Affective Synchrony: Individual Differences in Mixed Emotions

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Most models of affect suggest either inverse or null associations between positivity and negativity. Recent work has highlighted situations that sometimes lead to mixed positive-negative affect. Focusing on the counterpart to these situational factors, the authors explore the individual-difference tendency toward mixed emotions, which they term affective synchrony. *In five studies, the authors show that some individuals demonstrate affective synchrony (overlapping experience of positive and negative moods), others a-synchrony (positive and negative mood that fluctuate independently), and still others de-synchrony (positive and negative moods that function as bipolar opposites). These tendencies are stable over time within persons, vary broadly across individuals, and are associated with individual differences in cognitive representation of self and of emotions.*

Keywords: *affective structure; mixed emotions; individual differences; diary methods*

Can sadness and happiness, negative and positive moods, co-occur? Shall never the twain meet? J. T. Larsen, McGraw, and Cacioppo (2001) and Zautra and his colleagues (e.g., Zautra, Reich, Davis, Potter, & Nicolson, 2000) recently approached this question from a social psychological perspective, asking in effect "are there situations that lead to mixed emotional reactions, and if so, what are their characteristics?" J. T. Larsen et al. presented evidence from three situations that clearly elicited mixed emotions and concluded that although positive and negative evaluations are often negatively correlated, they should be conceptualized as bivariate, because under certain circumstances they have the potential of co-occurring. Zautra et al. (2000) demonstrated the situational effects of both experimentally induced and naturally occurring stress on the association between positivity and negativity and demonstrated that the association of positive and negative affect (PA and NA) became more polarized—that is, the scales became more inversely correlated—under high stress.

A complementary approach to the question of mixed emotions addresses it from a personality psychology perspective, inquiring, "Are there individuals who tend to experience mixed affective states, and if so, what else

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do we know about them?" Our goal is to answer this question and to explore the phenomenon of stable and broad individual differences in the experience of mixed affective states. We suggest that one important feature of mixed affect is its temporal dynamics, and specifically the possible existence of positive covariation over time of positive and negative emotions, which we term *affective synchrony*. We review affect theories that speak to the topic of mixed affective states, present evidence for the existence of broad and stable individual differences in affective synchrony, and begin to examine its construct validity. Finally, we argue that these individual differences may have several implications for normal and pathological functioning.

Affective Space

The view that mood (or core affect) exists in tonic activation, at all times, underlies several major theoretical models of the structure of affect (Barrett & Russell, 1998; Russell, 1980; Thayer, 1978; Watson & Tellegen, 1985; Zevon & Tellegen, 1982). Although these models disagree about some important factors, they all share a view that affect (or arousal; Thayer, 1989) can be best mapped in a two-dimensional space. They also agree that individual emotions can be located as points or regions within this space (cf. Yik, Russell, & Barrett, 1999). At any given time, a person is thought to experience a core affective state (e.g., dysphoria, contentment) that can be characterized by certain coordinates in this affective space.

Russell and his colleagues' (Barrett & Russell, 1998; Russell, 1979, 1980) circumplex model of affect focuses on an evaluative appraisal dimension: the valence of mood, seen as a bipolar dimension stretching between pleasant and unpleasant affect. It also identifies an arousal dimension, which lies orthogonal to the valence dimension, and reflects the intensity level of any particular mood.

An alternative approach (Thayer, 1989) rotates the axes of the affective space by 45º. This model characterizes mood or arousal by the degree of activation of two putative biological systems: energetic arousal (EA) and tense arousal (TA). The systems are thought to differ in the underlying physiology and in their evaluative and behavioral components. TA is related to negative appraisals and inhibition of behavior, whereas EA is related to positive appraisals and approach behavior.

Watson, Tellegen, and their colleagues (e.g., Watson & Tellegen, 1985; Zevon & Tellegen, 1982) espoused a related conceptualization of the affective space. Their model retains the same factor rotation, but refers to the axes as positive and negative activation (PA and NA, respectively). Both activation axes are hierarchical constructs and each subsumes a set of specific emotions (e.g., for NA: fear, sadness, hostility; for PA: joy, enthusiasm; Watson & Clark, 1992). The emotions subsumed by each axis are correlated; NA and PA are terms that refer to the component of variance shared by the basic emotions.

The Evaluative Space Model (ESM) was first developed by Cacioppo and his colleagues (Cacioppo & Berntson, 1994; Cacioppo, Gardner, & Berntson, 1999; J. T. Larsen et al., 2001) within the domain of attitudes, but has since been elaborated into a general model of valenced or evaluative experience. According to this model, positive feelings ("feelings for") and negative feelings ("feelings against") are often characterized by reciprocal activation (one type of feeling rises as the other falls), but could also be characterized by uncoupled activation or by co-activation. The terms *positivity* and *negativity* in ESM are more similar to pleasantness and unpleasantness (the markers of the Circumplex Model's valence dimension) than they are to Watson and Tellegen's (1985) PA and NA. Thus, the ESM prediction that positivity and negativity can be co-activated goes beyond the predictions of Watson and Tellegen, and suggests that the experience of valence itself (apart from arousal) represents the integration of two separable and partially distinct affective components, an appetitive and an aversive one.

Thayer's (1989) energy and tension model, Watson and Tellegen's (1985) PA and NA model, and Cacioppo et al.'s (1999) ESM model all converge on a functional model of affect suggesting two underlying affect systems (cf. Carver, 2001). As Carver notes, motive theories originating in neuropsychology, psychopathology, and conditioning research reached similar conclusions. These two systems are often referred to as the behavioral activation (or approach) system (BAS) and the behavioral inhibition system (BIS) (cf. Fowles, 1988; Gray, 1994). The former is attentive to reward cues, the latter attentive to threat or punishment cues.

The Synchrony of Affect

Clearly, individuals are not fixed into one set of coordinates in the affective space. In fact, mood or emotion typically shows very little stability from moment to moment (e.g., Diener & Larsen, 1984). Some research already exists on the fluctuation patterns of positive and negative activation (e.g., Watson, Wiese, Vaidya, & Tellegen, 1999). There has been little investigation, however, of the covariation of positive and negative mood states within individuals across time. Should we expect this covariation to be highly de-synchronous (reflecting an inverse association), a-synchronous (reflecting a null association), or maybe synchronous (reflecting a positive association) between the two affects?

Prediction of set synchrony levels. One answer is suggested by the work of Solomon (1980), who posits the presence of opponent processes in affect. According to this model, the nervous system's underlying positive and negative affect are reciprocally linked such that the deactivation of one is associated with the activation of the other. With regards to affect, this implies a rebound of one emotion when the other subsides. In fact, the "rebounding" emotion system plays a part in the deactivation of the first emotion, in a process of mutual equilibrium. This approach would expect a de-synchronous association between positivity and negativity (as in the top panel of Figure 1).

Russell's (1979, 1980; Russell & Carroll, 1999; see also Green, Goldman, & Salovey, 1993) circumplex model implicitly agrees with the prediction of affective de-synchrony. In keeping with the circumplex model's emphasis on the bipolar pleasantness dimension of positivity-negativity, any move in the direction of one valenced pole entails a move of equal magnitude *away* from the oppositely valenced pole. According to Russell and his colleagues, this should be particularly true when items reflecting positivity and negativity are chosen to be bipolar opposites. Should the items selected be more orthogonal to each other (e.g., high PA and NA on the Positive and Negative Affect Schedule [PANAS]; Watson, Clark, and Tellegen, 1988), the predicted value would shift toward weaker de-synchrony, or even a-synchrony (i.e., a null temporal association between positivity and negativity; as in the middle panel of Figure 1).

A similar prediction, of a-synchrony, emerges from many of the models that identify orthogonal BIS/BAS systems. For example, the early work of Gray (e.g., 1994) points to the separate neurological substrates underlying the two affective systems. Although Gray himself made no direct prediction regarding individual differences in synchrony, his model has implications for this question. On one hand, the independence of the two neuronal systems certainly allows the association between them to vary considerably. On the other hand, given the orthogonality, it would be parsimonious to expect no dependence (i.e., a-synchrony) on the average, because each system is activated by different cues and plays a separate role in motivated behavior.

Prediction of variable synchrony levels. Several of the models go beyond predicting a set level, or a nomothetic average, of synchrony. As a group, these models try to identify features of the situations in which affect is experienced, and suggest that situational determinants will lead to differing levels of synchrony (cf. J. T. Larsen et al., 2001).

Although not formulated as a model of affect, the classic static model of achievement motivation (Atkinson, 1957) and later dynamic reformulations of this model (Atkinson & Birch, 1970; Revelle & Michaels, 1976) suggest that achievement situations are likely to elicit mixed emotions. According to these models, the thrill of potential achievement (and anticipatory joy) inherently includes the anxiety of potential failure (and inhibited behavior).

More recently, the series of studies by Zautra and his colleagues (2000) provided a clear demonstration that the stressfulness of a situation is key in predicting the PA-NA association. These authors find that although PA and NA are typically weakly related, stressful situations,

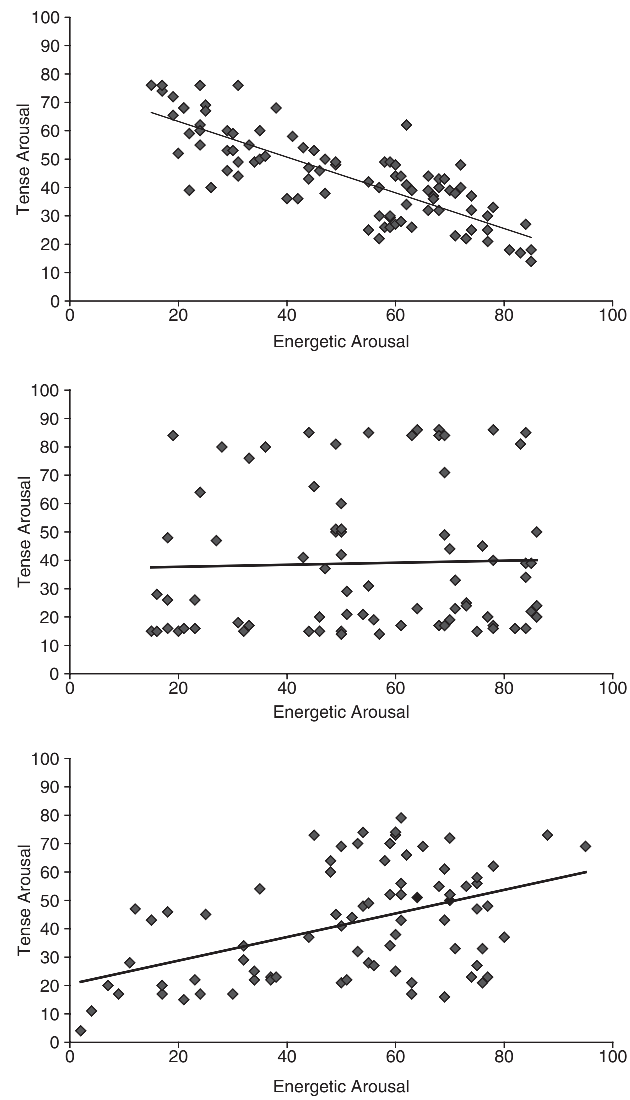

Figure 1 Illustration of synchrony plots for three study participants. Top: Strong de-synchrony (Subject 202, $r = -.81$). Middle: A-synchrony (Subject 121, $r = .03$). Bottom: Strong synchrony (Subject 225, $r = .47$). All three participated in Study 3. Note the presence of high EA/ high TA data points for both subjects 121 and 225. Possible range for EA/TA: 0-100.

NOTE: EA = energetic arousal; TA = tense arousal.

ranging from experimentally induced stress (e.g., preparing to give a speech) to naturally occurring interpersonal stress, increase polarization of PA and NA (e.g., Zautra et al., 2000). Zautra et al. presented an adaptive and/or cognitive model to explain these findings. According to this model, stressful conditions increase the need for heuristic, undifferentiated processing, and therefore lead to a cognitive simplification. Zautra and his colleagues posited that although maintaining multiple registers for different affects is adaptive (and for that reason, neurologically possible), relying on these multiple registers can also be costly and maladaptive at stressful times when resources are limited. Although this work does not explicitly address individual differences, it does suggest that individuals who are chronically stressed, or ones who adopt a less complex, undifferentiated cognitive view, would tend to experience stronger de-synchrony. In contrast, resilient individuals experience more synchrony between positive and negative emotions (Coifman, Bonanno, & Rafaeli, in press).

Predictions that are conditional on the stressfulness of the situation can also be found in the work of Watson and his colleagues (Watson & Clark, 1994; Watson & Tellegen, 1985), who expect PA and NA to be orthogonal at the nomothetic level but make more complex predictions for within-person data. Specifically, although these authors agree that in "extremely high levels of affect" (Watson & Clark, 1994, p. 91) the two dimensions are negatively related, they suggest that at all other levels, positive and negative affective experience remain unrelated. Two of the earliest daily-diary investigations of affect (Diener & Iran-Nejad, 1986; Watson, 1988) support this suggestion. Both these studies found that PA and NA are largely independent at low or moderate levels of intensity but are strongly (inversely) related at high intensity.

Thayer (1989) proposes two separate models that bear on the question of affective synchrony and that differ somewhat in their predictions. The first of these, (which we will term the *activating event* model) suggests that energy and tension are positively related under moderate conditions (i.e., when bodily resource demands are low) and negatively related as resource demands become considerable. The activating event model can be understood best by thinking of the events that serve as activating triggers for negativity. According to the model, aversive activating conditions (such as stress or pain) that lead to withdrawal or inhibition initially raise both TA and EA. This happens, presumably, because of an energizing appraisal of the situation. Thus, such activating conditions would lead to a positive correlation between TA and EA (i.e., high affective synchrony). Beyond some threshold, tension continues to rise while fatigue (i.e., a decrease in EA) sets in. Under such adverse conditions, uncontrollable stressors replace controllable ones that had previously elicited coping responses and lead to a negative correlation between TA and EA (i.e., low or negative affective synchrony).

In addition to the "activating events" model, Thayer (1989) presented a second account of energy-tension interactions that bears some similarity to those of Zautra, Watson, and their colleagues (Watson et al., 1999; Zautra et al., 2000). This account (the "requirements vs. resources imbalance" model; Thayer, 1989, p. 101) equates energetic arousal with personal coping resources. According to this model, individuals make split-second appraisals on entering a situation of the resources required in it. Simultaneously, they make a subjective appraisal of their current EA level (i.e., of the resources they have at their disposal). If an imbalance occurs between the required and the available resources, tension arises.

The imbalance model posits the following association between EA and TA. Under nondemanding conditions, changes in energy level should be unrelated to changes in tension level; in fact, tension levels are likely to be stable and low. Thus, under such conditions, a-synchrony should appear. Under stressful conditions (e.g., threat) on the other hand, an inverse association (i.e., de-synchrony) should appear: the greater the energy resources, the lesser the tension. Interestingly, the model's "high-stress" prediction is similar to that of Thayer's (1989) other ("activating events") model, whereas the "low-stress" prediction is inconsistent with that model.

To summarize thus far, several of the models reviewed yield predictions regarding the nomothetic levels of synchrony between positivity and negativity. These predictions are typically of de-synchrony or a-synchrony. Some of the models suggest that features of the activating events could affect the level of synchrony. With the exception of Thayer's (1989) "activating events model," all of these perspectives expect synchrony to be either negative or close to zero, depending on the condition. Specifically, Gray (1994), Watson et al. (1999; under "non-extreme" conditions), Zautra et al. (2000; under "non-stressful" conditions), and Thayer's (1989) imbalance model (under "moderate" conditions) all expect *a-synchrony* (though given the complexity of the more recent Gray and McNaughton, 2000, model, it is difficult to know what it predicts in terms of synchrony). Russell (1980), Solomon (1980), Thayer's (1989) imbalance model and Watson et al.'s (1999) model under "extreme" conditions, and Zautra et al.'s (2000) model under "stressful" conditions expect *de-synchrony*. Importantly, none of these models make predictions regarding individual differences in affective synchrony.

Individual Differences in Synchrony

Only investigations that utilize idiographic, repeated-measures, within-person design (e.g., circadian rhythm research: Rogers, 1998, Thayer, 1989; *p*-factor analyses: Feldman, 1995a, Zevon & Tellegen, 1982) bear directly on the issue of synchrony, and only Feldman (1995a) directly addressed the issue of cross-person variability in the covariance of affect systems. Feldman's main purpose was to propose two new individual difference variables, valence- and arousal-focus, which index the cognitive focus on arousal-related or valence-related information in emotions (e.g., in similarity ratings of emotion pairs). One of Feldman's main hypotheses was that the foci variables would account for variance in the observed correlations between pairs of affects, such as anxiety and depression or positivity and negativity. Her results supported this prediction.

Interestingly, Feldman (1995a) took as her starting point the existence of individual differences in the co-experience of affect. Our purpose is to go further back than that starting point and pose three fundamental questions: What should we expect the temporal association between energy and tension (or PA and NA) to be? Are there individual differences in this association? What can account for these individual differences? The three hypotheses guiding us are that (a) on average, synchrony levels will be close to zero (i.e., to a-synchrony); (b) this average will be qualified by wide-ranging and stable individual differences; and (c) these individual differences in within-person structure will not be easily reducible to other personality dimensions or between-person parameters of mood, but will be associated with social-cognitive variables related to the cognitive representation of self and emotions. The first two hypotheses will be tested by examining the range and variance of synchrony scores, to determine whether a sizable proportion of the subjects indeed exhibit high (synchronous) and low (de-synchronous) associations between positivity and negativity. The last hypothesis will be tested by examining the association of affective synchrony with several mood, personality, and social-cognitive variables, to reveal its convergent and discriminant validity. We present the results of five diary studies, which explore the existence of the affective synchrony construct (Studies 1-5) and document its stability (Studies 3-5). Studies 1 through 3 document the discriminant validity of affective synchrony, and Studies 4 through 5 its convergent validity. Together, these studies begin casting a nomological net for this unique affective phenomenon, a net we then use in the beginning to discern the meaning of affective synchrony.

STUDIES 1-3

Method

Participants

The participants in these studies (Study 1: 26, 14 female; Study 2: 29, 16 female; Study 3: 82, all female) were undergraduate students.[1] In Studies 1 and 2, they were recruited from a paid subject pool and offered $15 as compensation for their participation. In Study 3, they were fulfilling a requirement in an introductory psychology course. For purposes unrelated to those reported here, Studies 2 and 3 used extreme groups design. Study 2 included participants who scored in the high or low thirds on stability and/or neuroticism and in the high or low thirds on impulsivity were selected from among 87 respondents prescreened with the Eysenck Personality Inventory (EPI). A balanced number of participants in each of the four trait combinations were invited to participate in the study. In Study 3, two equal groups (with high and low neuroticism) were similarly selected; 8 participants (7 of the low-, 1 of the high-neuroticism group) later withdrew. The method of the larger study is described in greater detail in Rogers (1998).

Materials

Personality assessment. The EPI (Eysenck & Eysenck, 1964), a widely used measure that includes scales of extraversion-introversion and neuroticism, was used. The Extraversion scale is composed of subscales of impulsivity and sociability (Rocklin & Revelle, 1981).

Affect assessment. A visual analogue scale (VAS) containing eight words was employed to assess momentary mood states (see Folstein and Luria, 1973, for this method's utility). This method requires the individual to report the current intensities of feeling states by making vertical marks across 10-cm horizontal lines with the anchors *very little* and *very much* on each end. Four of the words load highly on the energetic arousal factor (energetic, lively, and reverse scores of sleepy and tired) and four load highly on the tense arousal factor (tense, frustrated, and reverse scores of calm and relaxed). The items were adapted from Thayer's Activation-Deactivation Adjective Check List (AD ACL) (Thayer, 1986).

Additional tasks. In Studies 1 and 2, choice response time (RT) and affective recall tasks were programmed onto a take-home floppy diskette. The RT and recall findings will not be discussed here but do provide a way of partially verifying compliance.

Procedure

In initial sessions, participants completed the EPI (and were screened with it in Studies 2 and 3). Subsequently, participants were given a packet of VAS forms to be completed every 3 waking hours over the duration of 5 days (Study 1), 7 days (Study 2), or 2 nonconsecutive weeks (Study 3). In the latter study, experimenters called each participant following Week 1 to provide feedback about the number of forms that had been returned, remind of the procedure, and give an opportunity to ask questions. Week 2 commenced 2 weeks after the completion of Week 1.

To encourage reliability in the completion of the forms, and to discourage participants from completing forms retrospectively, participants were informed that they would not incur a penalty for occasionally failing to complete a form. Participants were also given a portable computerized RT task, which afforded an additional check on compliance with the study instructions. Participants were instructed to complete the program once a day for the 5 days of the study, at a prespecified time range each day. One item on this task required the participant to enter the current time; this self-reported time could be compared to the time automatically stamped by the RT program.

Results

The total number of completed affect entries never fell below three entries a day (Study 1 range: 16 to 25, mean = 21.4, SD = 3.2; Study 2 range: 26-46, mean = 36.8, SD = 5.1; Study 3 overall range: 55-95, mean = 78.9, SD = 9.3). In Studies 1 and 2, where RT data were available, participants were accurate (i.e., within 5 minutes) in all of their time entries on the portable RT task. One male participant in Study 2 was excluded from the sample because of inconsistencies in the self-reported time entries.

Synchrony Scores: Level, Variability, and Temporal Stability

Synchrony scores reflect the within-person association of EA and TA. One way to index them is by using ordinary least squares (OLS) correlations between the two scales. This index revealed wide variation in synchrony scores and showed neither skew nor kurtosis in any of the studies. However, because our data are unbalanced (i.e., participants differed in the number of affect entries completed), we used multilevel regression analyses to formally test mean levels (fixed effects), variability (random effects), and prediction of synchrony scores (cross-level interactions). This analytic strategy allowed us to account for within-person dependence in diary data and to overcome the lack of balance. For the random coefficients regression model, we used EA to predict TA. All models were tested using the MIXED procedures in SAS (SAS Institute, 1997; for a nontechnical review, see Singer & Willett, 2003).

The fixed-effect estimate for the simple random coefficients regression models indicated weak negative (Study 1: $b = -.17$, $p < .05$, Study 3: $b = -.09$, $p < .05$) or null (Study 2: $b = -.03$, *ns*) average associations between EA and TA. More important, the random effect estimates (i.e., the variance of the random coefficients) was significant in each study (u = .06, .02, and .04, $p < .05$, $p < .05$, and $p < .0001$, respectively). This indicates significant individual differences in the association of EA and TA in each of the studies. Panels a to c of Figure 2 display histograms of the individual-level coefficients for synchrony in the three studies. These are the random coefficients derived from the multilevel regression model. Positive scores denote high synchrony, negative scores denote de-synchrony. Note the sizable number of individuals who obtained substantial *positive* as well as *negative* affective synchrony scores—clearly suggesting that a nomothetic average is insufficient in describing the entire range of scores.

Study 3 provides the opportunity to examine the temporal stability of synchrony scores. The correlation of affective synchrony indices obtained from two separate multilevel models, one for each week, was $r = .65$ ($p < .001$). This temporal stability, with a time lag of 2 weeks, indicates that the within-person association of EA and TA was quite consistent. For comparison's sake, the within-person stability in mean levels of EA and of TA (computed separately for each of the 2 weeks and then correlated across subjects) were of the same magnitude (rs = .62 and .65, respectively). These indices are comparable to the often used measures of positive and negative affectivity, the trait-like tendencies to experience positive and negative affect, respectively (e.g., Watson & Clark, 1992). In other words, affective synchrony appears to have as much trait-like stability as positive and negative affectivity.

Prediction of Synchrony Using Personality and Affect Variables

In each study, a conditional random coefficients model was computed to determine whether several personality variables are associated with affective synchrony. Personality variables included the neuroticism and extraversion dimensions of the EPI, which have been routinely linked to affective variables (e.g., Meyer & Shack, 1989; Rogers, 1998). Also included were the impulsivity and sociability subscales of extraversion, which have been shown to play divergent roles with

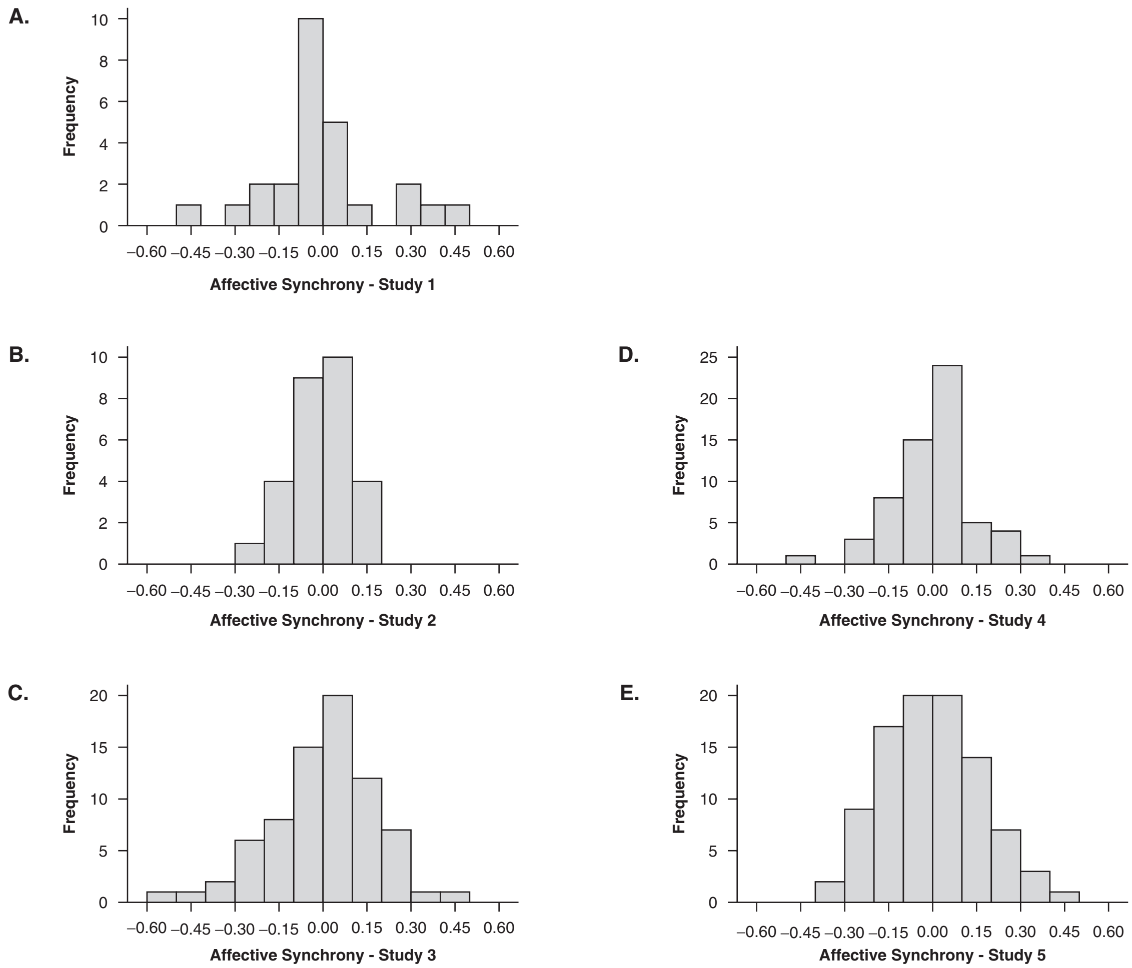

Figure 2 Frequency distributions of affective synchrony scores in the five studies, showing wide variability.

regards to affect. None of these cross-level interactions proved to be significant (Study 1: $p > .50$; Study 2: $p > .15$; Study 3: $p > .25$).

Additional analyses were conducted with several affective variables that can be extracted from the daily mood and energy data. These included mean EA and TA levels and the within-person variation in EA and TA (indexed by the standard deviation of energy and tension scores). Again, none of these cross-level interactions proved to be significant (Study 1: $p > .50$; Study 2: $p > .60$; Study 3: $p > .20$). A single exception, in Study 3, was a marginal negative association between affective synchrony and the variability in TA.

Discussion

The results of Studies 1 through 3 reveal that affective synchrony levels vary broadly, ranging from moderately positive to moderately or strongly negative correlations between energy and tension. On average, tension and energy were weakly negatively related to each other. However, the variability in synchrony levels was quite pronounced, and exceeded the variability that would have been expected by chance. Thus, reliance on average levels of synchrony sacrifices much relevant information regarding individual differences in this construct.

Following our initial examination of synchrony levels, we began casting a nomological net, with consistent findings of discriminant validity for synchrony. Neuroticism, extraversion, sociability, and impulsivity—major personality dimensions often associated with affective experience—were not associated with synchrony levels. In addition, the means and standard deviations of both tension and energy were unrelated to synchrony.

These three studies provided initial support for the individual difference construct of affective synchrony, and for the discrimination of this construct from other personality variables relevant to affect. In separate samples with somewhat different design, we were able to replicate its variability as well as the pattern of divergent findings. In addition, Study 3 served as an extension of the earlier two studies by demonstrating the temporal stability of affective synchrony, another important feature in establishing its construct validity. The next step in establishing the construct validity involves going beyond its *variability, divergence* from other personality and affectivity traits, and *temporal stability,* and finding its *convergence*. This is the central goal of Studies 4 and 5, in which we examine two possible cognitive predictors of affective synchrony, valence focus (Feldman, 1995a) and self-concept evaluative integration (Showers, 1992).

Valence focus. Feldman (1995a) suggested that individuals differ in their representation of emotion terms and of emotional experiences, and that these individual differences are best summarized as two competing tendencies—valence focus (VF) versus arousal focus—that distort the affective circumplex in different ways. Individuals who are more valence focused are less likely to notice or distinguish among arousal levels, and vice versa.

Valence and arousal focus alter the idiographic structure of affect. In the idealized nomothetic structure (e.g., Meyer & Shack, 1989; Russell, 1980) affect terms are ordered in a continuous fashion around the perimeter of a hypothetical circle—a circumplex. But when an individual places greater emphasis on one of the two dimensions underlying this structure, the ideal circle morphs into an ellipsoid. Thus, for individuals with a strong VF, the circle turns into an ellipse with valence as the elongated dimension and arousal as the smaller, secondary dimension. The opposite occurs for individuals with a strong arousal focus.

One proposed implication of these individual differences in the representation of emotions is to the cross-temporal correlation between NA and PA (and in fact, between any two specific emotions in the participant's emotion space). According to Feldman (1995a), individuals with a strong VF are more likely to differentiate PA and NA. This will be reflected in a negative correlation between the two factors. In contrast, individuals with a strong arousal focus are likely to experience positive and negative affect states as more similar and possibly as simultaneous (synchronous). This will be reflected in a positive correlation between the two factors.

Evaluative integration of the self-concept. Another cognitive structural variable to examine vis-à-vis synchrony is evaluative integration of the self (EI) (Showers, 1992). This concept was developed within the social-cognitive literature regarding self-structure (cf. Linville & Carlston, 1994; Rafaeli-Mor & Steinberg, 2002), which views the known-self (James, 1890) as an elaborate knowledge structure (schema) with individual differences in its organization (Kihlstrom & Klein, 1994).

Affective consequences have been of particular interest to cognitive researchers of the self. First, emotions and moods reflect the attainment (or impediment) of *self*-relevant goals. Second, the self-schema is thought of as a representation of one's own personality, formed through both experience and thought, and consisting of both semantic and episodic knowledge (Kihlstrom & Klein, 1994). Thus, knowledge about the self is likely to include a great deal of evaluative information. Affect ensues when this evaluative information is activated.

One particular structural variable, EI (Showers, 1992) seems uniquely suited to serve as a mediator between life events and varying levels of affective synchrony. EI refers to an individual's tendency to make balanced (both positive and negative) evaluations of his or her particular self-aspects. The antipode of EI, compartmentalization, refers to the tendency to make pure and strongly positive or strongly negative evaluations of individual self-aspects. As Showers (1995) explained, the evaluative organization of the self is believed to influence the accessibility of valenced information about the self. Specifically, as various self-relevant events happen, they prime particular self-aspects; the ensuing affect will be a function of the evaluative content of those self-aspects. In evaluatively integrated aspects, both positive and negative information will be primed. In compartmentalized aspects, only positive (or only negative) information will be primed. Over time, individuals with low EI (i.e., highly compartmentalized ones) can be expected to experience either positive or negative emotions at alternate times. Those with high EI can be expected to experience simultaneous positive and negative emotions. Thus, affective synchrony levels could be expected to emerge as a consequence of EI levels.

Hypotheses and Relationship Between the Predictors

Thus, Studies 4 and 5 were conducted with two main goals. First, we aimed to replicate the results found earlier with regards to range (Studies 1-3) and stability (Study 3) of synchrony scores. Second, we wanted to examine two possible cognitive predictors of affective synchrony.

Another goal was to replace the arousal-related items used earlier with more "affective" items. Though EA and TA are closely tied to positive and negative affectivity, one possible criticism of our previous studies was their use of terms that are less prototypically affective.

We hypothesized that VF would be negatively associated with affective synchrony: Individuals who are high in VF were expected to be more de-synchronous in their affect. In addition, we hypothesized that EI would be positively related to affective synchrony: Individuals whose self-concept is evaluatively integrated were expected to be more synchronous in their affect. The effects of the two variables are expected to be additive, as each of the variables is believed to mediate a different source of input for affective variability and synchrony. Thus, the two are hypothesized to have, at most, a weak relationship, as they reflect the cognitive organization of two separate domains of knowledge: the implicit model of emotions and the personal view of the self.

STUDY 4

Method

Participants

A total of 62 introductory psychology students (38 females) participated in the study as part of the requirement for the course. Unlike the participants in Studies 2 and 3, they were not preselected.

Materials

EI. EI is derived from the self-descriptive sorting task, used by Rafaeli-Mor, Gotlib, and Revelle (1999), which varies in minor ways from a task developed by Linville (1985). Each participant was given a packet of 44 randomly ordered cards, each printed with a trait adjective derived from pretesting, 10 blank cards, and a two-sided recording sheet with blank columns. Participants were asked to sort the cards into meaningful groups, so that each group is descriptive of an aspect of their life. The groups were recorded in the blank columns of the recording sheet. No limit was placed on the number of groups or on the number of cards (i.e., traits) within each group. Participants were informed that an adjective could be used once, several times (in different groups), or not at all. The blank cards could be used for repetition of traits. They were allowed 25 minutes to complete the task. Rather than using Linville's trait list, which has been found to be lacking in several respects (see Rafaeli-Mor et al., 1999; Rafaeli-Mor & Steinberg, 2002), the list of 44 adjectives was modified from the original in the following ways: It had a better balance between positive (23) and negative (21) traits, was somewhat larger (and therefore a more reliable sample of the entire trait lexicon), and utilizes the recent developments in lexical trait theories (e.g., Goldberg, 1992), which ensures the presence of markers for all Big-5 dimensions.

VF. In Feldman (1995a), levels of valence or arousal focus were estimated using mood diary data, which could give rise to some circularity in the results, as the same mood diaries were used to form the predicted variables of PA, NA, sadness, and anxiety (which were then correlated to obtain synchrony scores). In this study, we avoided such circularity by computing the VF index from a separate conditional probability rating task. This task includes all 120 possible pairs of 16 affect circumplex markers (taken from Feldman, 1995a). For each pair of affects, participants rate how likely they think it is to experience the second emotion while experiencing the first. Two somewhat similar instruments were administered. The first assessed the perceived conditional probabilities for the participant, himself or herself, jointly experiencing pairs of emotions. The second, identical in every other respect, differed simply in its instructions: Here, the frame of reference was changed and participants were asked about the conditional probabilities of *people in general* jointly experiencing the pairs of emotion.

The conditional probability ratings of both instruments were transformed into distance matrices, which were analyzed using an INDSCAL (individual differences in scaling) model. This analysis returns the individual weights of any participant on the various nomothetic dimensions in a multidimensional scaling (MDS) model (Carrol & Chang, 1970). Based on previous research (e.g., Russell, 1979; Thayer, 1989; Watson, 1988), a two-dimensional nomothetic solution was used, against which the idiographic weights were computed.

Affect assessment. This study employed a VAS, similar to the ones used in the earlier studies, but containing 14 words. These consisted of markers for each of the eight octants of the affective circumplex, which have been found to serve as good affect circumplex markers (see Feldman, 1995a; Rafaeli & Revelle, 2006). Two additional markers, one each for the positive poles of EA and TA ("energetic" and "tense"), were used. Each VAS was anchored by the labels *very little* and *very much*. The final EA scale was *aroused*, *energetic*, *peppy*, *enthusiastic*, *quiet*, *sleepy*, and *sluggish* (the last three reverse scored); the final TA scale was *nervous*, *afraid*, *sad*, *tense*, *disappointed*, *calm*, and *relaxed* (the last two reverse scored).

Procedure

In an initial study session, participants completed the social-cognitive measures and were instructed to complete VAS sheets every 3 waking hours for 2 noncontiguous weeks. Following Week 1, experimenters called each participant to provide feedback about the number of forms that had been returned, remind of the procedure, and give an opportunity to ask questions. A total of 2 weeks later, participants completed another week (Week 2) of diaries.

Results

A total of 60 participants completed the laboratory session and consented to participate in the rest of the study; and two additional participants took part only in the diary portion of the study. Of the 62, 1 failed to complete any diary entries, 14 completed 1 of the 2 weeks of entries, and 2 completed 2 weeks of data but with very few entries. Further analyses were computed with all available data, unless otherwise noted.

The total number of completed affect entries over the 14 days of the study varied from 4 to 80 (n = 61, M = 41.1, SD = 19.3). During the first of the 2 weeks, the total number of entries varied from 4 to 48 (n = 61, M = 23.4, SD = 9.3). During the second of the 2 weeks, the total number of entries varied from 5 to 40 (n = 47, M = 23.0, SD = 9.2). We compared those who completed more than 3 entries each day on both weeks (n = 45) to the remaining participants and found them not to differ in the number and variability of entries per day or in any of the primary mood indices, including the mean, standard deviation, or internal consistencies of their EA and TA scores. Subsequently, all participants' data were used.

Synchrony Scores: Level, Variability, and Temporal Stability

Initial OLS analyses again found wide variation in synchrony scores, with nonsignificant skew and kurtosis. As in the earlier studies, we used multilevel regressions in all subsequent analyses to formally test mean levels, variability, and prediction of synchrony scores. The fixed-effect estimate for the simple random coefficients regression model indicated a null average association between EA and TA (b = –.06, *ns*). More important, the random-effect estimate (u = .04, p < .01) was significant, indicating significant individual differences in the association of EA and TA. Panel d of Figure 2 displays a histogram of the individual-level coefficients for synchrony in Study 4. As before, a sizable number of individuals obtained substantial positive as well as negative synchrony scores. As in Study 3, the temporal stability (indexed by the Week 1 to Week 2 correlation of the affective synchrony indices, computed for the 45 participants with sufficient data, was high (r = .39, p < .001).

Prediction of Synchrony Using Social-Cognitive Variables

EI scores. The EI scores were computed from each individual's trait-sort data. The computation of this index is outlined by Showers (1992) and entails computing a phi (φ) coefficient based on the chi-square statistic for each participant. This coefficient ranges from 0 (perfectly random sort: low compartmentalization or high EI) to 1 (perfect compartmentalization: low EI). For ease of understanding, the score was reversed so that high scores denote high EI. Of the participants, 60 completed this task. On average, participants used negative traits to describe themselves 29% of the time (SD = 13%). However, 4 participants provided self-descriptive profiles without any negative traits; no EI scores could be computed based on these profiles. The remaining 56 participants had an average EI score (.27, SD = 0.17) that fell within the range typically found in EI studies (EI of .25 to .35, corresponding to compartmentalization of .65 to .75; Showers & Kling, 1996).

VF scores. The conditional probability tasks provide both nomothetic models of the organization of affect terms (based on MDS) and indices of individuals' distortions of the affect space (based on INDSCAL). The inclusion of two similar tasks was done to ensure that the conditional probabilities indeed reflect the semantic organization of affect and not simply the episodic memory of the participant's own experiences of emotions.

An MDS solution with two dimensions was obtained for each task. The solutions accounted for 80% and 81% of the variance in the "self" and "people in general" tasks, respectively. These solutions were used less for their sufficiency (both had stress indices of .17, which is above the recommended level of stress) than for their interpretability and comparability to other models of affective structure (e.g., Feldman, 1995a). Based on the identity and relative location of the 16 mood words in both solutions, the axes were labeled as EA and TA. MDS assigns a location in the two-dimensional space based on a vector reflecting both axes—essentially, based on the items' loadings. These numbers reflect the rating scale used in the conditional probability task (which ranged from 1 to 7).

The nomothetic structures emerging from the two tasks were remarkably similar (see Figure 3, Table 1). Coefficients of congruence were computed to further examine the comparability of the two tasks. For both EA and TA, the congruence coefficients as well as the simple correlations between the loadings of the 16 items in the "self" and "people in general" tasks exceeded r = .995. Thus, the average (shared) structure of affect seems insensitive to the type of question asked (i.e., focused on the self or on people in general).

As seen in Figure 3, the MDS solutions yielded EA and TA dimensions. To obtain a joint space organized along valence and arousal (which will serve as the reference point from which idiographic distortions would be obtained), the joint solutions first needed to be rotated. The factor loadings from Feldman (1995b, sample 3) were used as the target in the rotation of the

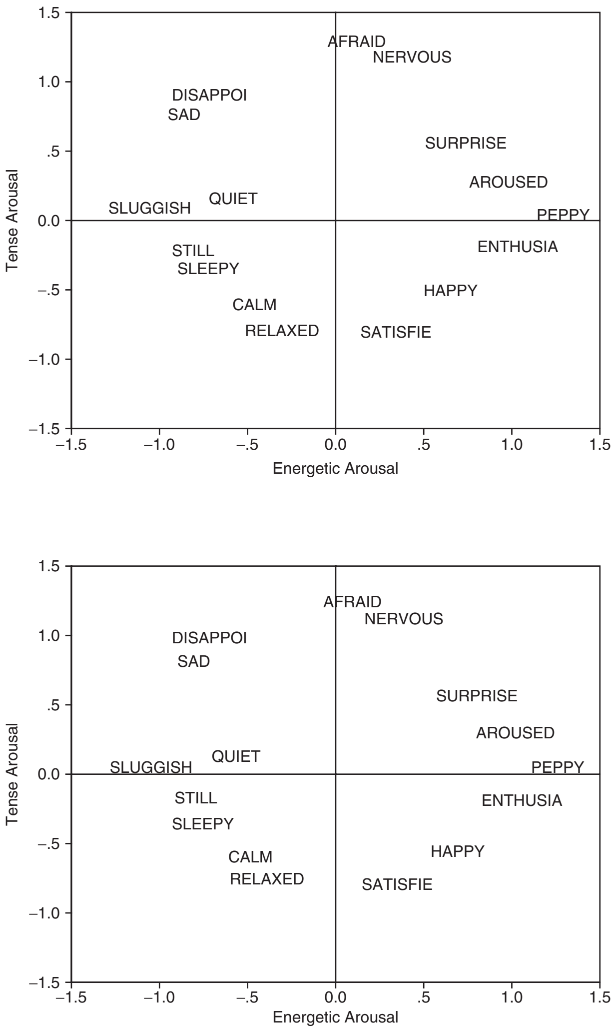

Figure 3 Multidimensional Scaling (MDS) plots of conditional probability ratings, Study 4. Top panel: "Self" data. Bottom panel: "People in general" data.

MDS solution. An OLS procedure was devised that rotated the MDS loadings so that the congruence with Feldman's (1995b) loadings would be maximized. For both the "self" and the "people in general," the highest congruence was achieved when the scores were rotated 48.4 degrees (in both tasks, the congruence for Dimension 1: .91; the congruence for Dimension 2: .86). The rotated joint space of the "self" task is presented in Figure 4. As the congruence coefficients between this solution and those of earlier investigators (e.g., Feldman, 1995b) are sufficiently high, it seems warranted to refer to these dimensions as "valence" and "arousal," respectively. In addition, as the results with "self" and "people in general" continued to be identical, we go on to report only those with the "self" conditional probability task.

INDSCAL computes individual distortions from the joint space anchored around valence and arousal. These distortions can be thought of as the weights (w_{lk}) given by person (1) to each of the dimensions (Dimension k = 1 or 2), so that the predicted distance ($\hat{d}_{ijl}$) between any two emotions (i and j)

$$\hat{d}_{ijl} = \sqrt{\sum_{k=1}^{2} w_{lk}\,(s_{ik} - s_{jk})^2}$$

would be as close as possible to the observed distance ($\hat{d}_{ijl}$). In other words, INDSCAL attempts to minimize the squared residuals ($\hat{d}_{ijl}$-d_{ijl})^2.

Each participant's data were summarized by four indices. The first two are the idiographic weights on valence and on arousal (i.e., to what degree is the person emphasizing valence or arousal in his or her subjective judgments of pairs of emotions). Third is the fit of the weighted space (i.e., how adequately does the joint space, distorted by idiographic weights, recreate the actual observed similarities between all pairs of emotions for that particular individual). Fourth, is a ratio of the valence and arousal weights (i.e., the relative focus of the individual on valence [yielding scores greater than 1] or on arousal [yielding scores less than 1]). The valence to arousal ratio varied from 0.68 to 1.49, which is roughly equivalent to ratios of between 2:3 and 3:2 of valence to arousal. These scores had a mean of 0.98 (SD = 0.20), which reflects an almost equal balance (1:1) of valence and arousal, on average. Ratio indices computed by dividing one variable by another yield skewed, nonsymmetrical distributions, which may weaken their linear relationship with other variables. To correct this problem, a log-transformation was computed for this variable. The rank order correlation of the original ratio and the transformed score (hereafter referred to as VF) was, of course, 1.00; the Pearson product-moment correlations were also very high (r > .99). Figure 5 provides examples of the idiographic (weighted) space of 2 participants, chosen to illustrate the extremes of VF. These plots are obtained by multiplying each item's loadings on the nomothetic dimensions by the individual's idiographic weights. As with the MDS plots, INDSCAL plots use the metric of the conditional probability task that yielded the similarity ratings among items. Participant 10 (top panel) had one of the lowest VF scores (0.68, log transformed –.38); as is clearly visible, this participant's affective space is somewhat elongated vertically, reflecting a stronger arousal focus than is common. Participant 54 (bottom panel) had one of the highest VF scores (1.49, log transformed .40), stemming from an affective space that is more horizontal, and less circular, than is typical.

TABLE 1: Dimension Weights of the 16 Emotions Words From Multidimensional Scaling Analysis of Conditional Prability Ratings, Study 4

	"Self" Rating Task		*"People in General" Rating Task*	
Emotion	*Dimension 1*	*Dimension 2*	*Dimension 1*	*Dimension 2*
Surprised	0.73	0.44	0.79	0.45
Still	–0.79	–0.34	–0.77	–0.29
Sluggish	–1.07	–0.03	–1.06	–0.07
Sleepy	–0.73	–0.47	–0.76	–0.48
Satisfied	0.36	–0.92	0.37	–0.91
Sad	–0.87	0.70	–0.81	0.70
Relaxed	–0.32	–0.91	–0.41	–0.87
Quiet	–0.58	0.04	–0.56	0.01
Peppy	1.28	–0.08	1.25	–0.07
Nervous	0.41	1.09	0.36	1.05
Happy	0.64	–0.62	0.68	–0.67
Enthusiastic	1.03	–0.31	1.05	–0.31
Disappointed	–0.71	0.79	–0.71	0.87
Calm	–0.47	–0.72	–0.50	–0.71
Aroused	0.95	0.16	0.99	0.18
Afraid	0.12	1.17	0.10	1.12

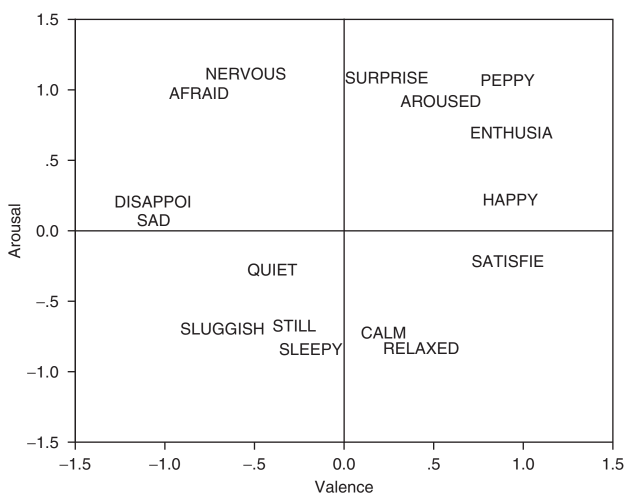

Figure 4 Joint semantic space (across all participants) derived from multidimensional scaling analysis and rotated to a Valence × Arousal solution, Study 4.

Examining the central hypothesis. The central hypothesis of this study was that EI and VF will independently predict individual differences in affective synchrony and that the two would be unrelated to each other. A conditional random coefficients model was computed to examine the convergent validity of synchrony with EI and VF. Both EI ($b = .37$, $p < .05$) and VF ($b = –.62$, $p < .001$) moderated the association between EA and TA in the expected directions (all *p*s one-sided). In other words, with greater VF, and with more compartmentalization (lower evaluative integration), individuals have a more de-synchronous or bipolar experience of EA and TA. The inverse association between VF and synchrony can be seen in the top panel of Figure 6. Interestingly, when VF (the log-transformed ratio of valence and arousal) equaled zero (i.e., when valence and arousal were weighted equally), the predicted synchrony score was zero. As in the unconditional model, EA itself was not a predictor of TA ($b = –.05$, *ns*), nor were VF or EI predictive of TA themselves. The two predictors were unrelated to each other ($r = .23$, *ns*).

Discussion

The findings of Study 4 were consistent with the predicted model. Broad and stable individual differences in affective synchrony were uncovered. These differences were predicted by two cognitive variables, VF and EI, beginning to establish convergent validity to the concept of affective synchrony. In Study 5, we sought to replicate the findings of variability, temporal stability, and convergent validity. In addition, because the findings with EI (which were weaker than those with VF) may have been a function of insufficient power, we used a bigger sample as well as electronic (rather than paper-and-pencil) diaries.

STUDY 5

Method

Participants

A total of 96 introductory psychology students (59 females) participated in the study as part of the requirement for the course. They were not preselected in any way.

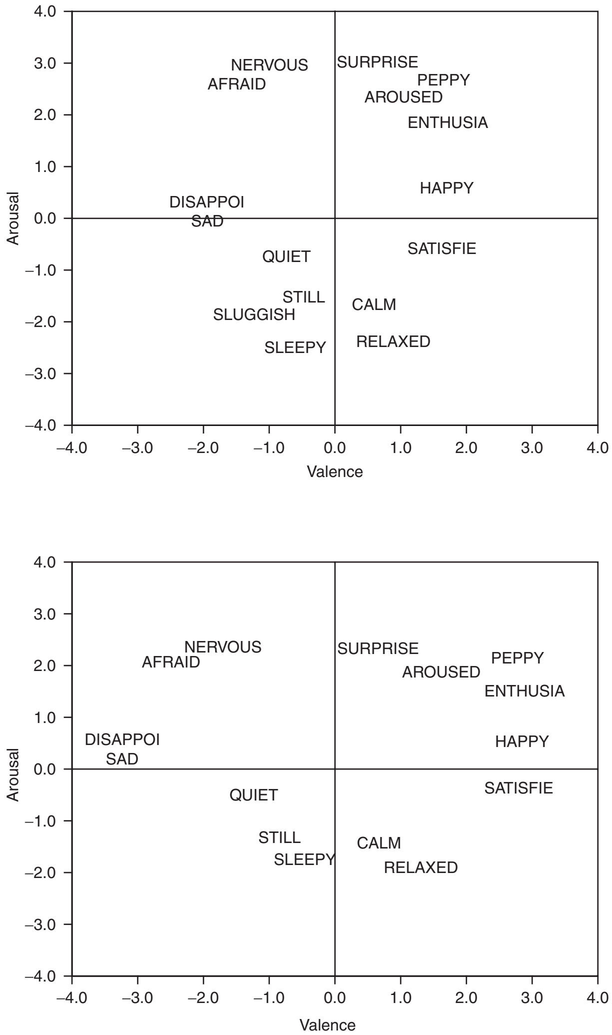

Figure 5 The INDSCAL results of two selected participants from Study 4. (A) participant 10, with low valence focus. (B) participant 54, with high valence focus.
NOTE: INDSCAL = Individual differences in scaling.

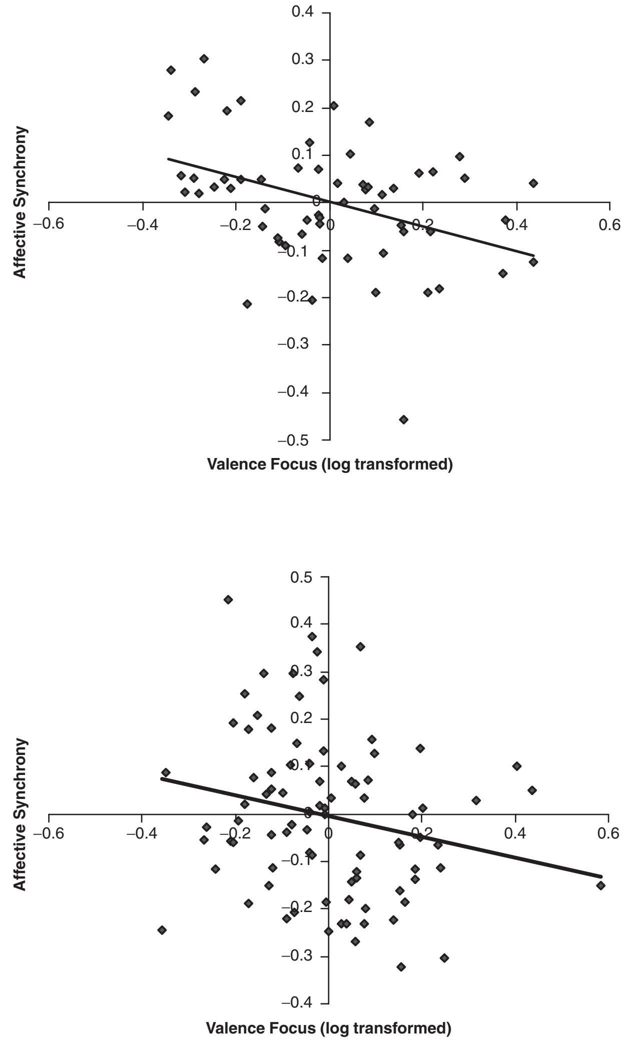

Figure 6 The association between valence focus and affective synchrony in Studies 4 (top panel) and 5 (bottom panel).

Materials

EI and VF. EI was measured as in Study 4. VF was again measured with a conditional probability questionnaire, which was analyzed using MDS and INDSCAL. Because the two versions used in Study 4 (which differed in the frame of reference: self vs. people in general) yielded very comparable results, only one, the self-referential task, was retained.

Affect assessment. To improve the reliability and efficiency of collecting momentary diary ratings, the mood questionnaire was administered using a hand-held Palm Inc. device. Moods were responded to on a 0 to 9 scale, with *not at all* and *very much* as anchors.

Procedure

The procedure was identical to that of Study 4, except for additional detailed instruction given during the initial session about the operation and use of the electronic mood diary.

Results

A total of 96 participants completed the laboratory session and consented to participate in the rest of the study. Of the 96 participants, 3 failed to complete any diary entries, 11 completed 1 of the 2 weeks, and 4 completed both weeks, but with few diary entries (either fewer than 4 days of one of the weeks, or a total of fewer than 20 entries over both weeks). Further analyses were computed with all available data, unless otherwise noted.

The total number of completed affect entries over the 14 days of the study varied from 6 to 89 ($n = 93$, $M = 46.5$, $SD = 17.1$). During the first of the 2 weeks, the total number of entries varied from 4 to 46 ($n = 93$, $M = 26.0$, $SD = 8.7$). During the second of the 2 weeks, the total number of entries varied from 2 to 45 ($n = 82$, $M = 23.2$, $SD = 8.9$). We compared those who completed more than 3 entries each day on both weeks ($n = 78$) to the remaining participants, and found them not to differ in the number and variability of entries per day or in any of the primary mood indices, with the exception of mean EA scores, which were somewhat higher among those who completed sufficient data on both weeks ($t = 2.07$, $p < .05$). Subsequently, all participants' data were used.

Synchrony Scores: Levels, Variability, and Temporal Stability

Initial OLS analyses again found wide variation in synchrony scores, with nonsignificant skew and kurtosis. The fixed-effect estimate for the simple random coefficients regression model indicated a null average association between EA and TA ($b = .01$, *ns*). More importantly, the random-effect estimate ($u = .04$, $p < .0001$) indicated significant individual differences in that association. Panel e of Figure 2 displays a histogram of the individual-level coefficients for synchrony in Study 5. As before, a sizable number of individuals obtained substantial positive as well as negative synchrony scores. As in Studies 3 and 4, the temporal stability (indexed by the Week 1 to Week 2 correlation of the affective synchrony indices, computed for the 78 participants with sufficient data) was high ($r = .43$, $p < .001$).

Prediction of Synchrony Using Social-Cognitive Predictors

EI scores. The EI index was computed in the same manner as in Study 4. All 96 participants completed this task. On average, participants used negative traits to describe themselves 29% of the time ($SD = 14\%$). One participant provided a self-descriptive profile without any negative traits; no EI scores could be computed based on this profile. The remaining 95 participants had an average EI score (.28, $SD = 0.22$) that was very close to that found in Study 4.

VF scores. Of the 96 participants, 7 failed to complete the conditional probability rating task. A two-dimensional MDS solution accounted for 77% of the variance in the task. As in Study 4, this solution was used less for its sufficiency (the solution had a stress index of .18, which is above the recommended level of stress) than for its interpretability and comparability to other models of affective structure. The congruence of the present solution with that found for the parallel task in Study 4 was very high (> .99 for both the EA and TA dimensions). Similarly, the correlations of the 16 item loadings on the respective dimensions within the two samples revealed the loadings to be almost identical ($r < .99$ for both EA and TA). For the reasons explained at length in Study 4, the joint solutions needed to be rotated to allow a computation of the VF index. As in Study 4, the factor loadings from Feldman (1995b, sample 3) were used as the anchors in the rotation of the MDS solution. The MDS loadings were rotated to maximize the congruence with Feldman's (1995b) loadings. The highest congruence was achieved when the scores were rotated 46.5 degrees (.91, .86 for the respective dimensions). The rotated joint space of the affect items was very similar to that found in Study 4, justifying the use of the terms *valence* and *arousal*, respectively. As in Study 4, the valence to arousal ratios (which varied from 0.67 to 1.71, with a mean of 0.97 [$SD = 0.17$]) were log transformed to obtain VF scores.

Examining the central hypothesis. A conditional random coefficients model was computed to examine the convergent validity of synchrony with EI and VF. Unlike Study 4, EI ($b = -.10$, *ns*) did not moderate the association of EA and TA. However, VF ($b = -.32$, $p < .05$) did moderate that association. In other words, with greater VF (though not with lower evaluative integration), individuals had a more de-synchronous or bipolar experience of EA and TA. The inverse association between VF and synchrony can be seen in the bottom panel of Figure 6; as in Study 4, when VF equaled zero (i.e., when valence and arousal were weighted equally), the predicted synchrony score was zero. As in the unconditional model and in Study 4, EA itself was not a predictor of TA ($b = -.05$, *ns*), nor were VF or EI predictive of TA themselves.

GENERAL DISCUSSION

We started our investigation with the following three questions: What should we expect the temporal association between energy and tension, or PA and NA, to be? Are there individual differences in this association? And what accounts for these individual differences? In answering the first two questions, we now know to expect synchrony to average close to zero, but also to vary widely. A sizable minority in each of the studies evidenced either a substantial negative or a substantial positive association between the supposedly unrelated affect dimensions. Moreover, based on Studies 3 to 5, we know that the individual differences in synchrony are quite stable. Our most dramatic finding is the discovery of some individuals who report experiencing either strongly inverse or moderately positive associations between energy and tension, positivity and negativity. The first of these two groups (the de-synchronous one) are characterized by a bipolar experience of affect: an alternation between positive (energy and no tension) and negative (tension and no energy). The second, synchronous group shows a tendency toward mixed emotions.

In answering the third question, we have found both discriminant and convergent validity for affective synchrony. We discuss these findings below.

Personality and affectivity. Are mixed emotions more moderate in intensity? Intuition would suggest this. After all, individuals who are de-synchronous tend to experience high energy along with low tension, and vice versa. Such absence of mixed moods may predispose these individuals to intense affective experience in both positive and negative moods. Thus, affective synchrony may be inversely related to affect intensity (R. J. Larsen & Diener, 1987). Affect intensity is itself related to several personality factors and behavioral outcomes (for example, R. J. Larsen, Diener, and Emmons, 1986, found it to relate positively to both extraversion and neuroticism). However, Studies 1 to 3 revealed that the personality dimensions tapping the strength of sensitivity or response to reward (extraversion, sociability, impulsivity, and positive affectivity) or to punishment (neuroticism, negative affectivity) were unrelated to synchrony. As a rule, neither were indices of levels of, or variability in, affect. Such trait and affectivity measures reflect biological and temperamental characteristics of the individual. Finding that they are discriminant from affective synchrony may be an indication that synchrony has to do more with processing mechanisms than with stable temperament. This led us to examine social cognitive characteristics as convergent variables.

Cognitive representation of self and emotions. Indeed, we found greater evidence for convergence of affective synchrony when we turned to such social-cognitive individual differences. Studies 4 and 5 tested the prediction that two structural variables—the degree of evaluative integration in the self-concept and of VF in emotion knowledge—would be independently predictive of affective synchrony. We found a robust relationship between VF and affective synchrony but only partial support for the predictive role of EI.

Several explanations may account for the inconsistent association between EI and synchrony. Perhaps, contrary to the hypothesis, self-reported affect and affective synchrony do not involve any activation of the self-schema. Accordingly, perhaps features of the self-schema (such as EI) play no part in the activation, or labeling, of affect. Alternatively, it may be the evaluative integration of knowledge about *others*, or about *situations* we find ourselves in—rather than about the self—that determines the activation of mixed emotions.

In contrast, it is possible that the role played by the self-schema in the generation of affect is more complex than the one assumed in this investigation. For example, the index of EI used in this study may have been too gross to detect the effect of mixed cognitive content on mood. EI can be thought of as the overall degree of cross-valence integration, across all self-aspects. However, at any given moment, individuals have one "working self-aspects," one part of their self-schema that is activated and engaged. Typically, this part will correspond to the social role they are enacting at the moment, or the personal goal they are pursuing. A more fine-tuned analysis of the EI hypothesis would involve monitoring of the self-aspects or roles that are activated at the time of a mood rating. Such a design, somewhat more elaborate than the present one, would require obtaining individuals' self-descriptions (including the list of their self-aspects) in advance. Each participant's diary would then allow reports about which role is being enacted at the moment. Affective responses, and particularly mixed affect, could then be predicted based on the degree of integration of positive and negative information in that particular self-aspects, as reported in the earlier session. Such an analysis (though more complex) would be consistent with social-cognitive theories of affect and personality, which are process (rather than trait) models. Until such an analysis is conducted, it appears premature to completely reject the EI hypothesis.

Happily, more robust results were obtained with VF in a conceptual, rather than literal, replication of Feldman (1995a). Our treatment of VF differed in two important ways. First, valence and arousal focus were treated as competing tendencies (as reflected in the log-transformed ratio index). This is consistent with Feldman's finding of a strong negative relationship between separate indices of valence and arousal focus, but differs from her analyses, which retained separate indices rather than creating a combined one. It is also consistent with related theoretical models (e.g., Blascovich, 1992), which suggest that an individual's attention is divided between internal (somatic, arousal-related) cues and external (consequential, socially relevant, and valence-related) cues. We reasoned that a single index should suffice to indicate the relative amount of attention given to either type of cue—and found support for this reasoning.

Second, the VF index was obtained from a separate source of data (the conditional probability rating task) rather than from the mood reports themselves. Although Feldman (1995a) assured that the circumplex items used to compute VF (and arousal focus) had little overlap with the items used in the dependent indices (e.g., the PA and NA scales), some degree of circularity remained. Demonstrating the validity of the focus indices requires using predictor and predicted indices computed from maximally divergent sources of data, as we did in our studies.

The association between VF and synchrony suggests that individuals use their idiosyncratic cognitive representation of affect when labeling their own emotional experience.[2] If the idiosyncratic structure is high in VF, individuals tend to label emotions as either positive or negative, and less often as mixed; arousal will play a smaller part in the labeling of emotions. The inverse will be true when VF is low.

Limitations

This set of studies is only a first step in examining the phenomenon of individual differences in affective synchrony. The evidence for variability, temporal stability, and discriminant and convergent validity needs to be supplemented by additional types of data to further clarify this construct. Chiefly, it will be important to explore its behavioral consequences and predictive validity. Below, we begin to speculate about the relevance of affective synchrony to the domains of psychopathology and learning; we hope further research will explore these domains as well as others.

These studies contain several other limitations. The temporal stability of synchrony, though considerable, was lower in Studies 4 and 5 than in Study 3. This drop could be due to several factors. First, EA and TA scores (which serve as the building blocks of synchrony) were themselves less temporally stable in the present samples and, thus, constrained the stability in synchrony. Second, the item composition of EA and TA differed from the earlier studies, where they comprised a more homogenous set of four markers (compared to seven markers in the later sets). Third, a longer time lag occurred between the two periods of measurement in Studies 4 and 5 compared to Study 3. In summary, affective synchrony is not perfectly stable, and its stability seems to decline with greater time lags; however, neither is it merely a state.

Given the modest temporal stability in synchrony, the findings of convergent validity are more impressive. However, much work remains in weaving a thicker nomological net for this construct. Above, we discussed changes to the assessment of self-schema activation that would be worthwhile if EI were to be found to be associated with synchrony. There are additional constructs, including affect intensity and several forms of psychopathology, discussed below, whose association with synchrony might be profitably explored. Finally, as one reviewer suggested, an important goal would be to partition the variance in synchrony that is attributable to persons versus situations. To do so, the researcher will need to compute multiple synchrony levels for each participant and to categorize the situations or times in which those levels are computed. The challenge in this sort of design is to find meaningful situational features that allow such a categorization; two promising ones are stress (cf. Zautra et al., 2000) and cultural priming (cf. Perunovic, Heller, & Rafaeli, in press).

Implications of Affective Synchrony

Understanding both nomothetic levels and individual differences in the organization of affect should be central to the study of affect systems. At the average level, synchrony should reflect the (in)dependence of affective systems. Our finding of an average association that is close to null is consistent with both prominent versions of the two-factor or circumplex models of affect (e.g., Russell & Carroll, 1999; Watson et al., 1999). However, our findings of wide and stable individual differences pose more of a challenge for affect models. No model explicitly predicts the full range of synchrony scores demonstrated here. Some models do not discuss flexibility in the degree of coactivation of the two affect systems. Others do discuss flexibility but relate it only to the activating conditions. Because the individual differences we document here are temporally stable, attributing the variance only to situational causes rather than individual features seems to miss the mark. At minimum, one would have to propose individual differences in the choice of situations, which then create different levels of synchrony.

Of the perspectives we reviewed above, only one provides explicit predictions of a full range of synchrony levels. This is Thayer's (1989) activating event model. In this model, Thayer arrives at this full range of predictions by appeal to a cognitive appraisal level of analysis. He posits that a positive association between energy and tension is a result of energizing appraisals under threat conditions or expectation appraisals under challenge conditions. We too are optimistic that cognitive appraisal processes may prove to be the key to understanding individual differences in synchrony. In particular, three candidates for exploration are the appraisal of the situation itself (as suggested by Thayer, 1999; cf. Zautra et al., 2000), the cognitive organization of affect within the self-system (cf. Showers, 1992), and the cognitive organization of knowledge about emotions (cf. Feldman, 1995a).

A major challenge for future research will be to explore the *predictive utility* of affective synchrony: Are there costs or benefits to a chronically mixed affective style? Under what conditions are mixed emotions beneficial or harmful? One possibility (congruous with Showers's [1992] evaluative integration model) is that mixed emotions occur when individuals hold an evaluatively integrated view of the world. Attending to multiple features of situations, and, in particular, holding an evaluatively integrated view incorporating both rewarding and aversive cues of objects, may lead to more moderate reactions and to more effective and deeply considered responses. If that is the case, we would expect it to be inversely related to a variety of somatic and affective problems. Indeed, some of these problems, which may be present in both normal and psychopathological functioning, may be understood better through the lens of affective synchrony and its underlying mechanisms. Specifically, it is possible to think of some psychological disorders (e.g., bipolar depression, cyclothymia, and borderline personality disorder) as disorders in synchrony levels. Individuals with these disorders display patterns of intense affect, of both positive and negative valence, at alternate times. The symptoms of such disorders may be manifestations of affective de-synchrony.

However, considering the adaptive role of affect (e.g., Cacioppo et al., 1999) could yield the following (opposing) argument. De-synchrony is related to intense unambiguous affect, which may be useful in the process of self-regulating approach or avoidance behaviors when these are appropriate. Thus, de-synchrony may be the advantageous strategy, and synchrony may pose a liability. Indeed, as Cacioppo and his colleagues have argued, individuals seem to benefit from escaping conditions of evaluative ambiguity (i.e., those conditions that produce mixed emotions), possibly because remaining in an ambiguous situation increases cognitive dissonance, which is psychologically unpleasant. A related possibility is that intense positive and negative affective states are crucial for operant learning. If situations are often perceived as ambiguous rather than as purely rewarding or purely punishing, the acquisition of new behaviors or the extinction of old ones is likely to be slowed. Thus, learning processes of various kinds may be adversely influenced by affective synchrony or mixed emotions.

Summary

Our goal was to introduce the concept of affective synchrony, an index of mixed emotions operationalized as the within-person association of positivity and negativity. In five studies, we showed that synchrony averages at close to zero. However, although most individuals exhibited a-synchrony, a sizable minority displayed either synchrony or de-synchrony. Synchrony levels were found to be stable over time, vary more broadly than would be expected by chance, and be characterized by both discriminant and convergent associations that begin to weave a nomological net for this construct. Clearly, there is a need for more research focused on understanding the nature and implications of individual differences in synchrony and affective structure. We believe this understanding will be advanced particularly by studies exploring idiographic social-cognitive models of event appraisal, evaluative integration, and emotion knowledge.

NOTES

1. We were able to use Studies 2, 4, and 5 to examine sex differences in affective synchrony and found no such differences.

2. This approach has been termed the *semantic hypothesis* of affect (Barrett & Fossum, 2001); an alternative approach (Schimmack & Reisenzein, 1997), sometimes called the "strong episodic hypothesis," challenges this interpretation with some compelling evidence that raises the possibility of reverse causation. Nonetheless, evidence for the role played by semantic knowledge and specifically by the concepts of valence and arousal is compelling (e.g., Study 2 in Barrett & Fossum, 2001). Our finding (Study 4) of almost identical structure in the conditional probability tasks for "self" and "other people in general" is also consistent with the view that valence focus is not a mere summary of the actual (episodic) emotion covariation. This finding helps rule out the possibility that individuals use only episodic knowledge when the self is the reference, yet use some additional (and possibly semantic) knowledge when rating the conditional probabilities among "people in general."

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