

Exploring the Boundaries of Emotion Contagion in Groups:
The Spread of Anger and Happiness with Minimal Nonverbal Cues
Within the Context of Flexible and Resolute Behaviors

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Abstract

Emotion contagion -- the spread of emotion from one person to other people -- is known to occur in dyads and in teams interacting face to face. Contagion is generally assumed to rely on automatic mimicking of nonverbal cues. We raise the question of whether contagion occurs in computer mediated communication, where nonverbal cues are limited or absent. Using a trained confederate, different conditions of displayed affect were introduced to the operation of interdependent distributed teams. The manipulation also tested the effects of congruency between the emotion and the behavior displayed by the confederate toward other team members: displays of anger were matched with either resolute or flexible behavior. Our findings demonstrate that affect spreads in the extreme condition of computer mediated communication even with minimal non-verbal cues: both individual and group level affect were influenced by the emotion displayed by the confederate in the predicted direction. The findings carry important implications for the study of emotion contagion and for the study of the influence of displayed emotion.

The spread of emotion from one individual to others has been documented in dyads and in team (e.g., Barsade, 2002; Barger & Grandey, 2006; Hatfield, Cacioppo & Rapson, 1992). The mechanism typically presumed to explain contagion as mimicking of nonverbal cues (e.g., Neumann & Strack, 2000). The current research examines whether emotion contagion occurs in teams and settings where nonverbal cues are limited or non-existent. A critical context where this question is relevant is when computer mediated communication replaces face-to-face communication, as often happens in distributed project teams or virtual teams (Fineman, 2003; Rafaeli, Ravid & Cheshin, 2009).

The Mechanisms of Emotion Contagion

Emotion contagion is a powerful yet fundamentally unconscious process (Neumann & Strack, 2000), frequently described as a primitive procedure in which people automatically mimic and synchronize postures, movements, expressions and vocalizations of other people (e.g., Hatfield, et al., 1992; Totterdell, Kellett, Teuchmann, & Bringer, 1998; Totterdell, 2000). Kelly and Barsade (2001) refer to contagion as an implicit process that is a part of the affective context of team emotion. Others have referred to contagion as playing a significant role in various group phenomena such as synergy, groupthink, and cohesiveness (e.g., Ashforth & Humphery, 1995; Felps, Mitchell, & Byington, 2006).

The spontaneous mimicking that creates emotion contagion can be of body language (Bernieri, 1988; Bernieri & Rosenthal, 1991; Chartrand & Bargh, 1999), facial expressions (Dimberg, 1982; Howard & Gengler, 2001; Lundqvist & Dimberg, 1995), vocal tones (Neumann & Strack, 2000) and speech patterns (Ekman, Friesen & Scherer,

1976). Mimicking can be critical in the context of team work, if members of teams transfer emotion to each other, resulting in members of a team coming to feel the same emotions (Hatfield, Cacioppo & Rapson, 1994; Larid, 1974; McIntosh, 1996; Strack, Martin & Stepper, 1988; Stepper & Strack, 1993).

For contagion to occur some type of scanning of others' emotions must occur, though this process is presumed to rely mostly upon nonverbal cues (Mehrabian, 1972). Contagion is presumably more likely to occur when people's emotional state is unclear; especially in instances of high physiological arousal when people interpret how they feel by watching others, and matching their displayed nonverbal cues, and therefore their emotions (Reisenzein, 1983). The process is not always conscious, and has been documented to occur in teams whose members were not aware of the feelings presented to them. (Barsade, 2002; Bartel & Saavedra, 2000; Gosselin, Kirouac & Dore, 1995; Wehrle, Kaiser, Schmidet & Scherer, 2000). Previous work continuously suggests that a key element in the transfer of emotion is nonverbal cues Mehrabian (1972; Sullins, 1991). The question we raise – whether emotion contagion occurs when only verbal communication is available – has received little attention, and is the first question in the current study: Does emotion displayed only through written, textual communication create contagion effects? Building on very recent laboratory research we have reason to believe that such contagion does occur (Foroni and Semin, 2009), and its occurrence is highly relevant to distributed virtual teams, where team communication is only or primarily through writing.

More cognitive explanations for emotion contagion can be constructed based on the theories of *social comparison* (Festinger, 1954) and of *social information processing*

(Salanick & Pfeffer, 1978). Festinger (1954) introduced the theory of *social comparison* to demonstrate that people use others' actions and reactions to guide and govern their own behavior. According to this framework people assess and compare the emotions of others when “deciding” how they themselves feel and react (Schwarz, 1990; Wood, 1989). As Schachter (1959: 129) noted in what is known as the *Emotional Similarity Hypothesis*, people have a tendency to bring themselves into close "emotional conformity with others.” The social information processing theory (Salanick & Pfeffer, 1978) also stresses that the scanning of the social environment influences behaviors, beliefs, and emotions. These theories suggest that beyond mimicking, a more cognitive process of scanning of the environment and blending into it can create emotion contagion.

Two recent studies provide evidence for the role of social comparison on emotion contagion (Epstude & Mussweiler, 2009; Parkinson & Simons, 2009). In a set of three lab studies Epstude and Mussweiler (2009) demonstrated social comparison influences on the spread of emotion. Participants in these studies spontaneously compared themselves to others, and in an experimental induction to focus on similarity, created emotions that matched (or 'contagied') the emotion depicted either in photos of faces or in auditory stimuli. An induction to focus on dissimilarity created the opposite emotions of those depicted. Similarly, Parkinson and Simons, (2009) showed that social appraisal processes were evident in diary reports that also conveyed emotion contagion.

Social comparison and mimicking are not mutually exclusive, however. Gump and Kulik (1997) found evidence for effects of both mimicry and comparison on emotion contagion. And Kelly and Barsade (2001), who integrated past research on emotions and groups, suggested an interplay of cognitive and mimicking as influences on group

emotion. They noted multiple non-affective factors that might impact team affect, such as the inter-team context (e.g., competition between teams), physical context (e.g., space and layout of the team) and technological conditions (e.g., facial contact vs. computer mediated communication). Kelly and Barsade (2001) called for research that integrates a look at such organizational factors with emotion. We attend to this call by examining the effects of computer mediated communication on emotion contagion in teams.

Affect in Groups Relying on Computer Mediated Communication

The first critical question regarding emotion contagion with text based communication is: To what extent does text based communication includes and communicates emotion? Byron and Baldrige (2005) reported that people *do* perceive emotion in the primarily text based medium of e-mail, and also identified cues that can convey emotion, such as response time, length of text, and use of emoticons, special fonts, and capital letters. However the exact emotion represented by some cues is not always clear (Byron & Baldrige, 2005). Length of message, for example, can be perceived as a cue of either positive or negative emotion. Some of the cues are language specific; for example, some languages do not routinely use capital letters (e.g., Arabic or Hebrew). Other cues, notably “emoticons” (or “smilies”¹ as they are commonly known), are not reliable messengers, because the intended emotion is usually unclear (Raymond, 1994; Walther & Addario, 2001; Wolf, 2000). For example, the message “the text was hard ;-)” can be interpreted as sarcasm but may have a genuine intent. And, as Byron (2008) noted it is difficult to separate emotional cues from other aspects or elements of computer mediated communication.

¹ The term ‘smilies’ seems to carry a positive connotation. Yet these symbols are not always positive. Hence “emoticons” is a more suitable name.

However there is some indication that emotion can be accurately detected in written communication. To illustrate, Hancock, Landrigan & Silver, (2007) asked dyads using text only communication (instant messenger) to identify the emotion of their partner, and one member of each dyad was asked to act either happy or sad. Partner's detection of emotion was accurate and, as would be expected, the desire to meet the person portraying negative affect was significantly lower. An analysis of the text of the messages revealed differences between the conditions in the number of words, exclamation points, negations, and mentioning of negative feeling.

Studies of negotiation also found that emotions can be perceived in computer mediated communication. Van Kleef, De Dreu and Manstead (2004a; 2004b) provided participants written information about the supposed emotion of negotiation partners. Participants accurately interpreted the intended emotions, and the interpretations significantly influenced negotiation outcomes.

At the same time, a theoretical analysis of the emotional influences of email (Byron, 2008) noted two biases in e-mail communication: The *neutrality bias* refers to a decrease in perceptions of positive emotions in texts, and the *negativity bias* refers to an increase in the perceived intensity of negative emotions in texts. Support of the negativity bias was provided by Walther and D'Addario (2001) who demonstrated that negative cues tend to override other cues in computer mediated communication.

When written communication of teams rather than dyads is considered, the room for error and the complexity of the analysis is much more complicated than with dyads. Review of research on virtual teams, from authors such as Martins, Gilson, and Maynard (2004), notes that emotion is largely absent from research on virtual teams. The current

research effort begins to address this gap. In the interest of examining the boundaries of emotion contagion we examine whether affect is conveyed when only written computer mediated communication is available. This focus affords a practical and a theoretical goal. At the practical level, distributed teams can at times use video or audio media, but they still largely rely on text interaction; so it is imperative to identify the extent and nature of emotion contagion in such teams. Theoretically, this analysis will identify the minimal set of cues needed for emotion contagion to occur.

Given the paucity of research on emotion contagion in teams using written communication we cannot offer a clear prediction. Since contagion was presumed to rely on mimicking of nonverbal cues, and these are lacking in written communication, presumably, contagion should not occur. On the other hand, both the social learning and social information processing perspectives, and the new information that reading of "emotion words" creates an actual personal sense of the emotions (Feroni and Semin, 2009), suggest that contagion should occur. Hence competing hypotheses can be examined in Study 1:

H1a: Emotion contagion will not occur in teams that rely only on written communication.

H1b: Emotion contagion will occur in teams that rely only on written communication.

Study I

Methods

Overview and Sample

Data were collected using the organizational simulation Shape Factory, which provides a unique way to systematically study distributed teams (Bos, Olson, Nan & Cheshin, 2009; Bos, Olson, Cheshin, Kim, & Nan, 2005). The simulation creates the experience of a distributed team that is collaborating to accomplish an individual and group goal; participants are allowed to interact only through written electronic communication on the task that allows both individual and team success. The group works together for approximately 90 minutes which makes external validity significantly higher than in typical, short term lab studies. Because of the relatively longer interaction, group dynamics manifest in this simulation, and we presumed that emotions would play out. Thus this task offers a good blend of the reliability and control of lab work and the external validity of real group work.

Undergraduate students (n=147, mean age=24.57, 51.02% females) were randomly assigned to a group of 4 members, one of which was a confederate who created the experimental manipulation by displaying either angry or happiness. Participants were promised a monetary reward based on their performance in the experimental task. The reward structure of the task was designed to stimulate commitment of participants to both individual and group performance.

Procedure

Participants were invited through campus postings to arrive at a computer lab where they met the other group members (including the confederate). Participants were randomly assigned a shape (square, triangle, X or circle) that would be their icon for the experiment, and were asked to not talk to the other participants. They then viewed a short presentation with the instructions for the experiment, and completed a short test that

verified their understanding of the task. Answers were checked, corrected and additional explanations were provided in order to ascertain that all players started off with a good level of understanding of the task. This was followed by a practice round in which further questions were clarified, and then the data collection phase started.

The data collection included three rounds of 12 minutes in which participants bought and sold shapes in order to complete orders sent to them by the system. Success in a round (and subsequent compensation to participants) was according to the number of orders a participant and his or her group managed to complete. The orders included a random selection of shapes; each participant could produce the shape by him or her self, for a relatively high price, or could try to purchase the shape from the other participant for whom it was the self-shape. The price of purchase was determined by the person responsible for the shape. The task therefore involved buying and selling parts and negotiating with other people about the purchase price of sold and bought shapes. An asynchronous chat messaging system, similar to that of an email messaging system, was the only means through which participants were allowed to communicate.

After completing the three rounds participants were asked to complete a survey that included demographic questions and the dependent variables. Finally they were paid based on their individual and team performance, debriefed and dismissed².

Variables

Independent Variables

A manipulation of *an angry or happy fellow group member* was created by the confederate (cf. Barsade, 2002; Izard, 1964) who was alternately played by a male and

² Payment was based on acceptable pay for subject in the institution where the study was run- ranging from approximately \$1-\$10 with additional class credit given for completing required experimental hours. .

female student and participated in the initial drawing for the representative shapes and so was represented by one of the shapes. No effects were found of confederate sex or shape. Confederates completed all phases of the experiment like the other participants, but their interactions with other group members consistently conveyed an either anger or happy emotion. A detailed list of pre-scripted text was prepared for the confederate and he or she copied and pasted answers from this list, making adjustments as needed. For example, in response to a request to sell some parts in the angry condition the confederate wrote back: "Your offer really makes me angry!"; in contrast, in response to a similar request in the happy condition the confederate write back "It is a pleasure doing business with you!"

Dependent Variables

Individual Affect

The affect felt by participants was measured before and after the data collection, using eight positive and negative affective terms from the short version of the PANAS (Watson, et al., 1998). Confirmatory factor analysis confirmed the two different dimensions³.

Group Affect

Two indices of group affect were collected. First, individual group members were asked to rate the emotion of each fellow group member by responding to two questions (1) "To what extent did *Shape X* display anger during the task?"; (2) "To what extent did *Shape X* display happiness during the task?"; responses were on a 7-point scale and were aggregated, creating an ***aggregated index of group anger and group happiness***. The

³ The Cronbach Alpha measures were .74 for time-1 NA and .77 time-1 PA, .85 for time-2 NA and .73 for time-2 PA

confederate ratings were not included in this index. Aggregation was justifiable since agreement among group members was sufficient ($Rwg(j) = 0.87$). The differences between groups was not very high ($ICC1=0.09$, $ICC2=0.23$), which is to be expected since members had no previous familiarity with each other, and the key emotional difference between the group should be the manipulation.

Second, all the communicated text among participants was coded by three independent raters, who were blind to the experimental condition (Cohen's Kappa = 0.79); messages were categorized as negative, positive or neutral, and each group was assigned a score based on the number of positive and negative messages in their communication.

Manipulation Check

A manipulation check was provided by the raters' ratings of all the messages, which included ratings of the confederate messages. Raters identified significantly more negative messages sent by the confederate in the angry than in the happy conditions ($T(47) = 32.13$, $p < 0.001$, Angry $M=52.75$, $SD=8.17$, Happy $M=0.16$, $SD=0.37$). And significantly more positive messages were sent by the confederate in the happy condition ($T(47) = 43.64$, $p < 0.001$, Happy $M=41.04$, $SD=4.61$, Angry $M=0$, $SD=0$).

A second manipulation check involved participants' ratings of the emotion of the confederate. Using the same items collected for the aggregated group affect score, we compared the ratings of the participant icon in the angry and happy condition. In the angry conditions; the rating of anger was significantly higher than in the happy conditions ($T(47) = 13.41$ $p < 0.001$, M Anger = 5.57, $SD=1.80$, M Happiness = 1.93, $SD=1.22$). And in the happy conditions the rating of happiness was significantly higher

than in the angry condition ($T(47) = 9.34$, $p < 0.001$, M Happiness = 4.48, $SD = 1.47$, M Anger = 2.01, $SD = 1.36$).

Results

Table 1 reports the means, standard deviations and inter-correlations among the study variables. A multilevel nested analysis accounted for different groups of participants, and the unique experience of each group. This analysis allowed for simultaneous consideration of both individual level factors and group level factors. Using mixed models analysis enables the consideration of random intercepts and random slopes for each group to check for differences while considering unique variances in groups. The F-tests presented in the analysis are actually differences between the predictors (betas) for each condition. This analysis shows which specific measures (i.e., individual affect) were or were not significantly different between conditions. (Insert Table 1 here).

PANAS

A first test of Hypothesis 1 was the effects of the emotion condition on reported PANAS of group members. A nested repeated measures analysis of Time 1 and Time 2 PANAS reports verified a significant difference between the two conditions: differences in both NA $F(1, 243) = 37.58$, $p < 0.001$, and PA $F(1, 243) = 4.61$, $p < 0.05$) were in the predicted directions, as is evident in Figures 1 and 2 and in Table 2.

Post hoc tests verified no significant difference in the NA between the two conditions in Time 1 ($T(84.5) = 0.77$, $p > .01$), and significant difference in Time 2 ($T(84.5) = 5.52$, $p < 0.001$), as well as difference within conditions over time (NA1 versus

NA2) (Angry $T(243) = 12.33$, $p < 0.001$, Happy $T(243) = 3.82$, $p < 0.001$), as summarized in Table 2.

The post hoc tests for the happy condition reveal a similar picture. There was a significant difference in Time 2 in reported PA but not in Time 1 (Time 1 $T(123) = 0.67$, $p > .01$, Time 2 $T(123) = 3.41$, $p < 0.001$). Concerning differences over time within conditions, only the happy condition had a significant change (happy $T(243) = 2.55$, $p < 0.05$, angry $T(243) = 0.51$, $p > .01$) These results are evident in Table 2.

(Insert Figures 1 and 2 and Table 2 here).

Thus, these analyses of the PANAS responses supported Hypothesis 1b, showing that emotion contagion occurred.

Group Level Emotion

Hypothesis 1b, that emotion contagion would occur, was also supported by the aggregated (bottom-up) measure of group emotion. Reported group anger was higher in the angry condition than in the happy condition ($T(47) = 7.40$, $p < 0.001$) and ratings of group "happiness" was higher in the happy condition than in the angry condition ($T(47) = 4.57$, $p < 0.001$). Table 3 reports these results.

A final test of the occurrence of contagion was afforded by the coding of the communicated messages, and this also confirmed a significant difference in the number of negatively ($T(47) = 23.06$, $p < 0.001$) and positively toned messages ($T(47) = 27.73$, $p < 0.001$) between the angry and happy conditions; as expected the happy condition had more positive messages than the angry condition and visa versa. These results are summarized in Table 3. (Insert Table 3 about here)

Discussion

The results of Study 1 clearly support H1b, suggesting that the emotion (anger or happiness) expressed by one individual group using only written communication spread to other team members, and influenced the group emotion. These findings challenge the idea that mimicking of nonverbal cues is the only mechanism for contagion (e.g., Hatfield, et al, 1992), since in the communication we examined nonverbal cues were non-existent.

One explanation for our findings may be that people did mimic the spirit of the messages of the confederate, which may have influenced their affect. So it may be that mimicking of others' verbal display of emotion is the mechanism behind emotion contagion when nonverbal cues are not available. Our findings cannot rule out this alternative explanation. Such mimicking lends support to the social learning and social information processing perspectives on emotion contagion (Festinger 1954; Salanick & Pfeffer, 1978). For participants in the experimental situation, the situation was novel, which could have led them to search for cues and mimic the affective tone of the messages of others (Schachter, 1959). So, similar to the mimicking of nonverbal cues (Hatfield, et al. 1992) it may be that mimicking of verbal/textual cues, can influence the affect a participant feels or reports at the end of the session.

Whatever the mechanism, however, the results imply that individuals interacting with fellow group members only in writing “catch” the affect of the other members, which continues to support the claim that affect is present in computer mediated communication (Hancock et al., 2007; Byronm & Baldrige, 2005).

Is It Really Contagion?

One might argue that these results do not necessarily show contagion. It could be, for example, that participants were angry *in response* to the angry confederate, hence reacting to him or her rather than mimicking him or her (Hareli and Rafaeli, 2008). To rule out this option an additional round of analyses of the coded data was conducted which excluded all messages sent to the confederate. This analysis examined only messages sent by the players to one another without the confederate. The analysis found no difference ($T(47) = 0.07$, $p > .01$, M anger = 2.49, $SD = 2.80$, M happy = 2.33, $SD = 2.73$) in the number of negatively toned messages sent in the two conditions, which might indicate that the findings reported above represent a reaction or response to the confederate rather than a true spread or contagion of anger (Hareli and Rafaeli, 2008). There was a significant difference between the conditions in positively toned messages in this analysis ($T(47) = 20.47$, $p < 0.001$, M Happy = 4.75, $SD = 4.39$, M Anger = 1.93, $SD = 2.65$), indicating that positive affect did spread to the rest of the group, and was not only a reaction to the confederate.

Hareli and Rafaeli (2008) suggest two key responses to encountering an emotion of another person: contagion and conversation. Emotional conversation is when an emotion of another person causes a person to react and feel certain affect. For example, if someone is angry at another person, the other person might get frightened. Since we did not test whether other specific emotions were felt by participants, it is possible that an emotional conversation took place. But whether or not this occurred, emotion contagion occurred as well. When looking at the group level results for both conditions we see that the manipulated emotion spread to all group members. It may be that contagion and

conversation occurred in the angry condition, but there is no doubt that contagion occurred in the happy condition.

The more complex pattern of results with anger may have occurred because it is a stronger and more salient emotion than happiness. Baumeister, Bratslavsky, Finkenauer & Vohs, (2001) suggested that the display of happiness is taken for granted in interactions between individuals, whereas the display of anger grabs more attention. Thus, individuals may have remembered who was angry, and responded to this anger, while the happiness good mood spread unconsciously and could not be pinpointed to a person or a situation.

An important theoretical question that was not addressed in this study, however, is; What exactly constitutes the display of an emotion? The confederate's emotional display was manipulated by the content of the messages he or she sent. But since the task was complex and involved actions regarding selling and buying of parts, amounts and prices, the expressions of anger were also obtained through control of the confederate's behavior. We developed our manipulation building on previous research that manipulated emotion displayed. Both Kopelman, Rosette, & Thompson (2006) and Sinaceur & Tiedens, (2006) noted that individuals convey anger by being resolute in negotiation settings, asking for higher gains, not giving in and acting 'tougher'. Therefore, we instructed the angry confederate to act in a more resolute way. For example, the confederate asked for relatively high gains and negotiated every offer received (up to 3 times) before selling or buying a part. It was possible to reach an agreement with a resolute confederate, but it was tougher. The happy confederate, on the other hand, was instructed to act in a flexible and cooperative manner, which meant accepting any offer as

long as there was some gain, not negotiating, and asking for reasonable rather than excessive gains.

These behavioral differences raise an important question of whether and how behavior might influence the perception of emotion, and how or whether behavior might evoke what was previously termed emotion contagion, but may actually be what Hareli and Rafaeli (2008) identified as “emotional conversation”. Study II addresses these questions.

Study II

Study II examined two hypotheses, both addressing the 2X2 situation of angry vs. happy emotion and resolute vs. flexible behavior of the confederate. The hypotheses were as follows:

Hypothesis 2: Resolute behavior will be viewed as a display of anger while flexible behavior will be viewed as a display of happiness.

Distinguishing between emotion and behavior allowed us to address a second question – of whether and *how* congruence or incongruence of emotion and behavior influences emotion contagion. In incongruent conditions (flexible and angry, resolute and happy), we hypothesized that emotional display will be largely ignored, affording lowering emotion contagion. In situations of congruence between behavior and affect we predicted strong emotion contagion.

Hypothesis 3: Contagion in conditions of incongruence between emotion and behavior will not be as strong as in congruent conditions.

A third question that Study 11 addressed regards the question of emotional change due to reaction or “conversation” rather than contagion, as suggested by Hareli and

Rafaeli, (2008). Incongruence between emotion and behavior might make the emotion of one's counterpart less salient and less obvious in these conditions. This can be expected to lower the chances of an emotional response or reaction and increase the likelihood of emotion contagion. Hence our final prediction:

Hypothesis 4: An incongruence between affect and behavior will create a more even spread of emotion to other group members than a congruent condition.

Methods

Overview and sample

The setting of Study II was identical to Study I except for the confederate actions, which included four conditions that created responses that were either congruent or not congruent with the emotion of anger or happiness (see Appendix I and II). For example, in the angry-flexible condition the confederate gave in more to other members but wrote them angry messages such as "You are really making me upset with your offer, but OK I agree...". In the happy-resolute condition the confederate negotiated and asked for higher prices but wrote happy messages such as "I will be happy to sell the parts to you, but I would like more money". Using the same recruiting system 147 undergraduate students (mean age =24.94, 55.48 % males) were randomly divided into 49 groups and received the same reward as that mentioned in Study I. The results of Study II were analyzed combined with the results of study I⁴ thus creating a 2X2 experimental design, separating emotion (angry/happy) and behavior (resoluteness/flexibility).

All the measures and variables collected were identical to Study 1.

Results

⁴ Both studies were run at the same academic semester and the procedure was identical. Combining them would not violate random assignment to experimental condition.

Table 4 presents means standard deviations and inter-correlations between study variables. (Insert Table 4 about here)

Manipulation Check

The manipulation check here is more complicated than in Study I, but similar to Study I, it was done using two methods. The experimental manipulation of anger worked, so that in the angry conditions the rating of anger were significantly higher than in the happy conditions ($F(3,289) = 76.65, p < 0.001$). Post hoc tests revealed a significant difference between all conditions. The experimental manipulation worked for happiness as well, as in the happy conditions the rating of happiness were significantly higher than in the angry condition ($F(3,289) = 44.31, p < 0.001$).

The number of negatively toned messages sent by the confederated differed significantly between the angry and the happy conditions ($F(3,96) = 547.54, p < 0.001$).

As for the number of positively toned messages sent by the confederate the manipulation checked was confirmed as well ($F(3,96) = 515.52, p < 0.001$). Post hoc tests revealed a significant difference between the happy conditions but not between the two angry conditions (see table 5 for means and SD). (Insert Table 5 Here).

Overall, the results indicate that when emotion and behavior differ, the evaluation of the emotion of another person, or in this case the degree of emotional display, differs as well. Thus, offering support for hypothesis 2.

Individual Level Emotion

A repeated measure analysis of the PANAS results in the 4 conditions was conducted and confirmed that change in emotion occurred in the hypothesized direction -

NA, ($F(3, 485) = 20.16, p < 0.001$) and PA, ($F(3, 486) = 6.23, p < 0.001$). All Time 1 measures were not significantly different, and changes in NA (negative affect) were significant in all conditions, meaning that NA increased regardless of condition. Yet, the change was significantly greater in the angry conditions than in the happy conditions on all but one pair-wise comparison (angry resolute and happy resolute were not significantly different). The change in PA (positive affect) was only significant in the happy conditions. The PANAS measure therefore indicates emotional change in all the conditions in the expected direction. (Insert tables 6 about here)

Group Level Emotion

Using the same bottom-up measure of group emotion as in Study I revealed that, there were differences between the conditions. The rating of group anger was higher in the angry conditions than in the happy conditions ($F(3, 289) = 30.30, p < 0.001$) and the rating of group happiness was higher in the happy conditions than in the angry condition ($F(3, 289) = 12.55, p < 0.001$). The means and standard deviations are presented in table 7. (Insert tables 7 about here)

Content Analysis of Group Communication

As in Study I, the final test of contagion in the groups was afforded by a comparison of the valence of the text messages that group members sent to each other. The analysis did not include the messages sent by the confederate, and it confirmed a significant difference in the number of negative ($F(3, 93) = 8.81, p < 0.001$) and positive messages ($F(3, 93) = 11.78, p < 0.001$) between the angry and happy conditions; where in the happy condition there were more positive messages than in the angry condition and visa versa. The results of this analysis are summarized in Table 8.

In order to check for emotional response or emotion contagion another analysis was done regarding the tone of the messages, where messages sent to the confederate were removed. This would indicate whether these messages were sent to all members of the group or only as a response to the confederate. The results reveal that there were differences between conditions (negatively toned messages $F(3,93) = 4.85, p < 0.01$, positively toned messages $F(3,93) = 8.23, p < 0.001$). Overall the results show that as for the spread of negatively toned messages there was a difference between the angry conditions where, in the *Angry Flexible* condition the anger was more spread out between members compared with the *Angry Resolute* condition. As for positively toned messages it can be seen that they were more spread out between group members in all happy conditions, but even more so in the flexible condition. (Insert table 8 about here)

Overall these results do not support Hypothesis 3- that there will be stronger emotion contagion in the congruent conditions than in the incongruent conditions.

Overall these results do not support Hypothesis 4- that emotional reaction will be spread out more in the incongruent conditions than in the congruent conditions.

Discussion Study II

Study II results indicate that behavior does play a role in the detection of other's emotion and consequently it has an effect on emotion contagion as well. These results point to the importance of not only evaluating one's emotional display, but the whole context of the interaction, when considering the effect of emotion. Moreover, the results indicate that change in emotions occurred in all conditions yet it was surprisingly stronger, not in the congruent conditions, but in the conditions where the confederate acted in a flexible manner. In addition the spread of emotion reaction indicated by the

tone of messages sent was more evenly distributed in the flexible conditions than in the other conditions. These results might indicate that the cognitive load one is dealing with plays a role in the effects of affect. The flexible condition was an easier condition to play as there were fewer messages sent by the confederate, reducing time pressure. This means that those in the flexible conditions supposedly had more time and were thus more open to the emotional displays of the confederate. This concept fits well with the work of Van Kleef et al (2004b), as they demonstrated that when individuals have motivation and resources are available, they pay attention to emotional contact and it has greater influence on them.

Overall Discussion

Affect exist in groups even when groups do not interact face to face! Furthermore, affect spreads and influence group members. Although not addressed in the current study, the effects of affect on individuals and groups have been shown in various studies to influence group dynamics and performance (e.g., Barsade, 2002). Therefore, affect can not and should not be taken lightly.

Emotion contagion does not operate only through mimicking of nonverbal cues! In our study we show that emotion spread between individuals even in extreme conditions of only textual interaction. This extends the possible mechanisms in which emotion contagion occurs. As evident from past research (e.g., Neumann, & Strack, 2000), there is no doubt that mimicking of nonverbal cues does cause emotion contagion, but as is apparent from the results of this study, other mechanisms are involved. These results complement and extend the recent results of Epstude and Mussweiler (2009), and Parkinson and Simons (2009). Our study shows that there is no need for traditional

emotional cues (visual or auditory) at all for contagion to occur. Additionally, the social comparison aspect has been recently suggested to be a spontaneous processes, requiring diminutive cognitive processing (Mussweiler & Epstude, 2009; Mussweiler, Rüter, & Epstude, 2004), thus strengthening the notion of contagion vs. emotional response. Overall, these recent results and the results of the present study suggest that social comparison and social processing theories play a larger role in the process of emotion contagion than previously suggested.

Recently, a study by Huntsinger and colleagues (Huntsinger, Lun, Sinclair, & Clore, 2009), demonstrates that emotion contagion can even occur with no contact at all. In their study, merely anticipating an interaction with a stranger, led to matching of affect. In 3 lab studies, Huntsinger et al (2009) demonstrated that when given affective information about the state of a partner one is about to interact with, individuals with motivation to get along with their partner "caught" their affect. This fascinating study also demonstrates that without nonverbal cues contagion is still possible.

As emotion contagion has been found to differ among situations and individuals (Anderson, Keltner & John, 2003; Bono, & Ilies, 2006; Davis & Rusbult, 2001; Ilies, Wagner & Morgeson, 2007), it might be that the convergence of affect in our study could have been induced by the dependency of the participants in the study. Therefore, future studies should test the limits of the phenomena to situations in which emotion contagion occurs when nonverbal cues are not present.

Evaluation of emotion is influenced not only by emotional display but also by behavior! Previous research has looked mostly at emotion without focusing on the behavior that accompanies it. Our results show that this should not be the case. The

interaction between emotion and behavior should be studied more carefully. It might be the case that behavior by itself is emotionally charged thus leading to emotional interpretations and effects.

Limitations

The groups in this study were not truly distributed groups. All participants arrived at the same lab and although they did not interact face to face, they were physically in the same room. Likewise, the interaction was synchronic, which is not the case in many distributed teams, as there are often time differences between locations. Yet, the question regarding the mechanism behind emotion contagion and the role of nonverbal cues is a dynamic part of distributed teams and should be applied to them.

Another limitation of this study is that it studied group affect only from a bottom up perspective. Barsade and Gibson (1998) suggested that the top-down and the bottom-up approaches to group emotion should be paired together in order to achieve a more complete picture of affect in groups. Pervious studies used outside observers to rate the overall group affect (Barsade, 2002; Bartel & Saavedra, 2000) and a lead rater to focus primarily on nonverbal communication. Aggregation of two approaches can lead to a better understanding and concept of emotion contagion. This is not trivial and may be because the concept of overall group affect envelopes the idea of emotion contagion. If there had been incongruence, and for example the emotions of aggregated individuals were found to be different from that of participants' overall top-down view of affect of the group, this might have been interpreted to mean that contagion did not occur. Despite the impairment of same source bias that might occur in this measurement, it is important, to continue to measure both overall and individual ratings.

As for the separation of behavior and emotion, participants were not asked questions regarding the behavior of the confederate, but only on the emotion he or she displayed. It would be interesting to see whether emotion is evaluated differently when it is accompanied with behavior. Since the behavior (resoluteness / flexibility) was acted in an extreme setting where nonverbal cues are limited, it might be that in face to face interactions behavior is not evaluated emotionally. Future studies should test the emotional evaluation of behavior in face to face interactions. To extend the finding of behavior that is emotionally charged, future studies should identify other behaviors besides resoluteness and flexibility.

Conclusions

There is no doubt that emotions are part of organizational life. This study shows that even groups that do not interact face to face, and use only computer mediated communication, are influenced by emotions. As previous studies have shown, emotions can be perceived in computer mediated communication and they influence individuals and teams. Emotion contagion is part of not only face to face groups but also of distributed teams. Moreover, behavior and not only emotional display is involved in the evolution of other's emotion.

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Tables

Table 1- Means, Standard Deviations and Intercorrelations

	Mean	SD	1	2	3	4	5	6	7	8	9
1. Rating of confederate anger display	3.71	2.38	--	--	--	--	--	--	--	--	--
2. Rating of confederate happiness display	3.27	1.88	-.69**	--	--	--	--	--	--	--	--
3. NA1	1.63	.74	-.20*	.18*	--	--	--	--	--	--	--
4. PA1	3.86	1.16	-.00	.04	.17*	--	--	--	--	--	--
5. NA2	2.82	1.37	.43**	-.27**	.16	.01	--	--	--	--	--
6. PA2	4.04	1.07	-.29**	.33**	.19*	.41**	-.24**	--	--	--	--
7. Team anger	2.75	1.00	.65**	-.39**	.03	-.03	.56**	-.27**	--	--	--
8. Team happiness	3.52	1.09	-.29**	.61**	.09	.17*	-.17*	.52**	-.19*	--	--
9. Team positive messages	5.21	5.76	-.37**	.30**	-.06	-.05	-.08	.22**	-.20*	.19*	--
10. Team negative messages	4.50	3.98	.33**	-.24**	-.04	-0.1	.40**	-.25**	.36**	-.22**	-.12

Note: * $p < 0.05$, ** $p < 0.01$

Table 2 – Individual Emotion, Means and SD in Two Experimental Conditions

	Angry Condition	Happy Condition
NA1	1.56 ^a (0.72)	1.70 ^a (0.75)
NA2	3.40 ^b (1.42)	2.27 ^c (1.06)
PA1	3.8 ^d (1.22)	3.93 ^d (1.09)
PA2	3.71 ^d (1.06)	4.37 ^c (0.98)

Note: figures with different superscript letters are different at the $p < 0.05$

Table 3 – Group Emotion, Means and SD

	Angry Condition	Happy Condition	T Value
Aggregated Group Ratings of Anger of all Group Members	3.29 (0.80)	2.22 (0.89)	7.40**
Aggregated Group Ratings of Happiness of all Group Members	3.11 (1.06)	3.91 (0.96)	4.57**
Number of Negatively Toned Messages Sent	6.24 (4.13)	2.83 (3.03)	23.06**
Number of Positively Toned Messages Sent	2.82 (3.74)	7.51 (6.41)	27.73**

Note: * p<0.05, ** p<0.01

Table 4 - Means, Standard Deviations and Intercorrelations

	Mean	SD	1	2	3	4	5	6	7	8	9
1. Rating of confederate anger display	3.68	2.19	--	--	--	--	--	--	--	--	--
2. Rating of confederate happiness display	3.17	1.77	-.53**	--	--	--	--	--	--	--	--
3. NA1	1.69	.80	-.04	.26*	--	--	--	--	--	--	--
4. PA1	3.88	1.17	.03	.19*	.25**	--	--	--	--	--	--
5. NA2	3.15	1.29	.38**	-.21**	.12*	.10	--	--	--	--	--
6. PA2	3.90	1.04	-.19*	.37**	.20**	.33**	-.28**	--	--	--	--
7. Team anger	2.89	1.05	.61**	-.18**	.13*	.08	.59**	-.23**	--	--	--
8. Team happiness	3.36	1.12	-.14*	.65**	.27**	.24**	-.11	.56**	-.00	--	--
9. Team positive messages	5.15	5.75	-.29**	.31**	.05	.01	-.08	.33**	-.12*	.27**	--
10. Team negative messages	4.58	4.03	.20**	-.21**	-.09	.00	.35**	-.17**	.25**	-.16**	-.06

Note: *p<0.05, **p<0.01

Table 5 - Confederate Emotional Display

	Angry Resolute	Happy Flexible	Angry Flexible	Happy Resolute
Rating of confederate display of anger	5.57 ^a (1.8)	1.93 ^b (1.22)	4.57 ^c (1.85)	2.65 ^d (1.63)
Rating of confederate display of happiness	2.01 ^e (1.36)	4.48 ^f (1.47)	2.43 ^e (1.30)	3.73 ^g (1.73)
Negatively toned messages sent by the confederate	52.75 ^h (8.17)	0.16 ⁱ (0.37)	35.01 ^j (7.50)	0.21 ⁱ (0.83)
Positively toned messages sent by the confederate	0 ^k (0)	41.04 ^l (4.61)	0.38 ^k (1.10)	52.33 ^m (8.83)

Note: figures with different superscript letters are different at the $p < 0.05$

Table 6 – Individual Emotion, Means and SD in All Experimental Conditions

	Angry Resolute	Happy Flexible	Angry Flexible	Happy Resolute
NA1	1.56 ^a (0.72)	1.70 ^a (0.75)	1.75 ^a (0.90)	1.77 ^a (0.81)
NA2	3.40 ^b (1.42)	2.27 ^c (1.06)	3.84 ^d (1.06)	3.11 ^b (1.07)
PA1	3.8 ^d (1.22)	3.93 ^d (1.09)	3.99 ^d (1.12)	3.82 ^d (1.36)
PA2	3.71 ^d (1.06)	4.37 ^e (0.98)	3.44 ^d (0.83)	4.01 ^e (1.03)

Note: figures with different superscript letters are different at the $p < 0.05$

Table 7– Group Emotion, Means and SD

	Angry Resolute	Happy Flexible	Angry Flexible	Happy Resolute
Individual Ratings of Anger of all Group Members	3.54 ^a (0.76)	2.27 ^b (0.97)	3.79 ^c (1.00)	2.61 ^d (1.17)
Individual Ratings of Happiness of all Group Members	2.92 ^e (1.08)	3.90 ^f (0.99)	2.73 ^g (1.00)	3.43 ^h (1.2)

Note: figures with different superscript letters are different at the $p < 0.05$

Table 8- Comparison of Emotionally Toned Messages

	Angry Resolute	Happy Flexible	Angry Flexible	Happy Resolute
Negatively Toned Messages	6.24 ^a (4.13)	2.83 ^b (3.03)	5.53 ^a (4.57)	3.67 ^b (3.37)
Positively Toned Messages	2.82 ^b (3.74)	7.51 ^c (6.41)	3.63 ^b (4.37)	6.4 ^c (6.6)
Negatively Toned Messages not sent to confederate	2.49 ^d (2.80)	2.33 ^d (2.73)	4.10 ^e (3.9)	1.78 ^d (1.89)
Positively Toned Messages not sent to confederate	1.93 ^f (2.65)	4.75 ^g (4.39)	2.58 ^f (3.24)	3.62 ^g (4.41)

Note: figures with different superscript letters are different at the $p < 0.05$

Figures

Figure 1 - Repeated Measures NA

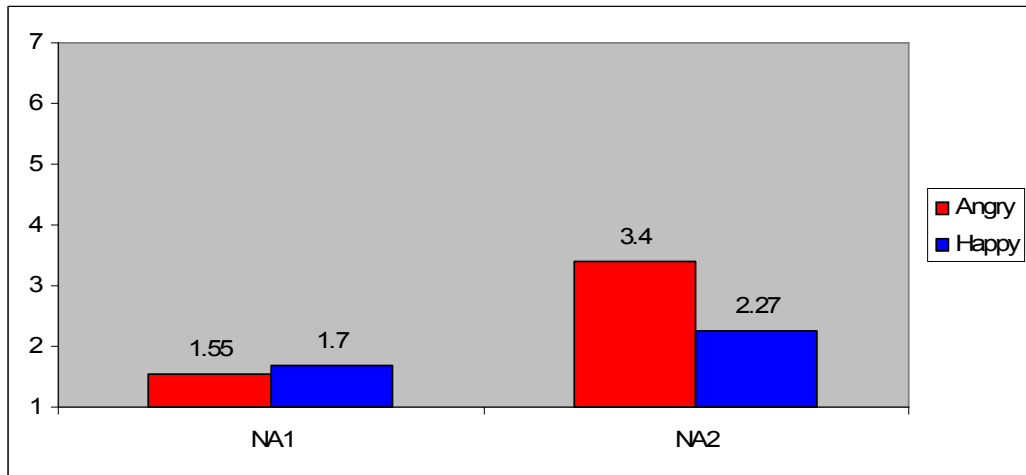
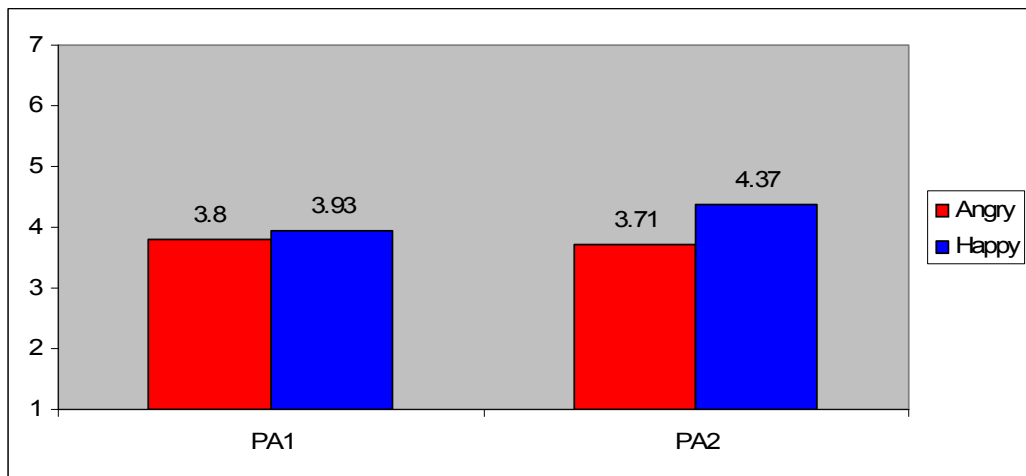


Figure 2 - Repeated Measures PA



Appendix I

Confederate Rules: ANGRY (resolute)

Task rules

- Don't create or change group policy. Try to blend in.
- Don't be the first to react. Wait for the others first and then react. First wait for a request from someone. After answering you can send a request to someone else, meaning, the order in which you play the game is: answer 1 request send 1 request. This means first sell then buy. If you do not receive a new request for more than a minute after answering a request you can move along and send a new request.
- When getting a request (someone wanting to buy from you) **ALWAYS** negotiate and ask for more money. Ask for + \$4 unless it is over the limit (30) and then just ask for the max. If there is a counter offer go down by only \$1 each time and do not go down more than \$2.
- When sending a request (buying from someone) ask for only \$3 more than your production cost, and increase only by \$1 increments no more than 3 times.
- If there is a policy of reciprocity try to play along, but stay aggressive and use this same policy regarding prices.
- NEVER sell more than 3 parts at once.
- Always make sure you sell all your parts each round (this should not be a problem as there is greater demand than supply). If you do not receive any more requests offer your parts to others but only in the last 2 minutes of the round.
- When you can not receive any parts, fill orders on your own.
- Don't over buy parts!

You should use emoticons that show anger :-@ and EMPHASIS!!!

Sample Sentences to use:

You are starting to make me MAD!

This offer makes me really ANGRY!

This is really getting on my nerves!

Are you selling or not? This is taking way too much time!

Come on! Make a decision already!

If there are questions that are unrelated to the task this is the answer:

What does this have to do with anything???

Appendix II - Confederate Rules: HAPPY (flexible)

Task rules

- Don't create or change group policy. Try to blend in.
- Don't be the first to react wait for the others first and then react. First wait for a request from someone. After answering you can send a request to someone else, meaning that the order in which you play the game is: answer 1 request send 1 request. This means first sell then buy. If you do not receive a new request for more then a minute after answering a request you can move a long and send a new request.
- When getting a request (someone wanting to buy from you) do **NOT** negotiate unless the price is below your production cost. If it is, ask for \$2 more than your production cost.
- When sending a request (buying from someone) ask for only \$7 less than your production cost of that part. Accept any counter offer as long as it is not above your production cost.
- If there is a policy of reciprocity try to play along. Stay with the same rules regarding buying and selling as mentioned above.
- Always make sure you sell all your parts each round (this should not be a problem as there is greater demand than supply). If you do not receive any more requests offer your parts to others but only in the last 2 minutes of the round.
- When you can not receive any parts fill orders on your own.
- Don't over buy parts!

You should use emoticons that show pleasantness ☺

You should use emphasis!!!

Sentences to use:

It is great working with you!

I really appreciate your help!

May I please buy a part from you?

If there are questions that are unrelated to the task this is the answer:

Thanks for asking but I am kind of busy now.