Emotional contagion and group performance

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Abstract
Emotional contagion is the process by which emotion spreads through a group of people. Previous work has focused on pairs; we are working to understand better emotion changes groups, using Hareli and Rafaeli's model of emotion cycles. Current work shows that angry emotions of one confederate change both emotion and performance in four-person groups playing a collaborative game. Future work will incorporate software agents who can communicate with players via text messages and convey emotional states cross-culturally.

Keywords
Emotion, affect, emotional contagion, software agents, multi-agent modeling, culture, cross-cultural

ACM Classification Keywords
K.4.2 Social Issues in Computing

Introduction
How does the emotion of one person influence a group? We are working on a set of studies on how strong emotions, especially negative ones, influence outcomes of group collaborations. Results to date are consistent with previous work on emotional contagion, showing that strong negative emotions expressed by one member of a group bring out the same in other members. Tentative results also suggest that

effectiveness of the entire group suffers in an interdependent task. In follow-up work we will be studying whether emotional contagion has the same effects when collaboration happens via computer-mediated communication, and when cultural differences (specifically Israeli and Arab cultures) are added to the mix.

Methodologically, this work is intended to yield these new capabilities:

1) A flexible and easily scalable experimental task (Shape Factory) where quantifiable group outcomes, as well as emotions (will have) been shown to be influenced by emotions
2) Software agents that can consistently convey emotional states such as anger
3) A text message library that can be used by humans speaking various languages as well as agents

Emotional contagion and emotion cycles

Emotional Contagion (EC) is the spread of emotion across group members. The first steps of EC appear as spontaneous mimicking of others' Non Verbal Cues (NVC) such as: body language [1,2], facial expression [3], vocal tones [4] and speech patterns [5].

Emotional Contagion has previously been studied mostly on pairs, and only recently has emotional *team* contagion been studied. Barsade [6] has shown that when a confederate acts and uses NVC to show emotion, team contagion can occur.

Hareli and Rafaeli [7] describe a model of emotion cycles between multiple collaborators. Strong emotions of one person influence both not only target of the emotion (if there is one) but also observers. However, the type of emotion evoked by targets and observers is not always the same the same as that displayed. Others may have reactions that go beyond mimickry; they make inferences about the intentions, genuineness, and other aspects of the person expressing emotion, and respond accordingly.

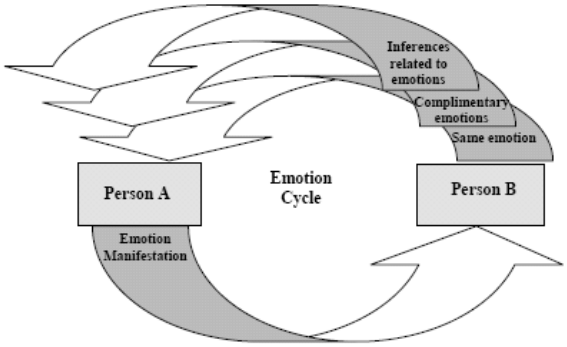

Figure 1: Hareli and Rafaeli's Emotion cycles

Current research

Our current research has focused on measuring the effect of strong emotions on four-person groups performing an interdependent collaborative task. Groups played four rounds of Shape Factory, a collaborative game previously used to study long-distance work [8].

One person in each group was a confederate who, following a script based on Barasade [6] acted out either a 'hostile irritable' or 'cheerful enthusiasm' strategy. Individuals completed the PANAS before and after the experiment, as well as a set of questions

asking them to rate the emotions of others in the group.

Results show that participants correctly perceived the confederates' intended emotional state. They also showed a corresponding change in the PANAS scores of all players, demonstrating emotional contagion throughout the group. Messages between participants were also coded as significantly more negative versus positive messages, corresponding to the conditions.

Group effectiveness, measured by the sum of group scores without the confederate score, was also lower in groups with 'hostile irritable' confederates. This research study is ongoing; additional conditions are being run to check for possible confounded results due to differing confederate game strategy as well as emotion displayed.

Automated agents

To enable future work to be done more flexibly, we are developing automated software agents that can reliably convey emotions in the same way a confederate would. These agents will monitor the game, set goals and choose actions, maintain a social network table of their attitudes toward other players, and choose text message from a large library of options pegged to different game, relationship, and emotional states, as shown in Figure 2.

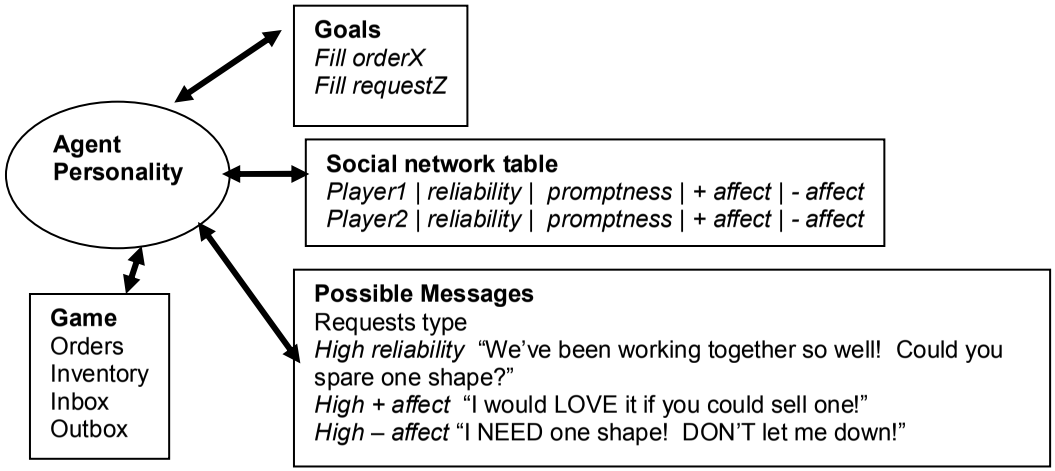

Figure 2. Agent design for Shape Factory

We believe that these automated agents can be brought to the level where human players cannot easily tell the difference between humans and agents. This is possible because of the constrained nature of the game and relatively small range of messages that are typical of in-game conversations in Shape Factory.

This new capability should open up possibilities including cross-cultural studies. We intend to recruit Israeli Arabs and Israeli Jews to play Shape Factory together in their native languages. Rather than allowing them to communicate in free text, (which could not be reliably translated in real-time anyway), subjects will use the same library of prewritten messages used by the agents. Thus, it will be relatively difficult to tell agents from humans. Agents with different affective styles can then be included into human experiments, ensuring consistent play across experiments and making trained confederates unnecessary.

This library of messages will be developed simultaneously in three languages (English, Arabic, and Hebrew). A validation study will be used to confirm that each message has equivalent meaning and emotional tone across the three languages. The development and validation of these messages is a considerable undertaking on its own, but if successful will open up a considerable range of future options for cross-cultural research.

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