.37/−.38 (−.28/−.24)	.63/.71 (.65/.75)			
NA_H2	−.35/−.29 (−.12/−.08)	.66/.71 (.59/.68)			
NA_H3	−.38/−.29 (−.09/−.14)	.56/.71 (.72/.78)			
NA_H4	−.26/−.38 (−.09/−.01)	.57/.72 (.69/.77)			
NA_H5	−.32/−.38 (−.17/−.12)	.69/.77 (.80/.85)			
NA_M1	−.61/−.55 (−.28/−.32)	.60/.71 (.66/.75)			
NA_M2	−.57/−.58 (−.09/−.17)	.67/.71 (.71/.79)			
NA_M3	−.51/−.62 (−.20/−.20)	.62/.67 (.80/.84)			
NA_M4	−.56/−.54 (−.24/−.17)	.67/.74 (.80/.83)			
NA_M5	−.61/−.58 (−.17/−.19)	.61/.70 (.83/.87)			

Table 3 continued

Parcels	General factor (pleasure-displeasure)	Negative affect (across activation)	High activation positive affect	Low activation positive affect	Low activation negative affect
NA_L1	−.51/−.37 (−.08/−.09)	.50/.40 (.59/.60)			.60/.73 (.53/.36)
NA_L2	−.43/−.36 (−.22/−.18)	.50/.54 (.69/.78)			.41/.61 (.44/.26)
NA_L3	−.39/−.35 (−.11/−.05)	.43/.41 (.73/.75)			.34/.72 (.45/.50)
NA_L4	−.46/−.43 (−.18/−.10)	.54/.51 (.79/.82)			.55/.62 (.26/.23)
NA_L5	−.34/−.47 (−.20/−.14)	.27/.55 (.79/.87)			.52/.49 (.24/.10)

Note Each parcel was created by averaging two items

Factor loadings in Studies 1_{China} and 2_{China} are presented in the parentheses

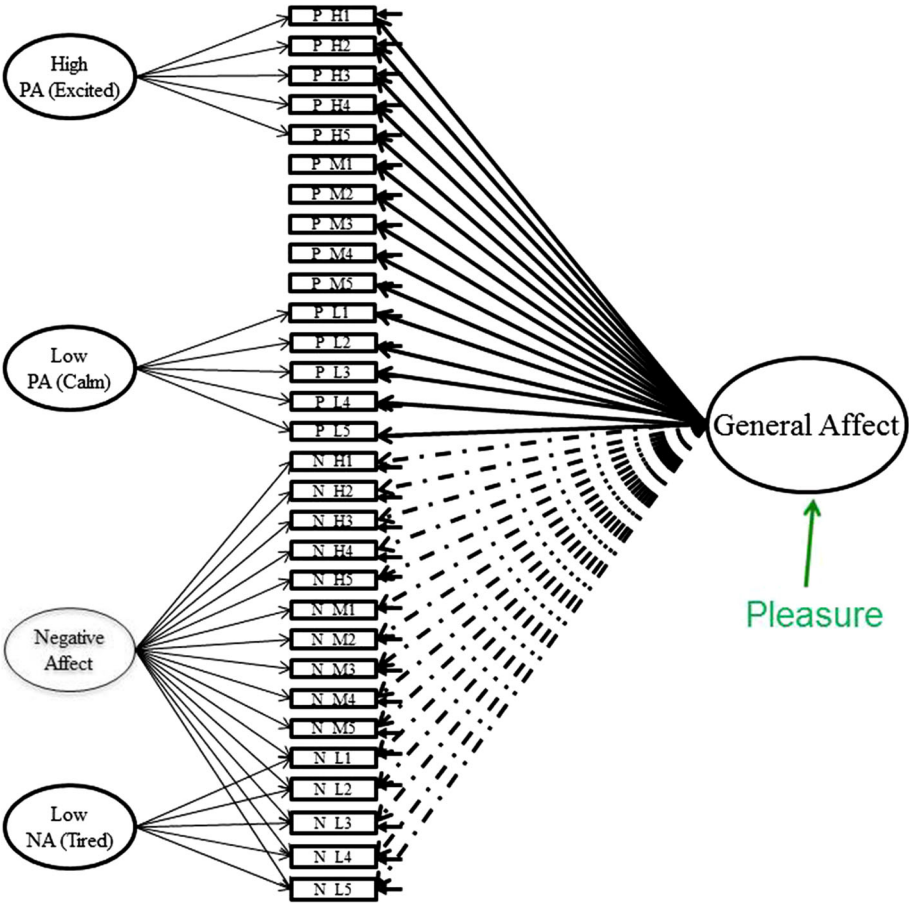

Fig. 2 Bifactor model of affect in China

thus represent the basic dimensions, whereas the group factors can characterize the unique contributions of each specific affect, and thus represent the secondary dimensions.

In the present investigations, we sampled the full range of affective experiences by crossing affective valence (i.e., positive and negative) with different levels of general activation (i.e., high, moderate, and low). This valence by activation cross-tab also included the energetic-tired arousal and tense-relaxed arousal, which made it possible to examine the major competing views on the structure of affect simultaneously. We used the bifactor model to test the competing views on the basic structure of affect cross-culturally, which revealed several major consistent findings across the studies.

4.1 Roles of Activation in the Relations Between Culture, Positive Affect, and Negative Affect

The results clearly demonstrate the advantages of adding activation into the debate regarding whether culture affects the relation between PA and NA, given that both within and cross-cultural differences are observed. In the U.S., activation moderates the relation

between PA and NA: the negative correlation is strong at the moderate activation level, but is medium to weak at the high and low activation levels. However, in China, PA and NA are completely independent at the high activation level, and somewhat related at the low and moderate activation levels. These findings help clarify the inconsistent findings regarding the relation between PA and NA in different cultural contexts. Specifically, depending upon the level of activation, the relation between PA and NA tends to differ both within and cross-culturally. It calls the pressing necessity of measuring and testing PA and NA at different activation levels regardless of the cultural context.

4.2 Independence Versus Bipolar View Visited

These findings shed light on the classic debate regarding the independence or bipolar nature of the PA and NA in the Western cultural context. Two different research views concerning the relations between PA and NA have been proposed, each with its own body of supportive research. The bipolar affect perspective presumes that PA and NA are related, but inversely so (e.g., Reisenzein 1994; Barrett and Russell 1999). In contrast, the independent affect perspective assumes that PA and NA are two basic and relatively independent dimensions (e.g., Diener and Emmons 1984; Watson and Clark 1997).

The present investigations indicate that when PA and NA are tested at the moderate activation level (i.e., pleasant and unpleasant), the bipolar view is likely be supported, given that pleasant affect and unpleasant affect are largely independent of each other in the U.S. In contrast, when PA and NA are examined at the high and low activation levels, the independent perspective is likely to be confirmed, given that PA and NA are more independent than related at these activation levels, after partialling out the common variance shared with moderate activation affect. The inclusion of PA and NA across different activation levels and the ulitization of the bifactor model made it possible to discover the merit of both perspectives and offer a common ground for the two views to meet.

4.3 Culture and Bifactor Modeling of Basic Structure of Affect

The most basic dimension of affect is fundamentally different in the two cultures. For the U.S. participants, the most basic dimension of affect, is defined by Moderate PA–NA (pleasure-displeasure) and this dimension is largely bipolar. A different pattern emerged for the Chinese participants. The most basic dimension is defined by Moderate PA (pleasure) alone, as opposed to Moderate PA–NA (pleasure-displeasure). In both cultures, negative affect across different levels of activation forms another important dimension, independent of the general factor. Beyond these basic dimensions, high activation PA, low activation PA, and low activation NA form secondary dimensions in both cultures, as they form relatively weak unique factors, independent of the two basic dimensions, suggesting that they are largely mixtures of the basic dimensions.

These results suggest that in the U.S., the experience of general happiness is characterized by the presence of pleasure, plus the absence of displeasure. However, in China, the experience of general happiness is largely captured by the presence of pleasure, regardless of the presence or absence of negative affect. In both cultures, the experience of general happiness is independent of the experience of the general NA. These findings suggest that the mere absence of general NA is not the same as the presence of general happiness, particularly in the East Asian cultural context. Consequently, researchers need to measure both PA and NA across activation levels, in addition to gauging global happiness.

4.4 Implications

The current findings have important theoretical and applied implications for the study of subjective well-being, given that affect is an essential component of subjective well-being. Theoretically, the cross-cultural difference on the basic structure of affect (i.e., the different nature of the general factor in the U.S. and China) points to important considerations in defining well-being across cultures. Although ultimately well-being entails maximizing pleasure and minimizing displeasure simultaneously, different cultures may emphasize different aspect to promote the development of well-being. For example, East Asian philosophies cultivate detachment from negative life events to reduce the negative consequences. In contrast, Western cultures appear to promote well-being by stressing the maximization of hedonic pleasure.

These results are also consistent with the cultural practice of self-enhancement in the West and self-improvement in the East. Specifically, East Asians have a tendency to perceive themselves in a self-effacing way, arguably for the goal of eliminating negative aspects of oneself, whereas North Americans have an inclination to view themselves in a positive light, arguably for the goal of feeling good about oneself (for review, see Heine et al. 1999).

Furthermore, the current findings have practical implications for designing culturally appropriate intervention programs to promote well-being. In the Western cultural context, it might be more effective to develop programs geared toward the maximization of pleasure, whereas in the Eastern cultural context, it might be fruitful to cultivate programs geared toward the minimization of displeasure.

4.5 Measurement of Affective Experiences

These results have practical implications for the measurement of affective experiences. Currently, PANAS is the most widely used instrument for measuring affect around the world. However, it only assesses high activation PA and NA. Findings from the current studies suggest that it is very important to focus on the moderate activation affect, as it defines the most basic dimension of affect, both in the U.S. and China. The inclusion of moderate activation affect (i.e., pleasure and displeasure) in the regular assessment of affect will have the potential to redefine relevant theories, measures and practices. For example, results from the current bifactor analysis challenges the notion that high activation PA defines extraversion (Tellegen 1985), which is based on the strong and robust association between extraversion and high activation PA. However, the present investigations indicate that the well-established strong link between extraversion and PA is largely due to moderate activation of pleasant affect, rather than to high activation PA.

Compared to high activation affect, low activation affect has received little attention in the literature. However, as Carver pointed out (2001), the experience of peace, relief, and relax also has its evolutionary function. It serves as the purpose of regrouping and restoring one's access to energy supply (cf. Baumeister et al. 1998), and allows an individual to reorient to possible new activities (Carver 2001). Therefore, it consists of an important part of the approach as well as avoidance processes. For example, the addition of low activation affect can be important in the study of affect change across life span. Research suggests that PA tends to decline with age, but negative affect and life satisfaction do not change with age (Diener and Lucas 2000). However, many measures of PA focus on high activation affect, which may account for the observed decline. Indeed, research suggests that

as people age, low activation affect (e.g., calm, peaceful) tends to increase (Mogilner et al. 2011), high activation affect (e.g., anger, stress, worry) tends to decrease (Stone et al. 2010), whereas moderate activation affect (e.g., happy and joy) are maintained (Lawton et al. 1993). Therefore, it is crucial to differentiate and measure different types of affect along the dimension of activation.

The addition of low activation affect could be critical for the study of affective experiences among different cultural groups. An interesting cultural phenomenon is that low activation PA, such as calm, content, and serene, are generally more valued in East Asian cultures than in Western cultures as ideal affect (Tsai et al. 2006). It is even difficult to identify adequate markers to test such states in the West (Watson et al. 1999). Although no major cultural differences are observed in the current studies regarding the function of low activation affect, it is possible, when the discrepancy between ideal affect and actual affect is assessed, its differential impact on well-being would emerge cross-culturally. Thus the inclusion of low activation affect is important in developing an affect structure that is suitable for people from different cultural backgrounds, given that U.S. is becoming increasingly multi-cultural and the world is moving toward globalization.

4.6 Beauty of Bifactor Modeling

The major advantage of adding the activation level to the study of affect is that it makes it possible to examine both within and between cultural differences with regard to the relation between PA and NA. The beauty of the bifactor model is that it integrates these correlations in a bifactor model, which makes it possible to examine the fundamental structure of affect in a synthesized way both within and cross-culturally.

The bifactor model is comprised of one general factor that accounts for the commonality shared by different types of affect, which captures the core feature in the affect structure. Over and beyond the general factor, there are multiple group factors, each of which accounts for the unique influence of each type of affect, which represent the secondary dimensions. If an oblique confirmatory factor analysis model is used to analyze the structure of affect, there would be six correlated factors that represent the cross tab of valence (positive, negative) by activation (low, moderate, high) of affect. However, unlike the bifactor model, the most basic dimension of affect (which is represented by the general factor in the bifactor model), would not be represented in the oblique model. Instead, it would be distributed among the 15 inter-factor correlations. Although a higher-order factor can represent the first layer of the general factor, it cannot adequately capture the second layer of the general factors as well as the group factors (Chen et al. 2006).

4.7 Limitations and Future Directions

There are several limitations to consider in this paper. With respect to the bifactor model, it requires sufficiently large sample sizes, as any structural equation models (SEMs). Minimum sample size depends on several aspects of a given study, including the level of communality of the variables and the level of overdetermination of the factors (MacCallum et al. 1999). Compared to regular SEMs, bifactor models may require the provision of start values for the models to converge, and thus it may take more effort to run the models, given the unique nature of the bifactor models.

Another limitation of the current studies is the nature of the samples. In the U.S., the participants consisted of both college and non-college students, and the findings are consistent across both samples. This replication indicates that the results are robust across

different samples in the U.S. However, the majority of the U.S. participants were Caucasian, and future research should be conducted with more diverse ethnic and cultural groups.

In China, the participants consisted of college students in both samples. Homogeneity of the samples poses limitations on the generalizability of our findings. Nevertheless, the two Chinese samples came from two different regions of China that embody different cultural traditions: one is from Northern China, and the other is from Southern China. The results were consistent across the two different samples. Future research should involve with more diverse groups in China.

5 Conclusions

The relation between culture and affective experiences is more complex than expected. The structure of affect is different cross-culturally. In the U.S., the most basic dimension is defined by moderate activation of bipolar pleasure-displeasure, whereas in China it is represented by pleasure alone. In both cultures, negative affect across levels of activation forms another important dimension. Beyond these basic dimensions, secondary dimensions are also identified in both cultures. The bifactor model provides a viable alternative for testing the core dimensions of affect cross-culturally. It has the distinctive advantage of separating commonality shared by different types of affect, which defines the basic dimensions of affect, from the unique variance specific to each type of affect, which captures the secondary dimensions.

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