Consuming with Others: Social Influences on Moment-to-Moment and Retrospective Evaluations of an Experience

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Two studies examine differences in participants' moment-to-moment and retrospective evaluations of an experience depending on whether they are alone or in the presence of another person. Findings support our hypotheses that joint consumption leads to similar patterns or "coherence" in moment-to-moment evaluations and that greater coherence leads to more positive retrospective evaluations. We trace the emergence of coherence to processes of mimicry and emotional contagion in experiment 1 by comparing evaluations for pairs of participants who could see each other's expression with pairs who could not do so and in experiment 2 by coding participants' facial expressions and head movements for direct evidence of contagion.

Many common consumption situations such as theme park rides, guided tours, watching TV, or attending a class involve the presence of others, be they family members, friends, or strangers. During many of these situations, consumers might not speak with each other, but they may nevertheless sense the reactions of their companions, as body postures, facial expressions, and gestures may communicate feelings such as interest, boredom, sadness, or amusement. As a consequence of this nonverbal communication, consumers may come to feel in sync with their companions in the shared experience or vastly out of step. Further, this awareness of others' feelings may come to color consumers' reactions as the experience unfolds, heightening or dampening their enjoyment. Thus, going through an experience with someone else may feel different from consuming alone. The present research examines this difference. Specifically, we wish to investigate how the joint consumption of an affective experience influences an individual's evaluations, both in terms of the feelings during the experience and in terms of summary judgments about it. Our central predictions are that joint consumption leads consumers to produce similar patterns—"coherence"—in their ongoing evaluations of an experience and that greater coherence leads to more positive retrospective evaluations of the experience.

Recent work on affective experiences has focused on understanding the relationship between the moment-to-moment affective reactions and the overall evaluation by an individual (Fredrickson and Kahneman 1993; Redelmeier and Kahneman 1996). This prior research does not explore the inputs to people's moment-to-moment reactions, which are assumed to result from individual preferences for the unfolding components of the experience. According to this research, overall evaluations of an experience can be predicted by two key moments in the ongoing experience, namely, the peak and the end affect felt by consumers who, interestingly, appear not to consider the duration of positive and negative components of the experience in judging its overall quality. In the domain of advertising, Baumgartner, Sujan, and Padgett (1997) similarly showed that it was the peak and the end affect that predicted liking of an ad regardless of the length of the ad, unless the extra length was used to create another peak. These studies do not consider, however, what might happen to an individual's moment-to-moment evaluations of the experience if there is someone else present and sharing the same experience and whether

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the global evaluations are based on the same factors as when the individual is alone.

A second recent stream of research in social psychology has begun to examine how people may influence each others' feelings in their joint interactions (Gump and Kulik 1997; Hatfield, Cacioppo, and Rapson 1994; Howard and Gengler 2001). A common finding in this research is that people's expressions of emotions may rub off on each other so that people acting together come to catch each others' moods, eventually even moving up and down together in a shared emotional rhythm (McGrath and Kelly 1986; Neumann and Strack 2000; Totterdell et al. 1998). This emotional contagion and entrainment of mood has been traced to mimicry of behavior, which can cause people to adopt the emotion associated with facial expressions and mannerisms that they have mimicked (Hatfield, Cacioppo, and Rapson 1992). For example, people smile in response to smiles, which in turn may lead to shared feelings of happiness. The result is a state of rapport, which is characterized by agreement and mutual interest that arises through convergence or synchrony of nonverbal expressive behavior (Bernieri, Reznick, and Rosenthal 1988; Drolet and Morris 2000; Tickle-Degnen and Rosenthal 1990).

In this article, we integrate these lines of research on affective experiences and emotional contagion and propose that moment-to-moment evaluations by consumers who can observe each others' reactions covary to a greater extent than those by participants who are alone. Further, we propose that global evaluations may be influenced not just by the consumer's own peak or end affective states but also by the degree to which the consumers' evaluations are indeed entwined with each other. That is, greater rapport among consumers, as manifested in shared patterns of evaluations, leads to higher evaluations of the overall experience. In our first study, we measured moment-to-moment and retrospective evaluations for consumers who were assigned to view a short film alone, with another person whose facial expressions and body posture they could not see or with another person whom they could see. In a second study, we videotaped participants as they watched a film with another person, in order to gather direct evidence for mimicry of expression and its effect on participants' evaluations.

THEORETICAL BACKGROUND

The Impact of Social Presence on Moment-to-Moment Evaluations

Consumers who share a consumption experience may influence each other's ongoing evaluations through processes of mimicry and emotional contagion. For example, people seated next to each other in a theater may be able to see each other's facial expressions and body postures. Recent research has shown that people often mimic each others' nonverbal expressions in such circumstances, for example, smiling, slouching, or jiggling one's foot to mirror the behavior of a companion, and that this mimicry can occur outside conscious awareness (Chartrand and Bargh 1999). Further, this "chameleon effect" may lead to emotional contagion in which moods transfer between people (Hatfield et al. 1994; Neumann and Strack 2000). Behaviors such as facial expressions may reflect underlying feelings, but processes of afferent feedback may also cause people who are mimicking behaviors to adopt the corresponding underlying affective state. That is, moods may cause expressions, but expressions may also cause moods. Friedman and Riggio (1981) found, for example, that sitting facing another person for a few minutes may cause the mood of the less expressive person to become more like the mood of the more expressive person.

Observing another person's expressions may also lead to contagion of emotion through conscious processes. Observation of another person's pleasure or displeasure with an experience may provide information about the nature and quality of an experience, causing people to adjust their own expressions and feelings. For example, upon observing another person laughing, a consumer may reason, "Perhaps this movie is funnier than I thought," and thus begin to smile more, laugh more, and in time feel more amused. In either case, either through conscious or nonconscious processes, people who can observe each other may copy each other and come to share similar moods. Importantly, in the present research, we refer to any type of copying and adoption of another's emotions through conscious or nonconscious processes as "mimicry and emotional contagion," a broader use of the term than is found in the literature on nonconscious mimicry.

Research further suggests that mimicry and emotional contagion may go back and forth causing a temporal association between people's moods. Hence, people who can observe each other may come to share a pattern of moods, leading to "*mutual entrainment*, in which one rhythmic process causes or is caused to oscillate with the same frequency as another," for example, when people who work together share the same highs and lows over a shift or a week (Totterdell et al. 1998, 1505, emphasis added; see also McGrath and Kelly 1986). Mutual entrainment can also occur between people interacting over shorter periods with no obvious, external cyclical structure (Drolet and Morris 2000; Tickle-Degnen and Rosenthal 1990).

Building on this prior work, our contention is that such mutual entrainment of mood may manifest itself in a shared pattern in consumers' moment-to-moment evaluations of an experience. That is, we expect that the dynamically entwined moods will jointly color consumers' reactions to the experience, leading to a similar pattern of ups and downs in their moment-to-moment assessments. Our proposed process assumes, therefore, that participants first note each other's expressions and "mimic" them either consciously or nonconsciously; that this mimicry of expressions leads to shared emotions that move together over time, that is, mutual entrainment of mood; and that the shared emotions influence, in turn, the ongoing evaluation of the experience. For example, one person smiles at something in the experience, which causes the second person first to mimic that smile

and then to feel a bit happier. This greater happiness leads to a more positive evaluation of subsequent components of the experience. Importantly, this process is expected to emerge only for people who can actually observe each other's expressions during an experience, a state that we term the "full social presence" condition in our studies.

Of course, some similarity in pattern among consumers would be predicted by characteristics of the experience itself. For example, consumers' evaluations should track the high-quality and low-quality scenes of a movie, producing shared patterns of evaluation among consumers independent of any effects due to observing each others' reactions. Nevertheless, we expect that comparison of moment-to-moment evaluations of consumers who went through an experience with others would reveal greater comovement than those who went through the experience alone due to these processes of mimicry and contagion:

H1a: Moment-to-moment evaluations by pairs of participants in the full social presence condition who can observe each other during the experience will covary to a greater extent than evaluations by (randomly constructed) "false" pairs of participants in the alone condition.

Evaluations by participants in the social presence of others might move together for other reasons than mimicry and contagion. For example, being in the room with others might shift the bases on which consumers evaluate an experience. People may attempt to suppress their idiosyncratic likes or likes that they feel are not socially appropriate, or people may focus on social aspects of the experience (e.g., love scenes in a movie) that are made more salient by the presence of others, concentrate more on aspects of an experience that would facilitate subsequent conversation, or simply pay more attention to the experience in the presence of others, which could increase covariation of moment-to-moment evaluations. Further, prior research has shown that the mere presence of others (i.e., the presence of others with whom the individual is not interacting in any way) may heighten people's arousal, causing them to produce less sophisticated or tailored responses, relying more on habitualized, routinized responses (Zajonc 1965).

To rule out such effects based on being near others but not actually achieving a conjoined mood due to mimicry and contagion, we contrast "observing pairs" of participants in the full social presence condition with two control groups. One control consists of pairs of participants in the "mere social presence" condition in which participants were seated next to each other but prevented from observing each other by a partition placed between them. The other control, labeled "nonobserving false pairs," was created by randomly pairing the moment-to-moment data of participants in the full presence condition who had not been seated next to each other. For example, imagine that participants A and B had been seated next to each other, as were C and D. From these observing pairs we could construct nonobserving false pairs such as A and C or B and D. We include this control in addition to that provided by the mere presence condition in case the greater exposure in the full social presence condition produced different or stronger social pressures that might have affected participants' moment-to-moment evaluations. This constructed control condition thus holds constant every aspect of the viewing environment, allowing us to isolate effects of mimicry and contagion between true observing pairs. Our expectation is that the moment-to-moment evaluations by observing pairs would move together to a greater extent than evaluations by pairs in either control condition:

H1b: Moment-to-moment evaluations by observing pairs of participants in the full social presence condition will covary to a greater extent compared to pairs of participants in the mere presence condition.

H1c: Moment-to-moment evaluations by observing pairs of participants in the full social presence condition will covary to a greater extent compared to nonobserving false pairs of participants in the same social presence condition.

Impact on Overall Evaluations of Experience

Our research has two intended contributions. The first, testing the effect of social presence on consumers' temporal pattern of evaluations, was described in the previous section. Our second, and perhaps more important contribution, addresses the relationship between the temporal pattern of responses and participants' overall retrospective evaluations of the experience. That is, we explore the links from mimicry of expression to shared patterns of evaluation and then from shared patterns of evaluation to retrospective judgments. Kahneman (1999) argues that an individual's true measure of an experience can be derived only from a moment-to-moment sampling of the thoughts and feelings throughout the experience. Nevertheless, prior research has found that retrospective evaluations correlate strongly with two key aspects of the experience—the peak and the end affect felt during the experience (Fredrickson and Kahneman 1993; Kahneman et al. 1993; Redelmeier and Kahneman 1996). When asked to assess overall quality or about their intentions to go through a similar experience again, people often construct a snapshot view of the experience, drawing from select moments in arriving at their judgment (Kahneman et al. 1993).

While the previous research on evaluations of experiences has shown that two key moments in the experience, namely, the peak and end affect, are instrumental in explaining variations in global evaluations, there is relatively little research on the effect of shared experiences. Our contention is that sharing experiences may lead to a sense of connectedness (as manifested in the mutual entrainment of mood and comovement of evaluations) and that this sense of connectedness will contribute independently to the evaluations of

the experience, over and above the effect of the peak and end affect that are individual specific.

We base this contention on previous research on contagion effects, which has suggested that social contagion leads to a sense of affiliation among the individuals concerned. For example, Van Baaren et al. (2003) found that patrons at a restaurant who were mimicked by a waitress gave the waitress a bigger tip, presumably because of the sense of rapport engendered by the mimicry (Chartrand and Bargh 1999). Tanner and Chartrand (2005) reported a study in which participants mimicked by a confederate during the presentation of a product consumed more of the product and had higher stated intentions of buying it than those who were not mimicked. This suggests that the effects of contagion can spill over to products and experiences that are associated, even if merely by proximity, with the individuals involved in the experience.

In the domain of conflict resolution, Drolet and Morris (2000) report that negotiators' visual access to each others' nonverbal behavior fostered a state of dyadic rapport that facilitated mutual cooperation. Raghunathan and Corfman (2006) also argue that "happiness shared is doubled," pointing to the value of joint consumption of an experience. According to this view, shared experiences may lead to greater enjoyment, particularly if the consumers have similar overt reactions to the experience due to greater feelings of belonging or to a sense of greater perceived accuracy in their judgments. Reflecting a difference in the focus of the research, participants in Raghunathan and Corfman's studies were reacting to explicit statements of agreement or disagreement by a confederate. Nevertheless, this body of work taken as a whole suggests that overall evaluations by individuals who consumed an experience with someone else may depend on the extent to which the consumers' moment-to-moment experiences covaried with each other. Hence,

H2: Type of presence will moderate the effect of covariation on overall evaluations of the experience:

- **a)** For pairs of participants in the full social presence condition, the extent of covariation in moment-to-moment evaluations will independently predict overall evaluations of an experience, together with the peak and end affect, such that higher covariation will lead to greater overall evaluations.
- **b)** Overall evaluations for participants in the alone false, mere presence, and nonobserving false conditions will be predicted only by their peak and end affect.

EXPERIMENT 1

Method

Fifty-seven undergraduate students at the University of Chicago participated for compensation of $6. Seventeen participants were assigned to single-person sessions, while the other 40 were assigned to two-person sessions. Half the pairs were randomly assigned to the mere social presence condition, while the other half were in the full social presence condition; both are described below.

Upon entering the lab, participants were seated in front of a computer and told that they would be seeing a short video. They were instructed to use a joystick to indicate their momentary gut reactions, by pushing the lever to the left if they did not like it and to the right if they did. A sliding scale showed the evaluation on screen (0 = dislike very much; 10 = like very much). Participants assigned to the mere social presence condition sat next to each other on two separate computers divided by a full hardboard partition that they could not see across. Participants assigned to the two-person full social presence condition were seated with a half partition dividing the two computers, such that they could see each other's heads and shoulders across the partition but not the joystick attached to the other computer. Participants in the full social presence condition were thus seated together much like audience members in a movie theater. Their ability to see each other's expressions and emotions relied on side glances.

The video files on the two computers were synchronized to play at the same time via an external signal through the serial ports of the two computers. We used a video clip called "Celebrity Jeopardy," lasting 7 minutes and 1 second, from the popular comedy show *Saturday Night Live*. Participants' joystick movements were captured every 0.1 seconds by the computer and averaged to 1-second intervals. We thus had 421 data points per individual.

After watching the video clip, participants completed several measures, including their evaluation of the program (enjoyable, quality, stimulating, entertaining, and engaging) and their intent to watch it or a similar program again. The five items for program evaluations and the two items for intent were combined into one composite measure of evaluation ($\alpha = .92$). In addition, participants rated the extent to which they paid attention to the program. After completing the scales, participants were then debriefed and dismissed.

Analytic Strategy

Our first hypotheses (1a–1c) concern differences in degree of comovement in evaluation for participants who could observe and potentially mimic each other compared with those who could not. Specifically, we compared the degree of comovement for observing pairs of participants in the full social presence condition, that is, pairs seated next to each other who could observe each others' reactions, to three other groups: (1) 10 "alone false pairs" constructed from participants in the alone condition (hypothesis 1a), (2) 10 pairs of participants in the mere presence condition (hypothesis 1b), and (3) 10 nonobserving false pairs constructed from participants in the full social condition who were paired with someone else (hypothesis 1c).

To explore differences in comovement, we analyzed the

time series of participants' online evaluations using both a conventional measure, correlation, and a method employed in the hard sciences and the econometrics literature called cross-spectral analysis, which is particularly suited to comparing two time series in terms of underlying cyclical patterns that conventional correlations would not be able to uncover (Bronnenberg, Mela, and Boulding 2006). See the appendix available in the online version of the *Journal of Consumer Research* for a technical note on this method.

Cross-spectral analysis is very useful in this case because our theorizing does not imply that people consuming together would evaluate each component of an experience in exactly the same way at the same instant. Rather, the literature on mutual entrainment and dyadic interactions suggests that evaluations or behavior could covary at different periodicities, both short cycles and broader sweeps (Drolet and Morris 2000; Tickle-Degnen and Rosenthal 1990; Totterdell et al. 1998). In fact, the processes of mimicry and emotional contagion that we propose suggest that evaluations may well move together over broader periods. According to the proposed process, each person may respond to momentary aspects of the experience according to his/her own idiosyncratic likes and dislikes. Despite this local independence of response, participants' evaluations may nevertheless move broadly up and down together to reflect the entwining or synchronization of moods.

To understand this assertion, consider this more elaborate description of the mimicry, contagion, and evaluation process. Imagine that Person 1 smiles broadly in response to an early moment in the experience that s/he likes a lot. Person 2 had not liked that moment as well but notices Person 1's smile, mimics it, and starts to feel happier. A few seconds later, Person 2, now in a more positive state of mind, evaluates a moment in the experience more positively than s/he would have had s/he been alone and turns to smile at Person 1, who reciprocates this positive expression. This shared look reinforces each person's good mood, which exerts a positive influence on subsequent evaluations. In this way, two people may trend up together in their evaluations, perhaps reaching a local peak due to the characteristics of the experience itself or due to one person' dislike (and accompanying negative facial expression) of a moment, which reverses the process and sends the trend downward. As this example illustrates, expressions may be mimicked quickly and directly, which leads to later, more subtle influence on the evaluation of each moment of the experience. Specifically, each moment is judged according to individual tastes, but these evaluations are also enhanced or degraded by the mood that people have come to share with each other. By analogy, the time series of sales at two retail stores may move independently from day to day to reflect differences in promotions and merchandise, while still swinging broadly up and down together due to seasonality or the business cycle. Participants' entrainment of mood is akin to these broader economic influences that could produce subtle underlying comovement in evaluation.

Cross-spectral analysis is ideally suited to finding shared swings in evaluation. Further, the extent to which an individual's evaluations lead or lag those of the other person may vary significantly across dyads, leading to an analytic problem of running multiple lagged correlations for each dyad in order to identify the lag at which correlations are the highest. Cross-spectral analysis identifies covariation at different frequencies or periodicities and requires no assumptions on specific patterns of cyclicality. The measures yielded by this process are also independent of lag; that is, regardless of whether interactions are instantaneous or lagged, the measure of covariation remains the same. Hence, behavior over time may follow rhythmic patterns or periodic movements in terms of short-term high-frequency oscillations and longer-term low-frequency oscillations, and cross-spectral analysis may be used to determine the frequency ranges in which two time series line up.

To conduct this analysis, we first looked for trends in the time series for each person. We found consistent evidence of a curvilinear (quadratic and cubic) trend, reflective of key moments in the short film that may have been more appealing than others. We therefore detrended these data by removing the curvilinear trends using least-squares regression (Gottman 1981). All subsequent analyses were carried out on the residuals. We then ran a cross-spectral analysis for each of the pairs of residuals. We used a program called XLStat-Time (Addinsoft Inc.) and SPSS Trends to carry out the analysis. By definition, the highest frequency (called the Nyquist frequency) for which the spectral analysis can be run is 0.5 cycles per time horizon, which corresponds to a cycle length of two units. Thus, the time series can be divided into 421/2, or 210, periodic components with cycle lengths of from 421 seconds (the longest period/lowest frequency in our data) to 2 seconds (the shortest period/highest frequency). For each time series, the analysis yielded a periodogram, which is simply the proportion of variance accounted for by each of the 210 periodicities. To determine whether the periodogram showed any evidence of cyclicality, we compared the periodogram against white noise using the Kolmogorov-Smirnov test. We confirmed that each of the individual periodograms showed a nonrandom and significant pattern of cyclicality. We used a Bartlett window to smooth the data.

The cross-spectral analysis yielded a statistic called "coherence" for each of the 210 periodicities. Coherence is simply the square of the correlation between the two time series at a given frequency. Thus, this procedure yields a measure of the proportion of variance accounted for by the influence of one person on the other at each frequency. Because this analysis implies 210 such measures of variance, it is useful to compute a summary statistic across specific planning horizons, akin to looking at business periods of a day, a week, or a quarter. In order to determine an appropriate horizon, we filtered the data to retain only those frequencies that were of interest. This technique enables the separation of the entire time series into bands of frequencies (e.g., 30 seconds or less often, 10–30 seconds, and 10 seconds or more often). Thus, for each individual, we had three

resultant time series that retained only the frequency spectrum of interest. We then ran simple correlations between individuals in each dyad and found that the highest correlations (0.4 or higher) were in the low-frequency band (30 seconds or less often). This suggests that the appropriate cutoff for splitting the continuous periodicities is 30 seconds. (Details of this technique are available from the authors. At a less technical level, one can look at this division as identifying where the maximum separation occurs in the data and dichotomizing the variable at that point.) Using the formulae described in Porges et al. (1980), a summary statistic called "weighted coherence" was calculated separately for the low-frequency range of the data (every 30 seconds to every 421 seconds) and for the high-frequency range (every 28 seconds to every 2 seconds).

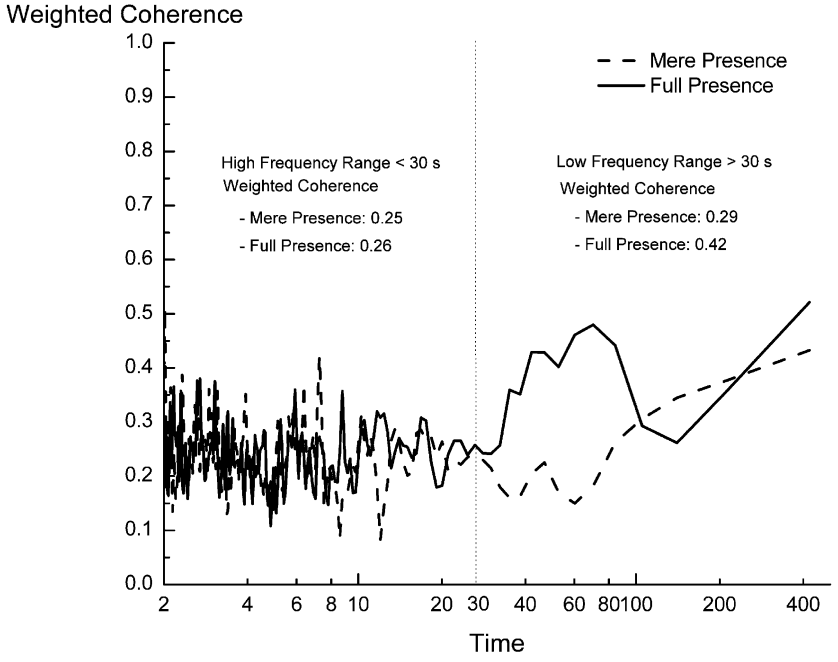
This division into high- and low-frequency weighted coherence at the 30-second mark therefore does not have an ex ante theoretical basis, but it does provide interesting evidence regarding the nature of synchrony that may develop between people consuming together, by allowing us to see whether their level of alignment is closer to a moment-to-moment agreement in evaluation (high-frequency coherence) or is more akin to a subtle shared coloring of experience that only emerges over a long view (low-frequency coherence). See figure 1, which shows the weighted coherence for the observing pairs and the mere presence across the high- and low-frequency ranges.

Overall Correlations of Moment-to-Moment Ratings

We computed the correlation between the residuals for each observing pair in the full social presence condition and contrasted it with the correlations for the alone false pairs, mere presence pairs, and nonobserving false pairs. These comparisons provide evidence for contemporaneous comovement between pairs, which as noted above is not predicted by our theorizing. As expected, this analysis revealed no difference in correlation between observing pairs and false alone pairs ($M_{ob} = 0.21$, $M_{alfal} = 0.17$, $t < 1$) or observing and mere presence pairs ($M_{ob} = 0.21$, $M_{mere} = 0.15$, $t < 1$), indicating that being able to observe another participants' expressions did not cause participants to become aligned in the immediate moment-to-moment evaluations. This analysis did reveal a significant difference between observing pairs and nonobserving false pairs from the same condition ($M_{ob} = 0.21$, $M_{nobfal} = -.04$, $t(36) = 2.57$, $p < .05$). This latter finding suggests that participants in the full social presence condition were responding to the specific other person with whom they were paired. We use

FIGURE 1

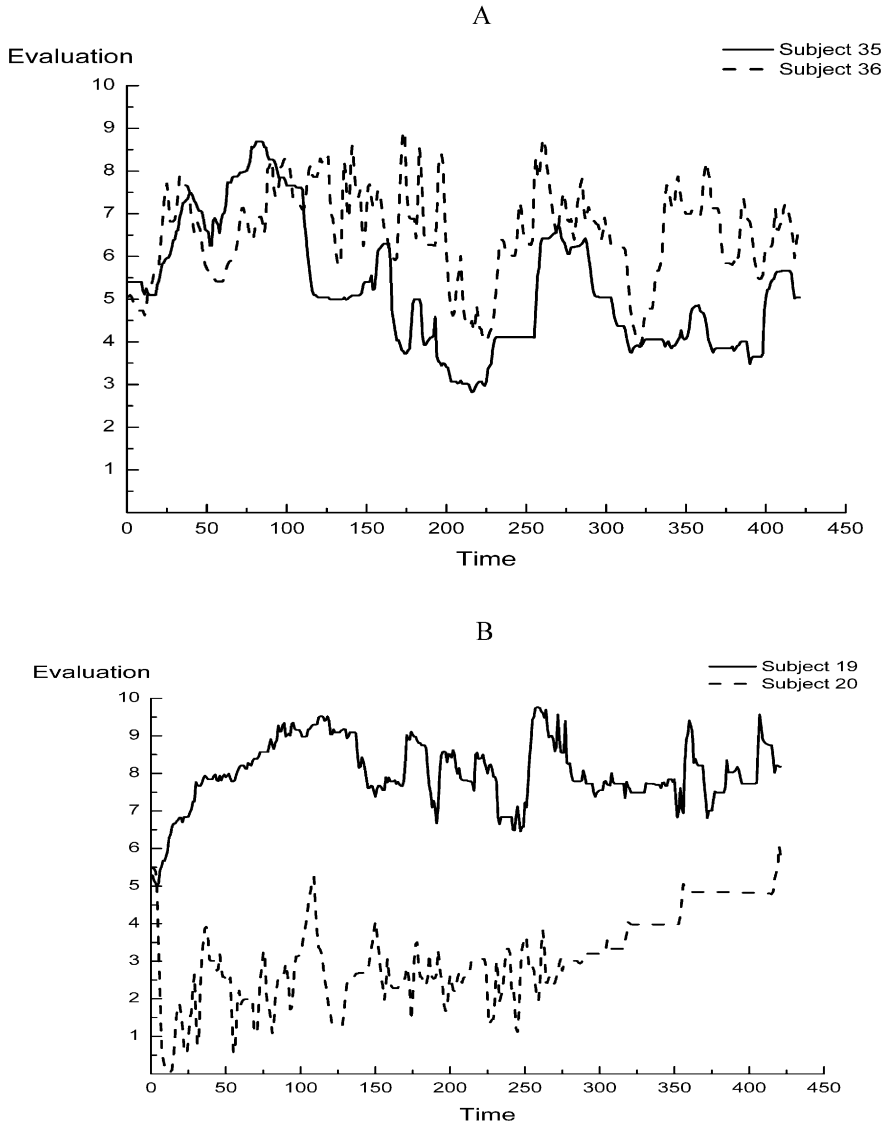
EXPERIMENT 1: THE EFFECT OF THE PRESENCE OF OTHERS ON COHERENCE



NOTE.—Average weighted coherence for each pair type depending on the length of oscillation period plotted on a logarithmic scale, ranging from 1-second oscillating periods to 1,000-second oscillating periods. Data periodicities range from 2 to 421 seconds. As shown, the observing and mere presence pairs did not differ in degree of coherence in the high-frequency range of oscillations (oscillating in periods less than 30 seconds), while the observing pairs revealed higher coherence in the low-frequency range of oscillations (oscillating in periods greater than 30 seconds).

FIGURE 2

EXPERIMENT 1: SAMPLE ONLINE EVALUATIONS



NOTE.—*A*, Observing pair 35-36; Low-Frequency Coherence = 0.40; High-Frequency Coherence = 0.22. *B*, Mere presence pair 19-20; Low-Frequency Coherence = 0.17; High-Frequency Coherence = 0.17.

cross-spectral analysis to analyze the nature of this response more precisely in our tests of hypotheses 1a–1c.

Hypothesis Testing

Hypothesis 1: Low- and High-Frequency Weighted Coherence. To test hypothesis 1, we examined difference in weighted coherence for individuals in observing pairs compared to the three controls: alone false pairs, mere presence pairs, and nonobserving false pairs, first in the high-frequency range and then the low-frequency range. Sample evaluations by two pairs, one in the observing condition and another in the mere presence condition, are shown in figure 2 to illustrate the data patterns and resultant statistics.

We conducted a one-way MANOVA on both types of coherence, contrasting type of presence (observing vs. control). The omnibus test for type of presence was significant ($F(2, 77) = 15.7$, $p < .001$). While there was no effect of type of presence on high-frequency coherence ($F < 1$), there was a significant effect of type of presence on low-frequency

coherence ($F(1, 78) = 27.45$, $p < .001$). To investigate this effect further, we ran post-hoc comparisons for individuals in the four pair types (observing, mere presence, nonobserving false, and alone false). Low-frequency coherence for observing pairs in the social presence condition was significantly higher compared to that for false pairs in the alone condition ($M_{ob} = .42$, $M_{al\,fal} = .22$, $t(79) = 5.25$, $p < .01$), consistent with hypothesis 1a. Further, there was a significant difference in low-frequency coherence for individuals in observing pairs compared to those in the mere presence condition ($M_{ob} = .42$, $M_{mere} = .29$, $t(79) = 3.55$, $p < .01$), consistent with hypothesis 1b. Finally, contrast analysis also revealed a significant difference in low-frequency coherence for observing compared to nonobserving false pairs in the social presence condition ($M_{ob} = .42$, $M_{nob\,fal} = .27$, $t(79) = 4.00$, $p < .01$), consistent with hypothesis 1c. There were no significant differences in low-frequency coherence for individuals in the three control conditions ($M_{mere} = .29$, $M_{al\,fal} = .22$, $t(79) = 1.61$, $p = .12$; $M_{mere} = .29$, $M_{nob\,fal} = .27$, $t < 1$; $M_{nob\,fal} = .27$, $M_{al\,fal} = .22$, $t(79) = 1.24$, $p = .22$).

Hypothesis 2: Overall Evaluations. We first ran a regression for all individuals in the study, testing the effect of peak and end affect on overall evaluations of the program. End affect was computed as the average of the ratings for the final 20 seconds of the program. Both peak affect ($b = .51$, $t(54) = 3.47$, $p < .001$) and end affect ($b = .34$, $t(54) = 4.74$, $p < .001$) were significant predictors of overall program evaluations. This result replicates the findings of Fredrickson and Kahneman (1993) that an individual's global retrospective evaluations of an experience can be explained by the peak and end affect.

In order to test hypothesis 2a, we ran a multilevel hierarchical linear regression (HLM; Raudenbush and Bryk 2002) using the SPSS Mixed procedure. Hierarchical modeling is a powerful way to analyze grouped data with repeated measures, first, because it takes into account the mathematical independence of the variances and covariances at each level of analysis (group and individual) and, second, because it allows for estimating actor-partner interactions in dyads, a critical aspect of our proposed model. Further, HLM, unlike ordinary least squares regression, allows for correlated errors between individuals in observing dyads. Goodness of fit was assessed using Schwarz's Bayesian Information Criterion (BIC).

We created a contrast variable for individuals who were part of observing pairs in the social presence condition and those who were part of the three controls (mere presence, alone false, and nonobserving false) and estimated two models on the average program evaluations of all individuals. First, we tested a baseline model with just peak and end affect, and, second, we tested one that included both low- and high-frequency weighted coherence, type of pair (observing vs. control), and interaction terms, crossing type of pair with each of the other independent variables. The base model with peak and end affect was significant, as expected. Both peak affect ($b = .46$, $t(77) = 4.20$, $p < .001$) and end affect ($b = .35$, $t(77) = 5.72$, $p < .001$) were significant predictors of program evaluation. In the augmented model, low-frequency coherence was an independent predictor of program evaluation ($b = 3.13$, $t(70) = 2.02$, $p = .05$), while peak affect ($b = .42$, $t(70) = 3.79$, $p < .001$) and end affect ($b = .35$, $t(70) = 5.57$, $p < .001$) continued to be significant. There was also a marginally significant interaction between type of pair and low-frequency coherence ($b = 3.84$, $t(70) = 1.94$, $p = .06$). Interestingly, high-frequency coherence did not have any effect on evaluations. The augmented model had a better goodness of fit (BIC: Base = 219.7 vs. Augmented = 211.1). Table 1 shows the results of the regression.

We investigated the interaction further by separately estimating two main effects models for observing pairs and control pairs. The effect of low-frequency coherence was significant for observing pairs ($b = 3.50$, $t(7) = 3.16$, $p < .05$). Thus, hypothesis 2a is confirmed. Overall evaluations by participants in the social presence condition appeared to depend on the extent to which they felt in sync with the specific other person with whom they were paired. Next, we compared the three control conditions, running a regression on program evaluations after creating two dummy variables for type of pair. In this case, because dyads were not expected to have correlated errors, we specified a simple scaled identity covariance structure. The base model showed a significant effect of peak affect ($b = .42$, $t(57) = 3.58$, $p < .001$) and of end affect ($b = .35$, $t(57) = 5.54$, $p < .001$). The augmented model with low- and high-frequency coherence, the two dummy variables for type of pair, and the interaction terms included showed no significant effects over and above that of the peak and end affect (all p's >

TABLE 1

EXPERIMENT 1: EFFECTS OF PEAK AND END AFFECT AND COHERENCE ON RETROSPECTIVE EVALUATIONS

Parameter	*b*	SE	*t*
Base model:			
Intercept	3.97	.11	37.41***
Peak	.46	.11	4.20***
End	.35	.06	5.72***
Augmented model:			
Intercept	3.66	.27	13.71***
Peak	.42	.11	3.79***
End	.35	.06	5.57***
Low-Frequency Coherence	3.13	1.55	2.02**
High-Frequency Coherence	1.12	2.19	.51
Condition	.27	.30	.91
Condition × Low-Frequency Coherence	3.84	1.98	1.94*
Condition × High-Frequency Coherence	−.22	2.75	−.08
Condition × Peak	−.04	.31	−.12
Condition × End	.11	.21	.52

NOTE.—Goodness of fit (Schwarz's Bayesian Information Criterion): base model = 219.7; augmented model = 211.1.

*$p < .10$.

**$p < .05$.

***$p < .001$.

.30). The goodness of fit of the augmented model was weaker than that of the base model (BIC: Base = 176.2 vs. Augmented = 178.4). Thus, hypothesis 2b is confirmed.

Discussion

In experiment 1, moment-to-moment judgments of a video program differed for participants who could observe (and thus potentially mimic) expressions of another person compared to those who could not, either because the other person's reactions were hidden from them in the mere presence condition or because they were watching alone. More specifically, evaluations by participants who could observe each others' reactions appeared to move up and down in a shared pattern of evaluation over the low- but not the high-frequency range. Contemporaneous evaluations, as measured through correlation of the time series, also did not differ for participants who could observe each other compared to those in the other conditions. This pattern of results suggests that patterns of mimicry and emotional contagion led to an entrainment of mood that manifested itself in broad patterns of agreement. That is, evaluations of the program moved up and down in broad swings of more than 30 seconds. The alignment of moods thus appeared to color participants' perceptions in a way that caused a subtle underlying pattern of synchrony in evaluations. From second to second or scene to scene, however, participants appeared to respond idiosyncratically.

Further, we found that retrospective evaluations depended on different factors for those participants who consumed with others compared to those who consumed alone. Specifically, our results revealed that low-frequency coherence was an independent predictor of participants' overall evaluations of the experience in the social presence condition, over and above peak and end affect. Hence, consuming with another person appears to change one's moment-to-moment reactions to be more in line with those of the other person, and this state of synchrony with the other person affects one's overall evaluation. The developing rapport, as evidenced by the low-frequency coherence measure, appears to influence the overall evaluation of the experience.

Results of experiment 1 are therefore consistent with our proposed process in which people adopt each other's expressions and then emotions, which colors their evaluations. Further, our use of the constructed control condition involving false nonobserving pairs allows us to rule out other effects due to being in the same social environment. The only factor that differed for the observing and nonobserving pairs was the ability to see and mimic each other. Our results also show that there is a distinct difference between being in the same viewing environment but not being able to see each other's expressions (mere presence) and actually being able to observe each other. In addition, results indicate that participants did not differ in the degree to which they paid attention to the program across conditions ($F < 1$), ruling out differences in attention as an explanation for the results. Nevertheless, experiment 1 does not provide direct evidence regarding mimicry and contagion. To obtain this evidence, we surreptitiously videotaped pairs of participants as they watched a short film and coded for their facial expressions as well for instances in which each one stole a glance at the other. These data can be analyzed directly for shared patterns of expression, which can be compared to the time series of evaluations.

EXPERIMENT 2

Contagion of Emotional Expressions

Prior research on emotional contagion has emphasized the importance of examining not just the emotional expressions of other people in the social environment but also whether those expressions are noticed by the target person (Friedman and Riggio 1981; Sullins 1991). Thus, in our second study, we examined three slightly different ways that participants might influence and be influenced by each other's emotional expressions: (1) by looking at the emotional expressions of the other person (who is not looking directly back), (2) by expressing an emotion that is looked at by the other person (but not looking directly back at that person), and (3) by looking at the other person who is concurrently looking back and noticing whether the other person is expressing the same or a different emotion. With respect to the first process, we expect that a participant who looks at another participant who is not looking back will be influenced by the emotional expression of that participant. Specifically, we expect that the first participant's emotional expression will, after a small delay, come to be like the expression of the second observed participant as a direct consequence of mimicry and emotional contagion. Hence, we predict that the current emotional expression of an individual will be a positive function of the prior expressions of the person that he/she has observed:

H3: Moment-to-moment emotional expressions of an individual in an observing pair will be influenced positively by his/her observation of the other individual's prior emotional expressions.

Further, an individual who is expressing emotions at a particular moment may peripherally register being observed, which may lead to increased arousal and consciousness of being the focus of attention (Wicker et al. 2003). This awareness may in turn lead to reinforcement of the current emotion, or it may cause the person to feel self-conscious and thus to mute subsequent expressions. Hence, we predict that emotional expressions of one person will be influenced by having been looked at by the other. This effect, however, is not a consequence of mimicry and emotional contagion but rather one of arousal and impression management. We do not predict the direction of this effect and hypothesize only that being looked at will either reinforce (and thus sustain) the emotion that was just expressed or cause it to be abandoned:

H4: Moment-to-moment emotional expressions of a participant in an observing pair will be influenced by the other individual's observation of

the target participant's own prior emotional expressions.

Hypotheses 3 and 4 addressed the effects of unreciprocated looks. However, contagion may depend on afferent feedback that results from people looking at each other at the same time. In other words, people may perceive each other's emotions through mutual gaze and receive confirmation or disconfirmation of what they are feeling at that instant. Such feedback may set into play processes of empathy at a conscious level (Stiff et al. 1988; Sullins 1991) or mutual entrainment at a nonconscious level (Hatfield et al. 1994). Merten (1997) found that smiles that occurred simultaneously between individuals were correlated positively with the experience of joy. In other words, congruity in emotions fed forward into more positive feelings subsequently. Similar findings have been reported by Raghunathan and Corfman (2006) who showed that congruent verbal feedback on emotions felt during an experience led to greater enjoyment of the experience. Thus, while hypothesis 3 suggested that mimicry and contagion occurred merely as a function of seeing another's expression, hypothesis 5 addresses perceived congruity or incongruity of emotion that is registered through shared looks. Our expectation was that perceived congruity would reinforce an emotional expression, causing it to be sustained, whereas perceived incongruity would undermine the expression, causing it to be abandoned:

H5a: Moment-to-moment emotional expressions of an individual in an observing pair will be positively influenced by the simultaneous observation of congruent emotions between both individuals in the pair.

H5b: Moment-to-moment emotional expressions of an individual in an observing pair will be negatively influenced by the simultaneous observation of incongruent emotions between both individuals in the pair.

We tested hypotheses 3–5 by testing a linear model, described below, of factors posited to influence an emotion. Our data analytic technique allowed us to measure not just the direction of the effects but also, by considering lagging influences, how soon these effects appeared and how long they lasted.

Emotional Expressions and Coherence of Evaluations

Experiment 2 was also intended to provide additional evidence regarding the relationship between participants looking at each other and adopting each other's expressions and the degree of coherence in their evaluations of the experience. Our hypotheses for these effects parallel our hypotheses in the preceding section regarding types of looks and their effects on emotional expressions. Specifically, we examined the effects of unreciprocated looks at the other person (observing), unreciprocated looks by the other person (being observed), and reciprocated looks on coherence. We had hypothesized (hypothesis 3) that observing the other person would lead to mimicry and contagion. It follows therefore from our broad argument that such unreciprocated looks should also increase low-frequency coherence:

H6: The number of unreciprocated looks at the other person will be positively associated with low-frequency coherence.

We had also predicted that being observed by the other person would affect emotional expression (hypothesis 4), although we did not predict whether being observed would cause someone to reinforce their expression or abandon it. Changes in expression in this case are not a consequence of our focal process of mimicry and contagion, but they do result from the presence of the other person and may therefore influence coherence, either pulling the two people closer in their shared assessment or disrupting their connection:

H7: The number of unreciprocated looks by the other person will influence low-frequency coherence.

In addition, we had hypothesized (hypothesis 5) that participants looking at each other at the same time would influence emotional expressions. In addition to providing information about the other person's expression, these reciprocated looks highlight and make jointly apparent agreement or disagreement. Hence, their effect on coherence may depend on whether the expressions are matched or mismatched. Specifically, we expect matching expressions to lead to greater coherence. By contrast, mismatched expressions cause participants to register overt disagreement and thus may disrupt the connection between them, thereby lessening coherence of evaluation:

H8a: The number of reciprocated looks will be positively associated with low-frequency coherence when both individuals are in a matched emotional state.

H8b: The number of reciprocated looks will be negatively associated with low-frequency coherence when both individuals are in a mismatched emotional state.

In experiment 2, we contrasted results for the full presence condition with those in the mere presence condition. Although participants in the mere presence condition could not see each other, we could nevertheless code for looks in the direction of the other person and whether these glances occurred at the same time for both participants. These "looks" are therefore not meaningful to the participants, but our analysis of them allows us to get a baseline measure of looking in the direction of the other person that is more conservative than an assumption of no looks at all. We do not expect these "looks" to have any effect on coherence, whether low or high frequency. Hence, in experiment 2, we contrast effects of reciprocated and unreciprocated "looks" for both full and mere presence participants and their effects

on emotional expressions. Finally, although we did not have specific hypotheses regarding the symmetry of social influence that we might observe, we also analyzed the data in experiment 2 for evidence of bidirectional influence of emotion, as contrasted with a leader-follower relationship.

Method

Forty undergraduate students at the University of Chicago participated for $6. Participants signed up for one of several two-person sessions in the lab, although none of them were informed about this restriction on session size. Half of them were assigned to a mere presence condition and the other half to a full presence condition. When both participants who were signed up for the session arrived at the lab, they were seated at one of two computers, next to each other. As in experiment 1, the height of the partition between the two computers determined whether the participants could see each other's faces and upper bodies. We used a prize-winning amateur short film from http://www.atomfilms.com called *Clean-Up on Aisle Five*, which featured two men vying for the attention of a woman in a grocery store. The duration of the film was 6 minutes and 32 seconds. Joystick reactions were again captured every 0.1 seconds and averaged to 1-second intervals, thus yielding 392 data points per individual.

Two cigar-sized video cameras were hidden from participants' view on a shelf directly above each computer terminal by placing them under cardboard boxes with small holes cut out. The video cameras were connected via a split-screen generator to a digital recorder that captured the combined split-screen image of both participants. Two table lamps were placed on the shelves above each participant. The room was dark except for the two lamps. The lamps were used for two reasons. First, their brightness helped prevent accidental detection of the cameras. Second, and more important, they served as time markers for the video recording. When the research assistant pressed the button on the serial port to activate the video clip on both computers, she also switched off the lamps for just an instant to create a momentary dark image on the video recording. This was the marker of the beginning of the video clip of participants as they watched the short film together.

Separate digital tapes were used to record each dyadic interaction, which were then transferred to DVD. Thus, we had one DVD for each pair of participants that showed their interactions on a split screen on a moment-to-moment basis. Two independent raters blind to the hypotheses of the study examined each DVD recording and coded the following behaviors: (*a*) facial expressions (laugh, big smile, little smile, neutral, little frown, and big frown) and (*b*) head movement (toward other individual, straight, and away from other individual). Interrater reliability was 85%, and differences were resolved by discussion. This coding scheme therefore allowed us to examine whether participants looked at each other, whether each look was shared or not, and the congruity of emotions expressed between participants in each pair. We thus had 392 data points of the coded behaviors (one for each second of the interaction) for each participant. After observing the videotapes, we found that two participants covered their faces or mouths with their hands through much of the interaction, which prevented analysis of their emotional expressions. As we were interested in the dyadic interaction, we were forced to discard the data of their partners in the interaction as well, leaving 36 participants.

After watching the film, participants were asked to indicate their evaluations of the video film (enjoyable, quality, stimulating, entertaining, and engaging) and their intention to watch the same or similar film again. They were also asked to indicate their feelings and emotions as they watched the film (positive emotions: amused, happy, joyful, delighted, excited, warm, empathetic, bored (reverse coded), $\alpha = .91$; negative emotions: sad, downhearted, distressed, conflicted, uncomfortable, regretful, angry, $\alpha = .81$). They also reported how aware they were of the presence of the other person, how much they felt influenced in their final evaluations by the other person, and how much they felt in sync with the other person. Finally, they were asked a series of background questions and debriefed about the video taping, for which separate consent was obtained. No participant reported having been aware of the cameras during the study.

Results

Contagion of Emotion. To gather evidence of emotional contagion, we examined whether a participant's emotional expressions in one moment were influenced by the other participant's emotional expressions in the preceding moments and whether participants looked at these expressions. However, a participant's emotions may also be a function of his or her own emotions in preceding moments, that is, they may be autocorrelated. Hence, a model of dyadic emotions must include two sets of terms—one that represents the effect of the participant's own past emotions, suitably lagged, and the other that represents the effect of the other person's emotions, again suitably lagged. Thus, any cross-person effects would need to emerge after controlling for autoregressive effects. In concordance with our hypotheses, we postulated that an individual's own emotions at time *t* would be a function of three factors: (1) per hypothesis 3, their own unreciprocated observation of the other person's emotions (Own Look × Other's Emotion); (2) per hypothesis 4, the other's unreciprocated observation of their own emotions (Other's Look × Own Emotion); and (3) per hypotheses 5a and b, the congruity or incongruity of emotions observed by both individuals (Matched Look × Congruity/Incongruity × Sum of Absolute Values of Both Emotions). Participants were treated as having looked at the other person if their heads turned in the direction of the other person. Two dummy variables were created for congruity and incongruity of emotions. Emotions were deemed to be congruent if both people had positive emotions, both had negative emotions, or one had a little smile/frown and the other had a neutral expression (i.e., we treated very mild expressions and neutral expressions as congruent). Emotions were incongruent if one person had a positive emotion and

the other a negative one or if one had a strongly positive or negative emotion and the other a neutral expression. These dummies were set up as contrasts to a condition in which both individuals had neutral expressions on their faces. Absolute values of emotions were used in summing the expressions of both participants in order to tease apart the effect of valence (captured by the congruity dummies) and the magnitude (represented by the absolute values).

In addition, recognizing that the content of the video film at a particular moment could independently influence emotions, we included a baseline measure averaging the emotions of all individuals in the study at time t, excluding the individual whose emotions were being modeled. The baseline measure therefore captured an overall sense of the emotional content of the program in the preceding moment. It also captured any time trends in the data. Further, we included fixed effects for dyad membership in order to account for heterogeneity across dyads. This was done through the creation of dummy variables for each dyad except the last one.

We used a four-step procedure originally proposed by Gottman and Ringland (1981) to assess the auto- and cross-regressive components of a person's emotions:

1. First, we verified that each time series was stationary, a critical assumption of any time series analysis. This step was accomplished via the Augmented Dickey-Fuller (ADF) test that looks for high levels of autocorrelation (values higher than 0.9 typically lead to nonstationarity, and the ADF test assesses the significance at the 5% level). All but two of the time series were stationary, leading us to conclude that there would be no serious violations of the assumptions for the analysis. We dropped the data from the two participants (both from the same dyad) for the purpose of this analysis.
2. Next, we fitted a large overfitted regression model with several lags included for both auto- and cross-regressive terms.
3. We removed higher-order (long lag) terms iteratively, so long as they failed to attain significance. Gottman and Ringland (1981) recommend a more liberal criterion for entry ($p = .10$). We thus had a final model with both auto- and cross-regressive components. Goodness-of-fit statistics (BIC) were computed for the final versus the overfitted model.
4. We then fitted a new regression model with only the autoregressive terms from step 2 above and again compared goodness of fit against the final model. If cross-regressive effects are significant, the final model is likely to have a better goodness of fit compared to the autoregressive model.

Our model for an individual i partnered with another individual j in dyad d and condition k at time t was as follows, where E indicates emotion, UL indicates whether the participant looked at the other person in an unreciprocated manner, RL represents a reciprocated look, I_m represents dummy variables for whether emotions were matched in valence or mismatched in valence, I_d represents dummy variables for each dyad, B is the baseline emotion for the condition, and r and s represent the number of lagged periods from the participant's own emotional responses and the other person's responses, respectively. We assume that the errors are independent and normally distributed, with mean zero and variance σ^2. This assumption is reasonable, given the stationarity in the time series.

$$
\begin{aligned}
E_{idkt} = {} & \alpha_k B_{(-i)kt} \text{ (baseline)} \\
& + \sum_{r=1}^{M} \beta_{idkr} E_{idk(t-r)} \text{ (autoregressive effect)} \\
& + \sum_{s=1}^{N} \Big(\gamma_{idks} (UL_{idk(t-s)} \times E_{jdk(t-s)}) \\
& \qquad + \eta_{idks} (UL_{jdk(t-s)} \times E_{idk(t-s)}) \\
& \qquad + \sum_{m=1}^{2} \kappa_{idks} I_m \{ RL_{idk(t-s)} \times RL_{jdk(t-s)} \\
& \qquad \times [\text{abs}(E_{idk(t-s)}) + \text{abs}(E_{jdk(t-s)})] \} \Big) \\
& \text{(cross-regressive effect)} \\
& + \sum_{d=1}^{D} \omega_{dk} I_{dk} + \varepsilon_{idkt} \text{ (dyadic effect).}
\end{aligned}
$$

We estimated separate parameters for both members of the dyad, in order to assess the extent of bidirectionality in influence, that is, whether both members had an effect on each other or not. This examination of bidirectionality allows us to assess whether there was a leader-follower relationship in the emotional influence or one of mutual influence.

We fitted models separately for each condition (full presence and mere presence), and examined the significance of each of the variables in the model.[1] In the first stage, we used 10 lags for the autoregressive terms and five lags for each of the cross-regressive terms.[2] We now detail the results of the modeling process for both conditions.

Full Presence. Table 2, A and B, shows the goodness-

[1]We estimate the regression by pooling observations across all individuals in the specific social presence condition. The implication of this approach is that the betas are a weighted average of the individual-level betas. Another way of estimating this model would be to nest the individuals within dyads and estimate dyad-specific betas as well, a process beyond the scope of this article.

[2]The number of lags to be included in the model was determined by running a spectral analysis on the time series of emotions—the number of peaks in the individual periodograms gives an indication of the number of autoregressive terms, while the degree by which the cross-spectrum is out of phase gives an indication of the number of cross-regressive terms. The reader is referred to Gottman and Ringland's (1981) guidelines for a more detailed discussion.

TABLE 2

EXPERIMENT 2: NUMBER OF PARAMETERS IN ESTIMATED MODELS AND GOODNESS-OF-FIT STATISTICS

Model	Time	Intercept	Baseline	Dyads	Own	Cross	BIC
			A. Full presence: Person 1				
1	1	1	1	8	10	5+5+5+5	1,674.62
2	1	1	1	5	5	2+4+5+4	1,591.72
3	1	1	1	5	5	0	1,655.78
			B. Full presence: Person 2				
1	1	1	1	8	10	5+5+5+5	2,758.70
2	1	1	1	4	7	3+2+5+4	2,659.99
3	1	1	1	4	7	0	2,674.89
			C. Mere presence: Person 1				
1	1	1	1	7	10	0+5+0+0	1,644.05
2	1	1	1	4	2	0+2+0+0	1,537.99
3	1	1	1	4	2	0	1,525.34
			D. Mere presence: Person 2				
1	1	1	1	7	10	0+5+0+0	−644.37
2	1	1	1	2	6	0+5+0+0	−720.01
3	1	1	1	2	6	0	−760.72

NOTE.—BIC = Bayesian Information Criterion. Some cross-regressive variables in the mere presence condition were redundant (all zeroes) and hence did not have parameter estimates. Cross-regressive terms are (*a*) one's own unreciprocated look at other's emotions, (*b*) other's unreciprocated look at one's own emotions, (*c*) shared looks of joint emotions—matched valence, and (*d*) shared looks of joint emotions—mismatched valence.

of-fit statistics for each of the two individuals in the full presence dyads. For participants sitting in the first position (labeled Person 1), the reduced form cross-regressive model (28 parameters) was more parsimonious than the overfitted model that had 41 parameters (BIC: Overfitted = 1,674.62 vs. Reduced Cross-Regressive = 1,591.72). The reduced form model was superior in goodness of fit compared to a purely autoregressive model (13 parameters) with cross-person effects dropped (BIC: Reduced Cross-Regressive = 1,591.72 vs. Autoregressive = 1,655.78). For participants in the second position (labeled Person 2), the reduced model (28 parameters) was again more parsimonious than the overfitted model with 41 parameters (BIC: Overfitted = 2,758.70 vs. Reduced Cross-Regressive = 2,659.99), while also being superior to the autoregressive model with 14 parameters (BIC: Reduced Cross-Regressive = 2,659.99 vs. Autoregressive = 2,674.89). Together, these results indicate that cross-person effects were significant in the full presence condition, over and above all effects accounted for by program content and the participant's own past emotions. Further, cross-person effects were significant for both individuals in the dyad, indicating that the effects were bidirectional and not asymmetric. That is, we did not observe a leader-follower pattern of influence but rather one of mutual effect.

Table 3, A, shows the parameter estimates for participants in the full presence condition. In both cases, there was a significant effect of program content as reflected in the baseline emotion. A participant's own past emotions were also significant, as would be expected, although they lasted for different durations across the two individuals. Consistent with hypothesis 3, the effects of the participant's own unreciprocated observations of the other's emotions were significant and positive and lasted 2–3 seconds for both individuals. However, supporting hypothesis 4, the effects of the other's observations on one's own emotional expressions were significant and negative and lasted 2–4 seconds. As predicted by hypothesis 5a, the effects of mutual gaze and congruity of emotions were significant and positive, emerging immediately and lasting up to 5 seconds. However, perception of incongruity in emotions had a significant negative effect on subsequent emotional expression, confirming hypothesis 5b. This effect emerged only after 2–3 seconds and lasted up to 4 seconds.

Mere Presence. Table 2, C and D, show the goodness-of-fit statistics for the two participants in the mere presence dyads. For Person 1, the reduced form model (11 parameters) with only significant effects included was more parsimonious than the overfitted model with 26 parameters (BIC: Overfitted = 1,644.05 vs. Reduced Cross-Regressive = 1,537.99) but weaker than a purely autoregressive model with 9 parameters (BIC: Reduced Cross-Regressive = 1,537.99 vs. Autoregressive = 1,525.34). For Person 2, the reduced model was superior to the overfitted one (BIC: Overfitted = −644.37 vs. Reduced Cross-Regressive = −720.01). However, the reduced model was inferior in fit compared to the autoregressive model (BIC: Reduced Cross-Regressive = −720.01 vs. Autoregressive = −760.72). These results suggest that emotions of participants in the mere presence condition were primarily guided by their own past emotions and that the autoregressive model was the most parsimonious account of these emotions.

Table 3, B, shows the parameter estimates for the final

TABLE 3

EXPERIMENT 2: EFFECTS OF GAZE, MUTUAL GAZE, AND PARTNER'S EMOTIONS ON THE PARTICIPANT'S OWN EMOTIONS—PARAMETER ESTIMATES FOR FINAL MODELS

	Person 1			Person 2		
Parameter	*b*	SE	*t*	*b*	SE	*t*
A. Full social presence condition						
Intercept	.06	.04	1.31	−.21	.04	−4.98****
Baseline	.10	.03	3.76****	.13	.03	4.31****
Own Emotion:						
Lag1	.83	.02	51.11****	.76	.02	46.26****
Lag2	.03	.02	1.61	.01	.02	.56
Lag3	.05	.02	2.51**	−.04	.02	−1.92**
Lag4	.00	.02	.23	.00	.02	.04
Lag5	.03	.01	2.06**	.05	.02	2.36**
Lag6				−.03	.02	−1.36
Lag7				.05	.02	2.76**
Own Look × Other Emotion:						
Lag1	.18	.03	5.83****	.16	.05	3.06****
Lag2	.12	.03	3.74****	.11	.05	1.99**
Lag3				.11	.05	2.05**
Other Look × Own Emotion:						
Lag1	−.04	.04	−.94	−.11	.04	−2.80***
Lag2	−.10	.04	−2.17**	−.12	.04	−3.15***
Lag3	.06	.04	1.40			
Lag4	−.10	.04	−2.28**			
Mutual Gaze × Sum of Emotions—Matched Valence:						
Lag1	.31	.03	8.67****	.26	.04	6.44****
Lag2	.03	.04	.82	−.00	.05	−.02
Lag3	.04	.04	.97	.08	.04	1.75
Lag4	.04	.04	.97	.15	.04	3.67****
Lag5	.08	.04	1.92*	.08	.04	2.12**
Mutual Gaze × Sum of Emotions—Mismatched Valence:						
Lag1	.11	.15	.77	.17	.17	1.06
Lag2	−.38	.15	−2.46**	.20	.18	1.15
Lag3	−.98	.16	−6.13****	−.31	.19	−1.66*
Lag4	−.91	.15	−5.93****	−.77	.19	−4.12****
B. Mere presence condition						
Intercept	.20	.04	5.23****	.12	.02	6.13****
Baseline	.09	.04	2.40**	.06	.03	2.19**
Own Emotion:						
Lag1	.83	.02	48.79****	.81	.02	47.43****
Lag2	−.04	.02	−2.08**	−.03	.02	−1.15
Lag3				.05	.02	2.26**
Lag4				−.04	.02	−1.77*
Lag5				.00	.02	.15
Lag6				.07	.02	3.93****

NOTE.—Dyad-specific fixed effects suppressed for reasons of brevity. Results are net of dyadic effects.
*$p < .10$.
**$p < .05$.
***$p < .01$.
****$p < .001$.

autoregressive model. As in the full presence condition, the effects of baseline emotion were significant and positive for both participants in the dyad. The effects of the participant's own past emotions were also significant, lasting 2 seconds in one model and 6 seconds in the other model.

Emotional Contagion and Coherence of Moment-to-Moment Evaluations. Next, we looked at the joystick data of participants' evaluations of the program, and, after detrending the time series, we ran a cross-spectral analysis for each dyad. We computed weighted coherence for the low-frequency and high-frequency band, as in experiment 1. A one-way MANOVA contrasting low- and high-frequency coherence for the mere presence versus full presence conditions showed a significant effect for condition (Wilks's lambda = .53, multivariate $F(2, 33) = 14.8$, $p < .001$). As in study 1, low-frequency weighted coherence in the full presence condition was significantly higher than in the mere

presence condition ($M_{full} = .48$, $M_{mere} = .27$, $F(1, 34) = 24.8$, $p < .001$). High-frequency coherence was directionally higher, although nonsignificantly so, in the full presence condition compared to the mere presence condition ($M_{full} = .31, M_{mere} = .27, F(1, 34) = 2.6, p < .11$). This result indicates once again that coherence among observing pairs emerged over broader periods more so than on a shorter time frame.

Our next step was to understand whether weighted coherence was a function of participants looking at each other's emotional expressions. To address hypotheses 6 and 7, we counted the number of unreciprocated looks by one person at the other's positive or negative emotional expressions. To address hypotheses 8a and b, we counted the number of instances when both individuals looked at each other and had matched and mismatched emotional expressions, respectively. Descriptive data for each condition are shown in table 4.

We ran separate HLMs (specifying correlated errors) on low- and high-frequency coherence, testing the effect of the number of the participant's own unreciprocated looks at the other person (observing the other's positive and negative emotions) and the number of unreciprocated looks by the other person (observing the participant's own positive and negative emotions), the number of shared looks of matched valence, and the number of shared looks of mismatched valence. We nested these variables within type of presence in order to examine differences across condition.

In the full presence condition, there was a significant positive effect of the participant's own unreciprocated looks at the other person on low-frequency coherence ($b = .02$, $t(14) = 3.24$, $p < .01$), supporting hypothesis 6. Consistent with hypothesis 7, we also observed a significant positive effect of unreciprocated looks by the other person ($b = .01$, $t(14) = 2.63$, $p < .05$). As was predicted by hypotheses 8a and b, shared looks with matched valence had a significant positive effect on low-frequency coherence ($b = .08$, $t(12) = 3.11$, $p < .01$), while shared looks with mismatched valence had a significant negative effect on low-frequency coherence ($b = -.10$, $t(12) = -2.28$, $p < .05$). There were no significant effects of any of the variables above on high-frequency coherence (all p's $> .50$). In the mere presence condition, there were no shared looks of either matched or mismatched valence. The effect of unreciprocated looks was not significant for either low-frequency coherence (p's $> .40$) or high-frequency coherence (p's $> .15$).

Coherence of Moment-to-Moment Evaluations and Retrospective Judgments. We ran an HLM on retrospective evaluations of the film after contrast coding the two conditions of presence. We specified that the residuals of the two individuals in a dyad were correlated. We fitted three models: (*a*) a base model with only peak and end affect, (*b*) an augmented model with condition, low-, and high-frequency coherence also added, and (*c*) a second augmented model with interaction terms between condition and all other predictors also added. The base model showed a significant effect of peak and end affect ($b = .29$, $t(23) = 3.23$, $p < .01$; $b = .60$, $t(30) = 3.88$, $p < .001$, respectively). The first augmented model with the main effects of coherence and condition included showed a significant effect of low-frequency coherence ($b = 3.23$, $t(14) = 2.37$, $p < .05$) in addition to the effects of peak affect ($b = .33$, $t(26) = 3.48$, $p < .01$) and end affect ($b = .43$, $t(29) = 2.60$, $p < .05$). Note that degrees of freedom reported here are adjusted due to the specification of correlated errors. There was a significant improvement in goodness of fit over the base model (BIC: Base = 105.7 vs. First Augmented = 95.1). We then included the interaction terms for condition and each of the predictor variables (after mean centering the predictor variables to reduce multicollinearity) to see whether the effects of coherence were truly a function of whether people could observe each other. We found a marginally significant interaction between condition and low-frequency coherence ($b = 7.03$, $t(20) = 1.97$, $p = .06$), such that the higher low-frequency coherence was more strongly predictive of program evaluations for observing pairs compared to mere presence pairs. In addition, the main effects of peak and end affect and low-frequency coherence continued to be significant. None of the other terms were significant. The addition of the interaction term led to a significant improvement in goodness of fit (BIC: First Augmented = 95.1, Second Augmented = 81.1). Table 5 shows the results of the regressions.

TABLE 4

MEAN AND RANGE FOR RECIPROCATED AND UNRECIPROCATED LOOKS AND VALENCE OF EXPRESSIONS BY TYPE OF PRESENCE

	Full presence		Mere presence	
Looks × Expressions	Mean	Range	Mean	Range
Reciprocated looks:				
Matched positive expressions	1.22	0–4	.00	0
Matched negative expressions	.00	0	.00	0
Mismatched expressions	.33	0–3	.00	0
Neutral expressions	1.23	0–5	.38	0–2
Unreciprocated looks:				
Positive expressions	3.05	0–14	.00	0
Negative expressions	.89	0–10	.12	0–2
Neutral expressions	2.95	0–12	1.26	0–10

Confound Checks. It is possible that the manipulations of social presence may have influenced participants' moods and hence affected their evaluations of the video clip. We therefore regressed program evaluations on the indices of positive and negative emotions, the social presence condition and interactions between condition, and each of the emotion indices. Results showed that while there was a significant main effect of positive emotions on evaluations ($b = .49$, $t(30) = 3.55$, $p < .001$), none of the other effects were significant. Most notably, both positive and negative emotions were no different across the two conditions in their influence on program evaluations (p's $> .50$).

We also looked at participants' awareness of the effect

TABLE 5

EXPERIMENT 2: EFFECT OF PEAK AND END AFFECT AND COHERENCE ON RETROSPECTIVE EVALUATIONS

Parameter	*b*	SE	*t*
Base model:			
Intercept	3.47	.20	17.67****
Peak	.29	.09	3.23***
End	.60	.16	3.88****
First augmented model:			
Intercept	3.11	.27	11.67****
Peak	.33	.09	3.48***
End	.43	.16	2.60**
Condition	.81	.52	1.56
Low-Frequency Coherence	3.23	1.36	2.37**
High-Frequency Coherence	.90	2.04	.44
Second augmented model:			
Intercept	3.00	.28	10.79****
Peak	.25	.12	2.05**
End	.46	.20	2.35**
Condition	−.01	.62	−.01
Low-Frequency Coherence	3.82	1.69	2.27**
High-Frequency Coherence	3.15	3.48	.91
Condition × Low-Frequency Coherence	7.03	3.58	1.97*
Condition × High-Frequency Coherence	6.74	4.57	1.48
Condition × Peak	−.11	.19	−.59
Condition × End	.19	.36	.52

NOTE.—Goodness of fit (Bayesian Information Criterion): base = 105.7; first augmented = 95.1; second augmented = 81.1

*$p < .10$.
**$p < .05$.
***$p < .01$.
****$p < .001$.

of the influence of the other person in the dyad and of the extent of synchrony on their retrospective evaluations. A MANOVA testing the effect of the social presence condition on both measures was marginally significant ($F(2, 33) = 3.04$, $p = .06$). While participants were more aware of the influence of the other person in the full presence condition ($M_{\text{mere}} = 1.4$, $M_{\text{full}} = 2.5$, $F(1, 34) = 5.79$, $p < .05$), they were not aware of being in sync with the other individual ($F < 1$). We further tested whether participants' awareness of influence and being in sync with the other person had an effect on subsequent evaluations either directly or moderated by condition. The regression showed no significant effects of self-reported awareness of influence or perceived synchrony (all t's < 1).

Discussion

Findings for experiment 2 provide direct evidence that participants looking at each other influenced their subsequent emotional expressions. More specifically, our results for the full presence condition are as follows:

1. Emotional expressions of the participant can be predicted in part by their own prior emotional expressions and a baseline measure of the other overall emotional content of the program. These findings reflect the nonsocial influences on emotional expressions.
2. Emotional expressions of a participant can also be predicted by the prior expressions of the other person, providing that the participant looked at the other person and thus observed these expressions. This result suggests a simple process of mimicry and contagion. These contagion effects lasted about 2–3 seconds in our participants' expressions.
3. Participants who were expressing an emotion and noticed, presumably out of the corner of their eye, that the other participant had glanced at them appeared to pull back from their own emotional expressions to the extent that their expressions 1–2 seconds later were negatively related to the expression at the time of the look. Participants may have become self-conscious about their own expressions upon receiving a look from the other person. This result suggests that an impression management process is occurring, intertwined with processes of mimicry and contagion.
4. Participants who looked at each other at the same time appeared to note whether the other person's face expressed the same or different emotion than their own. Perceived congruity of expressions caused participants to stick with their current emotional expression or increase it for a few seconds longer than they would have had they not shared a look. This effect registered in the very next second and lasted up to 5 seconds. Perceived incongruity, however, led to a dampening of subsequent expressions, but this took a little longer to register (2–3 seconds), and the effect lasted about as long (4 seconds). This result suggests a more complex form of social influence and contagion that goes beyond merely observing and mimicking and takes into account mutual reinforcement of expressions.
5. The social effects described above were bidirectional, suggesting that such influences were mutual rather than the result of a leader-follower pattern.

Results for the mere presence condition revealed only the nonsocial influences on current emotions, specifically, the participant's own prior emotions and the content of the program. Our results show further that social influences on emotional expression as described above led to greater synchrony in evaluation of the experience. In particular, unreciprocated looks at the other person led to mimicry and contagion (hypothesis 3) and to greater low-frequency coherence (hypothesis 6). Other social processes besides simple mimicry and contagion also appeared to influence coherence of evaluations. For example, being looked at by the other person caused participants to abandon their own expressions (hypothesis 4) but also to increase coherence (hypothesis 7). Future research should examine further why this "out of the corner of one's eye" effect occurred. Two possibilities are that (*a*) participants were actually able to discern the observing party's expressions, leading to simple mimicry and contagion just as when they observed the other person, or (*b*) being observed caused participants to feel self-conscious and thus to evaluate the program less in terms

of their own likes and dislikes and more in terms of their beliefs about social norms of evaluation, leading to greater agreement in moment-to-moment judgments.

Another set of interesting results occurred for reciprocated looks. Reciprocated looks that revealed emotional agreement reinforced these emotions (hypothesis 5a) and led to greater coherence of evaluation (hypothesis 8a). For participants who registered overt disagreement, we observed a difference in the influence of these looks on emotional expressions and low-frequency coherence. Specifically, participants who observed conflicting expressions abandoned their own expressions (hypothesis 5b), which might be consistent with mimicry and emotional contagion because it suggests that each participant's expression is moving in the direction of the other. However, this effect did not lead to greater coherence and, in fact, these mismatched expressions led to lower coherence (hypothesis 8b). Again, future research should examine this effect further, considering the possibility that discovery of overt disagreement initiated a different process than mimicry and contagion. Participants, having registered that the other person's judgments were clearly at odds with their own, may have retrenched into their own private evaluations, thereby disrupting the coherence in evaluations. Consistent with this assertion is our observation that the change in emotional expression after these shared looks occurred following a couple seconds delay and lasted for several subsequent seconds, which suggests that a more conscious process may have been at work in which participants were ruminating on the observed disagreement.

Finally, as in experiment 1, low-frequency coherence was greater in the full than in the mere presence condition. High-frequency coherence did not differ across conditions. In addition, as in experiment 1, low-frequency coherence, which we interpret as a form of rapport with the other participant, is an independent predictor, beyond peak and end affect, of participants' summary judgment of the experience for participants in the full but not in the mere presence condition.

In sum, results for experiment 2 provide evidence that participants who could see each other influenced each other's expression of emotions, sometimes pulling each other toward the same expression, sometimes causing participants to abandon their own feelings, and sometimes reinforcing and thus sustaining an expression. The behaviors that drive emotional contagion, specifically, looking at the other person, also appear to influence the degree of low-frequency coherence, that is, synchrony, in participants' evaluations of the program. The greater this synchrony, the more participants liked the experience. Interestingly, participants seemed unaware of the effect of being in sync with the other person on their evaluations of the experience. Also, while the connection with the other person improved the experience, this rapport was not reflected in self-reported ratings of emotions, whether positive or negative.

GENERAL DISCUSSION

Consuming with someone else is different from consuming alone. Our studies reveal that the moment-to-moment evaluations of an experience may change as a consequence of being with someone else. Further, the retrospective evaluations may be driven by different factors for joint compared to solo consumers. Specifically, our studies showed that the moment-to-moment evaluations by participants who could observe each other's expressions covaried with each other over broad more so than narrow time intervals. This result suggests that participants were evaluating each local element of the experience according to their own idiosyncratic likes and dislikes but that over a broader range, participants' evaluations moved up and down together in a shared rhythm reflecting a more global sense of agreement about the experience. Results of our second study in which we videotaped participants' expressions suggest that this global agreement or synchrony resulted from participants looking at each other from time to time throughout the experience. Further, contagion appeared to result from unreciprocated looks, which led to adopting the expressions of the other person, and from reciprocated (i.e., shared) looks, which led to reinforcing emotional expressions. This process led to synchrony of evaluations.

In addition, consistent with Fredrickson and Kahneman (1993), we found that participants' retrospective evaluations of the experience could be predicted by their peak and end affect if they were treated as individuals. However, our results reveal that retrospective evaluations by participants who could observe each other were influenced by an additional factor than peak and end affect, specifically, the extent to which their online evaluations tracked the other person's evaluations over the low-frequency range. That is, being able to see the other person aligned participants' reactions, and this greater alignment of feelings improved participants' overall evaluation of the experience. Findings indicate, however, that participants, while being aware of the presence of the other person in the dyad, were not aware of their feelings or evaluations being influenced by the other person. That is, participants attributed their greater enjoyment with the experience to the quality of the film clip, not to the rapport that developed in the evaluation of the program with the other person. Prior research on feelings as information (Schwarz and Clore 1983) suggests, in fact, that awareness of the rapport might undermine the effect on program evaluations. That is, participants in the present research might have been (mis)attributing positive affect to the quality of the program, whereas awareness of the synchrony in evaluation might cause participants to attribute their good feelings to the social situation. Our findings therefore complement the literature on social influences, demonstrating the impact of dynamic interactions among people and showing how these influences may operate outside conscious awareness (Chartrand and Bargh 1999; Cheng and Chartrand 2003).

The idea that feelings of connectedness or synchrony during an experience can have an independent effect on people's enjoyment of an experience, over and above their peak and end affect, is perhaps the highlight of this research. While previous studies on experiences have focused pri-

marily on individual entities (Branigan et al. 1997; Fredrickson and Kahneman 1993), our research is among the first to look at the impact of sharing an experience with another individual from two separate perspectives—people's online evaluations and their retrospective evaluations. Further, while Raghunathan and Corfman (2006) examined the effect of shared experiences, they did so by using a confederate who expressed explicit verbal agreement or disagreement with target participants. Our research builds on this insightful work by examining the naturally developing rapport between dyads of participants who shared an experience.

Our research findings also align with studies on "shared reality" (for a review, see Hardin and Higgins 1996). According to this theory "experience of reality and meaning is created and maintained for the individual when it is mutually shared with others [and] social interaction is predicated upon and regulated by the establishment of shared reality" (30), which serves then to regulate the self. Shared reality is achieved through ongoing communication that may be verbal or nonverbal. Hence, consumers' glancing at one another as they jointly consume may serve the broader social function of constructing a socially shared, "objective" experience.

LIMITATIONS AND FUTURE RESEARCH

Our studies are limited in that they used short films as the shared experience, and participants were paired with people whom they did not know. Future research therefore should extend our research to examination of other types of shared experiences such as classes, concerts, amusement park rides, board games, and flights. These future studies may examine conditions in which consumers do not have to steal glances at each other in order to see the other person's emotional expressions. Further, this research may examine differences in the shared experiences for people who know each other and thus may have different or more pronounced affiliation goals than strangers. Our expectation would be that pairs of consumers who know each other and elect to enjoy an experience together may show even greater low-frequency coherence in their moment-to-moment evaluations and that their overall evaluations may driven even more by the extent to which their momentary judgments are in sync.

Our results also suggest that processes of mimicry and social contagion may be entwined with processes of impression management. Future research could untangle the relative impact of these opposing social influences. This research may also explore the relationship between conscious awareness of social influence on judgments and the extent to which perceived rapport affects evaluations. Further, our studies found that social influences were bidirectional, whereas future research may explore conditions under which leader-follower roles emerge within dyads. Individual differences related to self-monitoring (Snyder and Gangestad 1986) and social anxiety (Fenigstein, Scheier, and Buss 1975) may affect the roles participants adopt. Differences in need for uniqueness (Snyder and Fromkin 1977) also may determine the extent to which consumers influence each other's evaluations. Consumers may differ in their expressivity of emotions and perceptivity to others (Snodgrass, Hecht, and Ploutz-Snyder 1998).

Future research may also examine conditions that might lead to greater high-frequency coherence, which may reflect deliberate efforts to copy the other person's judgments, for example, when someone is trying to convince another person of their shared interests on a date. It would be interesting to discover whether the person being copied did indeed prefer these overt attempts to align moment-to-moment evaluations to the more subtle, low-frequency coherence that results from emotional contagion. To examine such effects, future research may employ confederates who are instructed to copy or even "antimimic" their partner's reactions. Future research may also take on the great methodological challenge of examining the effects of emotional contagion among groups of consumers, not just pairs, sharing an experience.

CONCLUSION

In sum, our results support and explain a familiar sensation: consuming with others feels different. Watching a movie with a friend produces different moment-to-moment judgments and changes the basis on which the quality of the movie will later be judged. Specifically, our results show that sharing the experience with another person may cause the consumer's moment-to-moment evaluation to become more like that of the other person, through processes of emotional contagion. Further, this shared pattern of judgment emerges in a subtle fashion over a fluid, broad time frame and not over short periods, reflecting local agreement in moment-to-moment evaluations. Further, our results suggest that when later asked if an experience was good or not, the evaluation may depend on the extent to which the consumer was indeed moving in quiet tandem with the other person.

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