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15 Emotion and emotion regulation

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A wife expresses affection toward her husband as he walks toward a waiting taxi. He responds with affection, which leads to her expressing sadness in anticipation of the upcoming separation. In social situations, human emotions rarely occur in temporal isolation. Rather, in our interactions with others, emotions beget other emotions. The resulting chains of emotions can become long and variegated, as interactants express and regulate emotions, creating complex patterns of activation and soothing. Ironically, in both laboratory and survey research, emotion has typically been measured in ways that cause the interpersonal, sequential, and temporal information to be lost. In this chapter, I will review several ways in which we have attempted to preserve this information in our work, and will consider the value these approaches have had for providing a deeper understanding of the role that emotion plays in intimate relationships.

Background

In the 1980s, John Gottman and I developed a new observational paradigm for studying marital interaction in which couples engaged in several unrehearsed 15 minute conversations about marital conflicts and other topics (Levenson and Gottman, 1983). During the conversations, we obtained continuous measures of emotional behavior (coded from video and audio recordings) and emotional physiology (sampled from cardiovascular, electrodermal, and somatic systems thought to be important for emotion). To obtain a continuous measure of subjective emotional experience we developed a video recall methodology. In this procedure, each spouse separately viewed the videotape of their interaction and used a "rating dial" to rate continuously the valence of her or his own emotions as experienced during the actual interaction (Levenson and Gottman, 1983).

This paradigm for studying couples interactions represented a marked departure from the prevailing methods of the day (largely questionnaire studies) in terms of observing actual emotional behavior, studying two interacting individuals, and sampling multiple streams of continuous emotional data. Because of this, new ways to reduce, quantify, and analyze these data were needed.

Emotion dynamics in couples interactions

In typical laboratory studies of emotion, stimuli are standardized and the timing of stimulus and response are the same for all participants. In our new approach to studying emotion in couples, conversations were unrehearsed and idiosyncratic. Accordingly, emotional moments were different in kind and timing for each couple. Because of this, conventional data averaging techniques, which are useful for identifying common signals amidst random noise in classic experiments, are not very helpful. Figure 3 illustrates the problem. The top panel depicts a husband's second-by-second rating of the valence (1 = very negative, 5 = neutral, 9 = very positive) of his emotional experience during a five minute period of sitting silently across from his wife, followed by a 15 minute discussion of a marital problem. This panel illustrates the ebbs and flows of emotion that are typical of these kinds of data. The bottom panel depicts the result of applying second-by-second averaging across 151 of these ratings obtained from husbands in a study of long-term marriages (Levenson, Carstensen, and Gottman, 1994). The resultant average is fairly featureless, reflecting the fact that there are few features in common across participants when these kinds of data are obtained in this manner.

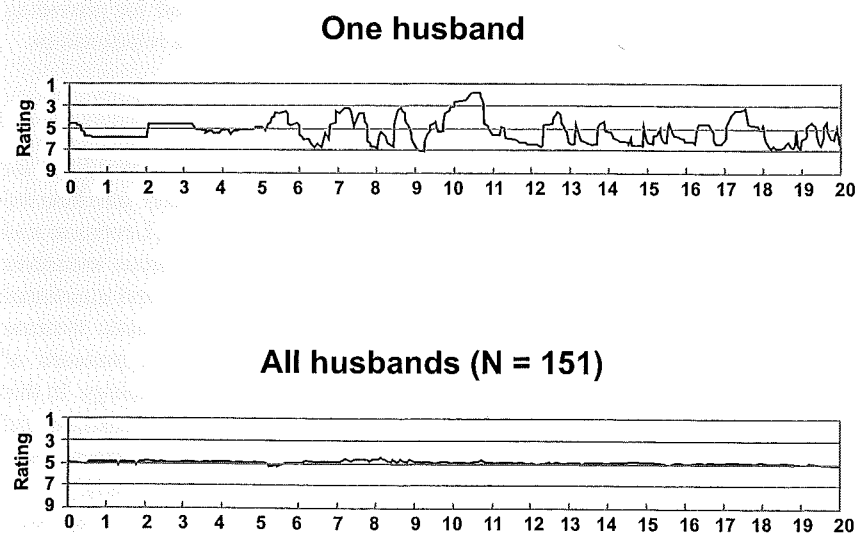


Figure 3 Upper panel: One husband's rating of valence (1 = very negative, 5 = neutral, 9 = very positive) of own emotional experience during discussion with spouse of marital problem (5 minute pre-interaction period followed by 15 minute discussion). Bottom panel: Rating data averaged across 151 husbands. All data are from a study of long-term marriages (Levenson, Carstensen, & Gottman, 1994)

Measuring the dynamics of couples emotion and emotion regulation

Physiological linkage

Physiological data are typically recorded continuously and thus are compelling candidates for characterizing temporal dynamics. However, these data are plagued by autocorrelations (i.e., intrinsic cyclicities) that can inflate simple Pearson correlations for reasons unrelated to the psychological phenomena of interest. A good example is found in heart rate, which naturally rises and falls with breathing (this respiratory sinus arrhythmia is produced by action of the vagal nerve acting on the pacemaker cells located in the sino-atrial node of the heart). Given that most individuals breathe at somewhat similar rates, the resultant similarities in rises and falls of heart rate can inflate correlations both when heart rate is measured in two interacting individuals as well as when measured on multiple occasions in the same individual.

One solution to this problem is to examine streams of physiological data for regular cycles of change and then remove these cyclicities prior to computing correlations. Time-series analysis provides these kinds of tools. Once autocorrelations are removed, the relatedness between the residual data streams can be calculated. To accomplish this in our work, we utilized a bivariate time series analysis (Gottman, 1981), which characterized the degree of relatedness or "linkage" between streams of physiological data and proved useful both across and within individuals.

Emotional "reliving". One of the first applications of this technique came as we were searching for a way to establish the validity of the video recall method for obtaining continuous self-ratings of subjective emotional experience during couples interaction. Most of us have had the experience of seeing ourselves on videotape and know how emotionally powerful this can be. Thus, we thought that watching oneself in a video of an affectively-laden marital interaction would cause the viewer to "re-live" the experience emotionally. Moreover, if this happened, the mirrored emotions occurring while viewing the taped interaction should produce patterns of attendant physiological activation that were similar to those that occurred during the original interaction. When bivariate-time series analyses were applied to the physiological data obtained during discussions of a marital conflict and while watching the video recording of these discussions, they did in fact reveal significant levels of physiological linkage (Gottman and Levenson, 1985).

Linkage and marital satisfaction. If physiology provides a window on to the emotional quality of marital interaction, then it is interesting to think about the conditions under which spouses' autonomic and somatic physiology might become synchronous or linked. One possibility is that linked physiology is a marker of "closeness", which on the surface sounds like it might be a marker of a satisfied marriage. However, if linkage is matched with a metaphor such as "enmeshment", then it might not be such a positive sign.

To investigate the association between physiological linkage and marital satisfaction, we again used bivariate time series analysis, this time assessing

the degree of relatedness between streams of physiological data obtained from husbands and wives (corrected for autocorrelations) as they discussed an area of current conflict in their relationship. We found that the higher levels of physiological linkage were associated with higher levels of marital dissatisfaction (Levenson and Gottman, 1983). In this context, we interpreted high levels of physiological linkage as indicating the kind of emotional enmeshment that occurs when distressed couples become trapped in repetitive cycles of escalating negative emotion.

Linkage and empathic accuracy. Having used the video recall method to obtain continuous reports of spouses' own emotion, we thought we could also use this approach to assess an important aspect of empathy, the ability to recognize another person's emotions. Most previous studies of emotion recognition had subjects identify the emotions shown in static photographs of facial expressions. What was needed was a way to assess ability to track emotions in others as they unfolded over time in dynamic social contexts.

We (Levenson and Ruef, 1992) developed a new measure of dynamic emotion recognition by modifying our video recall procedure. In this new variant, subjects watched videotaped interactions between married couples and used the rating dial to provide continuous ratings of how they thought one of the spouses was feeling (we again used ratings of valence). Accuracy was operationalized as the similarity between the subject's rating and the rating the target spouse had provided of his or her own emotions during the interaction. In addition to being based on an objective criterion of accuracy, this method had considerable ecological validity insofar as subjects were making continuous emotion judgments from information that was dynamic, multimodal (face, voice, posture, content), and interpersonal¹.

While our subjects were rating the emotions of the targets on the videotapes, we also obtained continuous measures of their physiological responses. We hypothesized that raters who were particularly empathic would be sufficiently attuned to the emotions of the target that they would experience the target's emotions themselves. The similar emotions experienced by raters and targets at similar points in time should produce similar patterns of physiological response, thus creating physiological linkage between raters and targets. The results supported this hypothesis, with high accuracy in rating the negative emotions of others associated with high levels of physiological linkage (again assessed by bivariate time-series analysis) between raters and targets (Levenson and Ruef, 1992).

Positive emotion and physiological "soothing"

We have long been interested in the role that certain positive emotions play in providing us with an antidote that helps "undo" the physiological activation

¹ At about the same time as we were developing our measure, Ickes et al., (1990) were developing a similar measure of what they called "empathic accuracy" in which they had subjects rate the thoughts and feelings of others.

associated with negative emotions (Levenson, 1988). In our first experimental test of this notion, we found that positive emotions such as contentment and enjoyment do in fact shorten the duration of physiological arousal produced by negative emotions such as fear and sadness (Fredrickson and Levenson, 1998). In this work we studied individual subjects whose emotions were stimulated by films, quantifying the duration of physiological response as the time taken for physiological activation to return to pre-emotional levels.

More recently, we began studying the soothing effect of positive emotions during couples interactions. For this, we (Yuan, McCarthy, Holley, and Levenson, 2010) developed a new way to quantify the dynamics of emotion regulation using a technique based on sequential analysis (Bakeman and Gottman, 1986). In this approach, we operationalized soothing "events" as moments in a dyadic interaction where a spouse transitions from being in a state of high physiological activation (defined as a certain number of physiological systems exceeding a given threshold for a certain period of time) to being in a state of low physiological activation (defined as all measured physiological systems staying below a given threshold for a certain period of time). When discussing an area of conflict in their relationship, we found that most couples show at least one of these soothing moments. Examining the observational coding of emotional behavior that occurred during these soothing moments, we found that the ratio of positive to negative emotional behaviors was more emotionally positive than during comparison non-soothing moments (Yuan, McCarthy, Holley, and Levenson, 2010). This finding supports the notion that positive emotions are associated with emotion down-regulation during couples interactions, and points the way toward additional studies focusing on specific positive emotions and on cross- and co-regulation of emotion between spouses.

Characterizing the temporal dynamics of emotional behavior, physiology, and experience

Finding ways to take into account physiology, behavior, and subjective experience presents significant challenges for research on emotion dynamics. This problem was pursued by the late Loren McCarter, an immensely talented and creative scientist who began working on ways to quantify emotion dynamics while a graduate student in my laboratory. The goal of this work was to identify emotion cycles in each spouse, which were defined as the transitions between positive and negative valence in emotional experience and emotional behavior, and between low activation and high activation in emotional physiology.

I will briefly outline the methodology McCarter developed; additional details are available on request. The data used to identify emotion cycles were spouses' second-by-second averages of their own emotional experience (from the rating dial), emotional behavior (from behavioral coding collapsed into five point positive-neutral-negative scores), and physiology (using cardiac interbeat interval scores corrected for somatic activity by regressing the cardiac interbeat interval

time-series on the somatic activity time-series) obtained during the discussion of a marital problem. Time-series analysis requires that data meet criteria for stationarity (consistency of mean over time); thus, spouse's time series that did not meet these criteria were corrected by fitting a linear trend and using the residual scores. To remove high frequency noise and oscillations, a natural cubic splines smoothing method was applied to all of the time series (experience, behavior, and physiology). In this method, data were taken in "knots" N points at a time (19 points were used) and a smoothed line was fitted to each knot using a cubic polynomial function to connect the lines. The resulting data were then processed as follows: (a) each time series was examined for cycles using a differencing method that focused on identifying minima and maxima; (b) lead and lag relationships across the separate emotion experience, behavior, and physiology time-series were examined within spouses using lag-correlations to identify the temporal offset that produced the maximum correlation; and (c) each spouse's experience, behavior, and physiology time-series were combined into a single composite time series using a principle components analysis and the resultant composite was examined for cycles in the same way that had been done for the individual time series. These analyses revealed a number of interesting findings concerning emotion dynamics during these couples interactions.

Three-minute cycles. Examining the composite of physiology, behavior, and experience for each spouse revealed that, on average, spouses went through a cycle of increasing and decreasing emotional negativity/physiological activation every three minutes, or five times during the 15 minute conversation. These cycles reflect the ebb and flow of emotional arousal and soothing/regulation that we described earlier when characterizing the emotional dynamics that occur when couples discuss a marital problem. We believe the cycles occur because few couples can stay fully engaged with this kind of difficult material for the entire 15 minutes, and thus go through cycles of arousal and soothing that are facilitated by numerous behaviors including positive emotion (Yuan, McCarthy, Holley, and Levenson, 2010), staying on and going off topic, and engaging and disengaging.

Amplitude of emotion cycles decreases with age. Comparing cycles between older couples (in their 60s and married at least 35 years) and middle age couples (in their 40s and married at least 15 years) revealed that older couples had smaller amplitude cycles (maxima minus minima), but no age differences in cycle duration. Some of this reduction in amplitude may result from habituation to or lessening of the impact of the severity of longstanding marital problems over time. However, these smaller amplitude cycles may also reflect older couples having greater emotion regulatory skills that allow them to deal with difficult marital problems without reaching emotional extremes. Consistent with this is a recent finding from our group that older individuals are better at utilizing emotion regulation strategies that involve positive reframing than middle-aged or young individuals (Shiota and Levenson, 2009)

Emotion cycles begin with visceral changes. Examining the pattern of lead and lag relationships across the 312 spouses in the sample, physiology (cardiac interbeat interval corrected for somatic activity) was found to be the leading

indicator of each emotion cycle. These cycles that began in physiology were followed three seconds later by cycles in emotional behavior and two seconds after that by cycles in emotional experience. Although there are clearly caveats that must be registered (e.g., there is undoubtedly delay between the "actual" start of subjective experience and registration of experience on the rating dial), this suggests a bottom-up organization of emotion dynamics during couples interactions, with physiology occurring first, followed by behavior, and then finally by emotional experience. Such a model is consistent with the peripheralist views espoused most famously in the James-Lange theory of emotion and with the notion that emotional experience is constructed post-facto from the processing of visceral and somatic information (Levenson, 1999).

Summary and concluding thoughts

Emotions are by nature dynamic rather than steady-state. Biological, behavioral, and phenomenological aspects of emotion onset progressively in organized ways, are sustained for finite periods of time, and then offset before cycles start anew. Emotions rarely occur without the involvement of emotion regulatory processes. Patterns of activation accompanied by patterns of regulation further add to the cyclical qualities of emotion. In addition, because most human emotion occurs in social, interpersonal contexts, co-activation and co-regulation of emotion across individuals adds additional complexities and richness to emotion dynamics.

Affective science, especially as it branches into the realms of functional versus dysfunctional emotions, normal versus abnormal emotional behaviors, and the nature of individual and group differences will be enriched greatly by studying emotions in ways that allow emotion dynamics to emerge fully. These efforts will also be well-served by utilizing methods for data reduction and analysis that preserve temporal and sequential information, and by adopting research designs and considering research questions that do justice to the rich complexities of emotion dynamics.

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16 Emotional climate

How is it shaped, fostered, and changed?

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During Christmas, positive feelings are fostered through sharing, and embedded in symbols (e.g., Santa Claus). This symbolic communication generates an affective field. Individuals may react to such celebrations with a spectrum of emotions from excitement and joy to nervousness, anxiety, and loneliness. Nevertheless, this common affective field constantly fosters hope and joy. The emotional climate (EC) of Christmas influences personal and group dynamics. Indeed, being satisfied with Christmas rituals predicts one month later higher levels of well-being and a more positive perception of family climate (Páez, Bobowik, Bilbao, Campos, and Basabe, 2011).

This chapter aims to analyze how EC is different from other emotion-related processes, and to identify the mechanisms that shape and change it. First, we briefly define EC and how it affects behavior, beliefs, and personal emotions. We then focus on processes which may affect EC. Objective social indicators, values, collective identity and memory are factors related to formation and maintenance of EC. Shared historical experiences of collective violence, as well as dealing with them, can provoke change in EC.

Emotional climate: what does it mean and what purpose does it serve?

ECs refer to predominant collective emotions perceived as shared by members of social groups, such as national communities or ethnic minorities. The term also reflects how an individual thinks that most of the people feel about their ingroup's situation. Unlike emotional atmospheres, which depend on group members focusing on a particular event, ECs involve relationships among them. ECs can be expressed as perceptions of collective and interpersonal feelings: *fear*, used