Review of General Psychology
1999, Vol. 3, No. 1, 14–22

1089-2680/99/$3.00

On the Psychometric Principles of Affect

James M. Carroll, Michelle S. M. Yik, and James A. Russell
University of British Columbia

Lisa Feldman Barrett
Boston College

D. Watson and L. A. Clark (1997) announced "two fundamental psychometric principles" (p. 282) of affect: The positive correlation between affects with the same valence tends to be substantial, whereas the negative correlation between affects with opposite valence tends to be weak. These allegedly robust empirical generalizations underlie various conceptual models of affect (such as those that posit an independence between positive and negative affect) and various scales of affect. The authors offer an alternative analysis: The correlation between two affects is a function of the angle between them within a circular ordering. Two data sets were reanalyzed and showed predicted exceptions to Watson and Clark's principles: same-valenced pairs with weak correlations and oppositely valenced pairs with substantial correlations.

Affective feelings pervade every aspect of human life. Affect is implicated in human behavior, motivation, attitudes, cognition, psychopathology, health, and well-being. Affect is inevitably encountered in research laboratories, clinics, schools, and every human setting. Affect is increasingly incorporated into psychological research, theory, and practice. Success of this research, tests of these theories, and efficacy of these practices require the means to describe and to assess affect. Like the emergence of the "big five" structure for the description of personality or the Linnean system in biology, agreement on a descriptive structure of affect would be invaluable.

As a summary of more than a decade of their research, Watson and Clark (1997) announced "two fundamental psychometric principles" (p. 282) in the description and assessment of affect:

> The first is that affects with same valence [i.e., same hedonic value] (e.g., *nervous* vs. *angry; enthusiastic* vs. *happy*) tend to be substantially positively intercorrelated.... The second principle is that oppositely valenced affects (e.g., *nervous* vs. *enthusiastic*) tend to be only weakly negatively correlated with one another. (p. 282)

What is striking about these principles is their asymmetry: substantial correlations when valence is the same, and weak correlations when valence is opposite.

In an earlier statement of these principles, Watson, Clark, and Tellegen (1994) referred to them as robust empirical generalizations. They argued that these two principles are "sufficiently clear and obvious that everyone should acknowledge their existence, regardless of their theoretical view, or their position regarding each of the various controversies" (p. 3) that have arisen in the study of affect. Indeed, these principles underlie their own theory in which "Positive Affect" is independent of "Negative Affect" (Watson & Tellegen, 1985) and their own scales for the assessment of affect (Positive and Negative Affect Schedule, or PANAS; Watson, Clark, & Tellegen, 1988). These principles could also have a far-reaching impact in the application of psychology. For example, the second principle suggests that techniques for increasing positive affect might have little effect on the crippling negative emotions seen in psychopathology or on low morale seen in a work setting.

The articulation of clear and general principles is a necessary step in the progress of

James M. Carroll, Michelle S. M. Yik, and James A. Russell, Department of Psychology, University of British Columbia, Vancouver, British Columbia, Canada; Lisa Feldman Barrett, Department of Psychology, Boston College.

This study was supported by a doctoral fellowship and Research Grant SSHRC 410-95-0863 from the Social Sciences and Humanities Research Council of Canada and by a University Graduate Fellowship from the University of British Columbia.

Correspondence concerning this article should be addressed to James M. Carroll or James A. Russell, University of British Columbia, Department of Psychology, 2136 West Mall, Vancouver, British Columbia, Canada V6T 1Z4. Electronic mail may be sent to mcarroll@unixg.ubc.ca or jrussell@psych.ubc.ca.

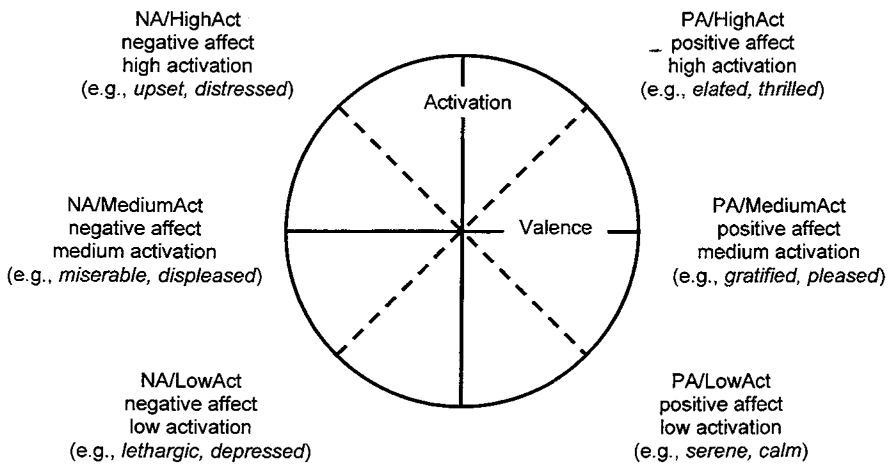

Figure 1. A circular structure of affect. PA = positive affect; NA = negative affect; HighAct = high activation; MediumAct = medium activation; LowAct = low activation.

science, and psychology is advanced by Watson and Clark's (1997) thesis. Here we offer an antithesis.[1] We argue that Watson and Clark's proposed principles are at best special cases of a broader and more precise scheme, to be described shortly, and that the asymmetry implied does not exist. A broader definition of affect, to which we also return, shows serious departures from both of Watson and Clark's two principles, which thus fail to characterize the full domain of affect. Rather than being fundamental to the domain of affect, their principles result from such extraneous factors as the selection of subsamples of items and from errors inherent in measurement. We next consider each of these factors in turn, and then examine some relevant data.

Item Selection From a Circular Structure

Valence is of course the major, but not the only, component of affect. In words from *thrilled* to *tranquil,* our English lexicon recognizes many different types of positive affect. Similarly, in words from *shocked* to *bored,* it recognizes many different types of negative affect. This variety points to components in addition to valence. Here we emphasize one additional component, namely, what is variously called *arousal, activity,* or *activation* (Hebb, 1955; Lang 1994; Lindsley, 1951; Thayer, 1989, 1996; Thayer & Newman, 1994). Both pleasant and unpleasant words for affect vary in the level of activation they imply (Averill, 1975; Bush, 1973; Neufeld, 1975, 1976; Russell, 1978; Thayer, 1989; Whissell, 1981). The activation implied by pleasant affective words can be high (e.g., *elated, thrilled*), medium (e.g., *gratified, pleased*), or low (e.g., *serene, calm*). In exactly the same manner, the activation implied by unpleasant affective words can be high (e.g., *upset, distressed*), medium (e.g., *miserable, displeased*), or low (e.g., *lethargic, depressed*). Activation is a dimension of affect that must be taken into account.

Figure 1 shows the Cartesian space formed by valence (the horizontal axis) and activation (the vertical axis). The resulting semantic structure is consistent with extensive evidence from unidimensional and multidimensional scaling of words of affect (Averill, 1975; Russell, 1980; Whissell, 1981). It is also consistent with representations of experienced affect given by Watson and Tellegen (1985) and many others (Bradley, 1994; Feldman, 1995; Lang, 1994; Larsen & Diener, 1992; Russell, 1980; Thayer, 1989).

On the right side of Figure 1, we have defined three clusters of positive (pleasant) affect items.

[1] In this article, we restrict our discussion to *momentary affect* (that is, to affect at a slice in time); the psychometrics of affect extended over time is sufficiently complicated to warrant a separate analysis (Carroll, Russell, & Reynolds, 1998; Russell & Carroll, in press).

Positive Affect With High Activation (PA/HighAct) refers to a cluster of positively valenced items that are also high in activation, as exemplified by items such as *enthused, excited,* and *energetic*. *Positive Affect With Medium Activation* (PA/MediumAct) refers to a cluster of positively valenced items that are medium (or noncommittal) on activation, with items such as *happy, gratified,* and *content*. *Positive Affect With Low Activation* (PA/LowAct) refers to a cluster of positively valenced items that are also low in activation, with items such as *calm, serene,* and *relaxed*.

In parallel fashion, we have defined three clusters of negative (unpleasant) affect items on the left side of Figure 1. *Negative Affect With High Activation* (NA/HighAct) refers to a cluster of negatively valenced items that are also high in activation, such as *jittery, tense,* and *nervous*. *Negative Affect With Medium Activation* (NA/MediumAct) refers to a cluster of items that are medium (or noncommittal) on activation, such as *unhappy, miserable,* and *troubled*. *Negative Affect With Low Activation* (NA/LowAct) refers to a cluster of negatively valenced items that are low in activation, such as *depressed, lethargic,* and *down*.

We formed six clusters simply for convenience. We believe that more or fewer clusters are also possible. Indeed, the two-dimensional space of Figure 1 can be sliced into an arbitrary number of segments. Much evidence suggests that affect items and scales fall in a more or less continuous order around the perimeter of this space, thus forming a circle or circumplex of affect (Browne, 1992; Fabrigar, Visser, & Browne, 1997; Plutchik, 1980; Russell, 1980; Schlosberg, 1941, 1954).

The central question raised by Watson and Clark's (1997) proposed principles is this: what is the correlation between any two affective items? Our answer: the theoretic correlation is a function of the angle between the items within the circular structure of Figure 1. Watson and Clark's two principles can be seen as special cases of our prediction. Watson and Clark focused on one pair of clusters from Figure 1, namely, PA/HighAct and NA/HighAct, which they term *Positive Affect* (PA) and *Negative Affect* (NA), respectively. About 90 degrees happens to separate this particular pair. As their first principle states, items within each of these two clusters tend to be highly intercorrelated (e.g., *excited* and *enthused* are substantially and positively correlated; *nervous* and *tense* are substantially and positively correlated). As their second principle states, any item from one of these two clusters tends to be only weakly correlated with an item from the other (e.g., *excited* and *nervous* correlate with each other near zero). We agree with both principles, provided that attention is restricted to PA/HighAct and NA/HighAct.

The difference between Watson and Clark's (1997) two principles and our formulation can be seen in other pairs. When other pairs are considered, we predict that the asymmetry at the heart of Watson and Clark's principles disappears. Indeed, roughly opposite principles are also possible: Correlations between same valenced pairs (such as PA/HighAct and PA/LowAct) can be weak in magnitude, and the correlation between oppositely valenced pairs (such as PA/MediumAct and NA/MediumAct) can be substantial in magnitude.

Errors of Measurement

In building a general account of affect, it is essential that those aspects of the data that arise from the nature of affect be separated from those aspects that are introduced by the process of measurement. In stating our prediction, we wrote about a "theoretic correlation" to distinguish it from an observed correlation. Watson and Clark's (1997) principles are problematic not only because of selection of segments of affect but also because they were derived largely from observed correlations, which are subject to various errors of measurement. The magnitude of negative correlations has been shown to be attenuated by systematic errors inherent in the process of measurement.[2] In one especially dramatic example, Green, Goldman, and Salovey (1993) found that the observed correlation between happy and sad scales was −.25; with error controlled, the correlation between the latent variables themselves was estimated to be −.84. (Incidentally, Green et al.'s result is

[2] Random and systematic errors both distort correlations, but random error cannot produce the asymmetry postulated in Watson and Clark's (1997) principles. We believe that that asymmetry is due both to item selection and to systematic errors of measurement. Watson and Clark of course acknowledged the role of measurement error in observed correlations but argued that the magnitude of their influence is not so great as to undermine their principles.

already a violation of Watson and Clark's second principle.)

Green et al.'s (1993) conceptual and empirical analysis of affect ratings exposed the danger of reliance on observed correlations. Diener, Smith, and Fujita (1995, p. 131) concluded, "the work of Green et al. clearly demonstrated the absolute necessity of controlling measurement error when examining the structure of affect." Green et al. developed a new procedure that is the method of choice in estimating the correlation, not between highly fallible observed indicators of two variables, but between the variables themselves. Both random and systematic error can be controlled by assessing each variable with several maximally different response formats and then analyzing the data with a structural equation modeling program such as LISREL, EQS, or SEPATH.

Empirical Support

Rather than review past studies, which have mainly reported observed correlations, we reanalyzed data that had been gathered with Green et al.'s (1993) procedure. We also needed data that systematically sampled affect items from each cluster shown in Figure 1.

A Vancouver Sample

We reanalyzed data that had been gathered for the more general purpose of testing the circular model of Figure 1 (Yik, Russell, & Feldman Barrett, 1998; Vancouver sample). Participants had described their current affective state on a battery of three questionnaires, each with a different response format. For the present analysis, the affect items within each questionnaire were divided into the six clusters of Figure 1, according to the translation scheme listed in Table 1. For example, we used items from Thayer's (1986) Energy scale and from Larsen and Diener's (1992) scale of Pleasant Activated Affect as our example of the PA/HighAct cluster.

To test our prediction, we needed two figures: the angle between each pair of clusters of Figure 1 and the correlation between them. The angle between each pair of variables was estimated using the program CIRCUM (Browne, 1992), which provides maximum likelihood estimates

Table 1
The Original Source and Number of Items Used to Assess Each Cluster in Figure 1

Cluster	Source for Vancouver sample (n = 217)	No. items per cluster	Source for Boston sample (n = 198)	No. items per cluster
PA/HighAct	Pleasant activation (Larsen & Diener, 1992) Energy (Thayer, 1996)	10, 7, 7	Positive affect (Watson et al., 1988)	10, 8, 8
PA/MediumAct	Pleasant (Feldman Barrett & Russell, 1998)	3, 3, 2	Pleasant (Feldman Barrett & Russell, 1998)	3, 3, 2
PA/LowAct	Pleasant unactivated (Larsen & Diener, 1992) Calmness (Thayer, 1996)	7, 7, 6	Pleasant deactivated (Feldman Barrett & Russell, 1998)	4, 5, 6
NA/HighAct	Unpleasant activation (Larsen & Diener, 1992) Tension (Thayer, 1996)	9, 7, 8	Negative affect (Watson et al., 1988)	10, 8, 9
NA/MediumAct	Unpleasant (Feldman Barrett & Russell, 1998)	3, 3, 3	Unpleasant (Feldman Barrett & Russell, 1998)	3, 3, 3
NA/LowAct	Unpleasant unactivated (Larsen & Diener, 1992) Tiredness (Thayer, 1996)	8, 6, 5	Unpleasant deactivated (Feldman Barrett & Russell, 1998)	6, 6, 5

Note. The number of items varied from format to format. In the No. of items columns, the first number refers to the number of items in an adjective format, the second number refers to the number in an Agree–Disagree format, and the third number refers to the number in the Describes Me format. PA = positive affect; NA = negative affect; HighAct = high activation; MediumAct = medium activation; LowAct = low activation.

Table 2
Observed and Latent Correlations for Affect Clusters at Different Angles to One Another (Vancouver Sample: N = 217)

Angle between pair	Pair of affect clusters	Mean interitem correlation: Adjective format	Mean interitem correlation: Agree–Disagree format	Mean interitem correlation: Describes Me format	Latent correlation
		Positive pairs			
29°	PA/HighAct, PA/MediumAct	.40	.32	.41	.64
34°	PA/MediumAct, PA/LowAct	.32	.34	.35	.62
63°	PA/HighAct, PA/LowAct	.12	.14	.08	.23
		Negative pairs			
18°	NA/HighAct, NA/MediumAct	.50	.49	.56	.82
39°	NA/MediumAct, NA/LowAct	.27	.30	.37	.47
57°	NA/HighAct, NA/LowAct	.17	.18	.21	.31
		Oppositely valenced pairs			
113°	PA/LowAct, NA/LowAct	−.05	−.03	−.01	−.06
127°	PA/HighAct, NA/HighAct	.08	−.11	−.09	−.20
145°	PA/HighAct, NA/MediumAct	−.10	−.24	−.31	−.46
147°	PA/MediumAct, NA/LowAct	−.23	−.24	−.33	−.47
152°	PA/LowAct, NA/MediumAct	−.25	−.31	−.38	−.60
156°	PA/MediumAct, NA/HighAct	−.21	−.42	−.41	−.69
170°	PA/LowAct, NA/HighAct	−.26	−.33	−.42	−.74
174°	PA/MediumAct, NA/MediumAct	−.43	−.64	−.61	−.90
176°	PA/HighAct, NA/LowAct	−.23	−.33	−.38	−.64

Note. Data analyzed ($N = 217$) were reported by Yik, Russell, and Feldman Barrett (1998, Sample 2). Angles between pairs of clusters were estimated by the program CIRCUM (Browne, 1992; $M = 3$ free parameters in the correlation function; the input variables are sum of three standard scores corresponding to the three response formats). Latent correlations were estimated with a confirmatory factor analysis with 6 latent variables (PA/HighAct, PA/MediumAct, PA/LowAct, NA/HighAct, NA/MediumAct, and NA/LowAct); that model fit the data well: χ^2 (75, $N = 217$) = 124.67, root mean square error of approximation = .05, adjusted goodness-of-fit index = .87, comparative fit index = .99. PA = positive affect; NA = negative affect; HighAct = high activation; MediumAct = medium activation; LowAct = low activation.

of polar angles.[3] In this procedure, the variables are assumed to fall on a circle in a two-dimensional space. One variable is arbitrarily chosen as a reference point and fixed at 0 degrees; an angle for each other variable (in our case, clusters) is then estimated relative to this fixed point. Finally, for each pair of clusters, we calculated the difference between their angles.

The correlation between clusters was calculated in two ways. The first concerns individual items. For each pair of clusters, we calculated a *mean interitem correlation,* which is a mean observed correlation for all pairs of items where one item was taken from one cluster and the other item was taken from the other. A mean was taken for all possible nonredundant pairs.

The second type of correlation concerns entire clusters and is called the *latent correlation.* The latent correlation is a correlation between two entire clusters of items estimated by a structural equation modeling program. Both random and systematic measurement errors were taken into account (the latter by estimating the correlations among error terms for variables gathered with the same response format). The model we used had six latent variables (corresponding to the six clusters), each indicated by three manifest variables (corresponding to the three different response formats). For each cluster, items were summed within each response format, and the three separate response formats were treated as separate manifest indicators of the latent variable. For instance, the PA/HighAct cluster was one latent variable, indicated by three manifest variables: PA/HighAct items in an *adjective* format, PA/HighAct items in a "*Describes Me*" format and PA/HighAct items in an "*Agree–Disagree*" format.

The results are shown in Table 2. As expected, the mean interitem correlations, tainted as they

[3] The program derives from a model for circumplex correlation matrices developed by Browne (1992). An accessible description of this model is given by Fabrigar, Visser, and Browne (1997).

are with random and systematic error variance, tended to be modest in magnitude and thus difficult to use as the basis for the delineation of basic principles. Further, what correlation is weak and what is substantial has not been specified. So, Watson and Clark might well argue that these results agree with their principles just as we could argue that the observed correlations fit our predicted pattern.

The latent correlations (given in the last column of Table 2) provide a much clearer picture of the actual pattern, and we focus on them. That pattern is shown in Figure 2, where the estimated latent correlation between each pair of clusters is plotted as a function of the angle between clusters. The correlations varied in the manner we predicted. Contrary to Watson and Clark's (1997) first principle, the correlations between same valenced pairs were not uniformly substantial, but rather varied dramatically and systematically with the angle. Contrary to Watson and Clark's second principle, the correlations between oppositely valenced pairs were not uniformly weak, but rather varied, again dramatically and systematically with the angle. The asymmetry at the heart of Watson and Clark's principles (substantial correlations for same-valenced pairs, weak correlations for oppositely valenced pairs) failed to materialize. Weak correlations exist for some same valenced pairs, substantial correlations for some oppositely valenced pairs. Where Watson and Clark predicted asymmetry, we found symmetry.

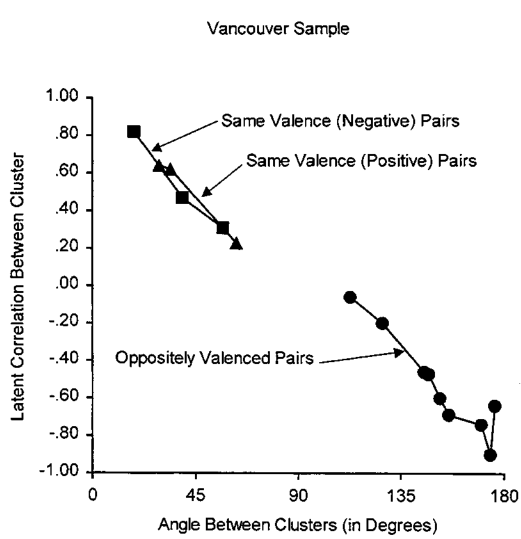

Figure 2. Estimated latent correlation between item clusters as a function of the angle between the clusters (Vancouver sample).

A Boston Sample

It might be argued that the results described so far were unduly influenced by the choice of questionnaires. We next reanalyzed data (Yik et al. 1998; Boston sample) based on questionnaires that included Watson, Clark, and Tellegen's (1988) PANAS. The study was identical in most respects to that just reported. The source of all items for the six clusters of Figure 1 is listed in Table 1. The data were analyzed in a manner identical to that used for the Vancouver sample. Table 3 shows the results. Because the items within some of the clusters changed, the empirical angles and correlations changed. Nonetheless, the same pattern emerged. This pattern is illustrated in Figure 3.

Deriving General Principles

Watson and Clark's (1997) two principles did hold, provided that one limit one's attention to PA/HighAct and NA/HighAct. In accord with Watson and Clark's first principle, one can find items of positive affect that are highly correlated with certain other items of the same valence. One can find items of negative affect that are highly correlated with certain other items of the same valence. Specifically, the correlation between PA/HighAct (e.g., *excited* and *enthused*) and PA/MediumAct (e.g., *happy, pleased*) was .64 (in the Vancouver sample) and .79 (in the Boston sample). The correlation between NA/HighAct (e.g., *upset* and *jittery*) and NA/MediumAct (e.g., *unhappy, troubled*) was .82 (in the Vancouver sample) and .88 (in the Boston sample). (Correlations within each cluster would be even higher.) In accord with Watson and Clark's second principle, one can find items of positive affect that are but weakly correlated with certain items of opposite valence. Specifically, the correlation between PA/HighAct and NA/HighAct was −.20 (in the Vancouver sample) and −.39 (in the Boston sample).

However, it is possible to select items that give quite different principles. Contrary to Watson and Clark's (1997) first principle, one can select items of positive affect that are but weakly correlated with certain other items of positive affect: The correlations between PA/

Table 3
Observed and Latent Correlations for Affect Clusters at Different Angles to One Another (Boston Data, N = 198)

Angle between pair	Pair of affect clusters	Mean interitem correlation: Adjective format	Agree–Disagree format	Describes Me format	Latent correlation
		Positive pairs			
28°	PA/HighAct, PA/MediumAct	.34	.34	.35	.79
28°	PA/MediumAct, PA/LowAct	.29	.26	.49	.81
56°	PA/HighAct, PA/LowAct	.08	.17	.26	.49
		Negative pairs			
16°	NA/HighAct, NA/MediumAct	.47	.46	.44	.88
52°	NA/MediumAct, NA/LowAct	.23	.25	.31	.41
68°	NA/HighAct, NA/LowAct	.15	.16	.13	.29
		Oppositely valenced pairs			
106°	PA/LowAct, NA/LowAct	−.02	−.11	−.15	−.25
130°	PA/HighAct, NA/HighAct	.00	−.21	−.08	−.39
134°	PA/MediumAct, NA/LowAct	−.20	−.19	−.22	−.45
146°	PA/HighAct, NA/MediumAct	−.12	−.34	−.29	−.59
158°	PA/MediumAct, NA/HighAct	−.21	−.36	−.29	−.75
158°	PA/LowAct, NA/MediumAct	−.24	−.26	−.49	−.79
162°	PA/HighAct, NA/LowAct	−.20	−.25	−.26	−.73
174°	PA/MediumAct, NA/MediumAct	−.40	−.55	−.49	−.91
174°	PA/LowAct, NA/HighAct	−.23	−.22	−.35	−.81

Note. Data analyzed (N = 198) were reported by Yik, Russell, and Feldman Barrett (1998, Sample 1). Angles between pairs of clusters were estimated by the program CIRCUM (Browne, 1982; m = 3 free parameters in the correlation function; the input variables are sum of three standard scores corresponding to the three response formats). Latent correlations were estimated with a confirmatory factor analysis with 6 latent variables (PA/HighAct, PA/MediumAct, PA/LowAct, NA/HighAct, NA/MediumAct, and NA/LowAct); that model fit the data reasonably well: $\chi^2(75, N = 198) = 127.43$, root mean square error of approximation = .06, adjusted goodness-of-fit index = .85, comparative fit index = .98. PA = positive affect; NA = negative affect, HighAct = high activation; MediumAct = medium activation; LowAct = low activation.

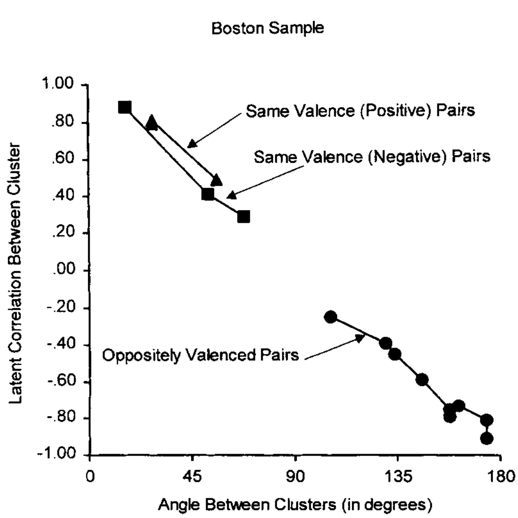

Figure 3. Estimated latent correlation between item clusters as a function of the angle between the clusters (Boston sample).

HighAct and PA/LowAct (e.g., *calm, serene*) were .23 and .49 in the two samples, respectively. One can select items of negative affect that are but weakly correlated with certain other items of negative affect: The correlations between NA/HighAct and NA/LowAct (e.g., *tired, sluggish*) were .31 and .29, respectively. And one can select items of positive affect that are substantially negatively correlated with certain items of negative affect: The correlations between PA/MediumAct (e.g., *happy*) and NA/MediumAct (e.g., *miserable*) were −.90 and −.91, respectively.

Finally, the results allow us to state psychometric principles that are much more precise than Watson and Clark's (1997) division into weak and substantial: The correlation between any two affective clusters corresponds well with the angle between them in Figure 1.

The Definition of Affect

Once measurement error is removed to the extent currently possible, Watson and Clark's

(1997) principles can still be seen. But they can be seen only in certain segments selected from a larger picture. It might therefore be argued that the difference between our scheme and Watson and Clark's principles amounts to which items are selected. Selection, in turn, is to some extent a matter of definition. Implicit in Watson and Tellegen's (1985) concepts of "Positive Affect" and "Negative Affect" (in our terms, *PA/HighAct* and *NA/HighAct,* respectively) and implicit in Watson et al.'s (1988) PANAS questionnaire appears to be a highly specific definition of affect:[4] *Affect* is restricted by definition to PA/HighAct and NA/HighAct. If affect is thus restricted, then we and Watson and Clark arrive at the same predictions, and those predictions are borne out by the data. By the same token, other definitions of *affect* would produce other fundamental principles. If affect were restricted to PA/MediumAct and NA/MediumAct, then two different fundamental principles would apply (substantial positive correlations for same valenced items; substantial negative correlations for oppositely valenced items). If *affect* were defined to include all six clusters formed in Figure 1, then still other principles would hold (namely, our prediction based on angles within a circular ordering).

Alternatively, we see no reason to select certain parts of Figure 1 and label those parts as *affect.* Restricting the definition of *affect* to two clusters, PA/HighAct and NA/HighAct, leaves out a large number of states, such as happiness, serenity, misery, sadness, and depression that other researchers might want included. Psychology must surely examine states such as happiness, serenity, misery, sadness, and depression. Arbitrary definitions can exclude them from the domain of affect, but cannot exclude them from the human condition. Furthermore, we believe that it is an empirical result that these excluded states (and more) can be included within the same descriptive structure as can PA/HighAct and NA/HighAct. If so, that descriptive structure is a useful scientific tool, whatever it is called. Figure 1 is a coherent structure that allows predictions for a wider array of items than any principles based on selected parts. We call it *affect,* but others can call it something else. Its empirical validity does not depend in the slightest on what it is called. (Watson & Tellegen [1985] found it useful to embed PA/HighAct and NA/HighAct within a broader framework similar to our Figure 1; they then distinguished this broader descriptive framework from the dimensions of affect, which they characterized as unipolar parts of that framework.)

Definitions can be questioned. What is the rationale for restricting *affect* to PA/HighAct and NA/HighAct? Watson and Tellegen (1985) stated that affect is, by definition, high in activation. The status of this claim is unclear. If they mean that they choose to define *affect* in this way, then the claim is prescriptive rather than empirical. The usefulness of this restriction would still have to be demonstrated, and, as we just argued, we believe that there are more useful definitions. If they mean that their definition is descriptive of ordinary usage (i.e., an empirical matter), then we submit that the claim is false. The borders around the affective domain (captured, for example, by the word *emotion*) are fuzzy, but that domain surely includes happiness, serenity, misery, and depression. Indeed, the status of these items as affective is more secure than the status of some items on Watson et al.'s (1988) scale of affect (such items as *active, strong,* and *determined* included in their scale of PA).

Although we take issue with Watson and Clark's (1997) two principles and therefore with their scales and concepts based on those principles, there are areas of agreement that are a potential basis for progress. Our Figure 1 is similar to Watson and Tellegen's (1985) broader description of affect, which, in turn, derives from earlier circular models of affect (Plutchik, 1980; Russell, 1980; Schlosberg, 1941, 1954). We therefore offer the structure seen in Figure 1 as the basis of a broader and potentially more useful framework that includes more restricted definitions as special cases.

[4] Watson and Tellegen (1985) referred to their Positive and Negative Affect dimensions as *descriptively bipolar* but *affectively unipolar.* They emphasized that only one end of each dimension is a "state of emotional arousal (or high affect), whereas the low end of each factor is most clearly and strongly defined by terms reflecting a relative absence of affective involvement" (p. 221).

References

Averill, J. R. (1975). A semantic atlas of emotional concepts. *JSAS: Catalog of Selected Documents in Psychology, 5* (MS. No. 1103).

Bradley, M. M. (1994). Emotional memory: A dimensional analysis. In S. H. M. Van Goozen,

N. E. Van de Poll, & J. A. Sergent (Eds.), *Emotions: Essays on emotion theory* (pp. 97–134). Hillsdale, NJ: Erlbaum.

Browne, M. W. (1992). Circumplex models for correlation matrices. *Psychometrika, 57,* 469–497.

Bush, L. E., II. (1973). Individual differences multidimensional scaling of adjectives denoting feelings. *Journal of Personality and Social Psychology, 25,* 50–57.

Carroll, J. M., Russell, J. A., & Reynolds, S. (1998). *The psychometrics of bipolarity.* Manuscript submitted for publication.

Diener, E., Smith, H., & Fujita, F. (1995). The personality structure of affect. *Journal of Personality and Social Psychology, 69,* 130–141.

Fabrigar, L. R., Visser, P. S., & Browne, M. W. (1997). Conceptual and methodological issues in testing the circumplex structure of data in personality and social psychology. *Personality and Social Psychology Review, 1,* 184–203.

Feldman, L. A. (1995). Variations in the circumplex structure of mood. *Personality and Social Psychology Bulletin, 21,* 806–817.

Feldman Barrett, L., & Russell, J. A. (1998). Independence and bipolarity in the structure of affect. *Journal of Personality and Social Psychology, 74,* 967–984.

Green, D. P., Goldman, S. L., & Salovey, P. (1993). Measurement error masks bipolarity in affect ratings. *Journal of Personality and Social Psychology, 64,* 1029–1041.

Hebb, D. O. (1955). Drives and the C.N.S. (conceptual nervous system). *Psychological Review, 62,* 243–254.

Lang, P. J. (1994). The motivational organization of emotion: Affect-reflex connections. In S. H. M. Van Goozen, N. E. Van de Poll, & J. A. Sergent (Eds.), *Emotions: Essays on emotion theory* (pp. 61–93). Hillsdale, NJ: Erlbaum.

Larsen, R. J., & Diener, E. (1992). Promises and problems with the circumplex model of emotion. In M. S. Clark (Ed.), *Review of Personality and Social Psychology: Emotion* (Vol. 13, pp. 25–59). Newbury Park, CA: Sage.

Lindsley, D. B. (1951). Emotion. In S. S. Stevens (Ed.), *Handbook of experimental psychology* (pp. 473–516). New York: Wiley.

Neufeld, R. W. J. (1975). A multidimensional scaling analysis of schizophrenics' and normals' perceptions of verbal similarity. *Journal of Abnormal Psychology, 84,* 498–507.

Neufeld, R. W. J. (1976). Simultaneous processing of multiple stimulus dimensions among paranoid and non-paranoid schizophrenics. *Multivariate Behavioral Research, 11,* 425–441.

Plutchik, R. (1980). *Emotion: A psychoevolutionary synthesis.* New York: Harper & Row.

Russell, J. A. (1978). Evidence of convergent validity on the dimensions of affect. *Journal of Personality and Social Psychology, 36,* 1152–1168.

Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology, 39,* 1161–1178.

Russell, J. A., & Carroll, J. M. (1999). On the bipolarity of positive and negative affect. *Psychological Bulletin, 125,* 3–30.

Schlosberg, H. (1941). A scale for judgment of facial expressions. *Journal of Experimental Psychology, 29,* 497–510.

Schlosberg, H. (1954). Three dimensions of emotion. *Psychological Review, 61,* 81–88.

Thayer, R. E. (1986). Activation-Deactivation Check List: Current overview and structural analysis. *Psychological Reports, 58,* 607–614.

Thayer, R. E. (1989). *The biopsychology of mood and arousal.* New York: Oxford.

Thayer, R. E. (1996). *The origin of everyday moods: Managing energy, tension, and stress.* New York: Oxford University Press.

Thayer, R. E., & Newman, J. R. (1994). Self-regulation of mood: Strategies for changing a bad mood, raising energy, and reducing tension. *Journal of Personality and Social Psychology, 67,* 910–925.

Watson, D., & Clark, L. A. (1997). The measurement and mismeasurement of mood: Recurrent and emergent issues. *Journal of Personality Assessment, 86,* 267–296.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54,* 1063–1070.

Watson, D., Clark, L. A., & Tellegen, A. (1994). Basic principles of affective structure. In L. A. Feldman (Chair), *Mood: Consensus and controversy.* Symposium presented at the 102nd Annual Conference of the American Psychological Association, Los Angeles.

Watson, D., & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin, 98,* 219–235.

Whissell, C. M. (1981). Pleasure and activation revisited: Dimensions underlying semantic responses to fifty randomly selected "emotional" words. *Perceptual and Motor Skills, 53,* 871–874.

Yik, M. S. M., Russell, J. A., & Feldman Barrett, L. (1998). *Structure of current affect: Integration and beyond.* Manuscript submitted for publication.

Received January 1, 1998
Revision received April 24, 1998
Accepted May 18, 1998 ■