

# CoFeel: Using Emotions for Social Interaction in Group Recommender Systems

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## ABSTRACT

Group and social recommender systems aim to suggest items of interest to a group or a community of people. One important issue in such environment is to understand each individual's preference and attitude within the group. Social and behavioral scientist have evidenced the role of emotions in group work and social communication. This paper aims to examine the role of emotion for social interaction in group recommenders. We implemented CoFeel, an interface that aims to provide emotional input in group recommenders. We further apply CoFeel in a GroupFun, a mobile group music recommender system. Results of an in-depth field study show that by exchanging feelings with other users, CoFeel motivates users to provide feedback on recommended items in a natural and enjoyable way. Results also show that emotions do serve as an effective and promising element to elicitate users' attitudes, and that they do have the potential to increase user engagement in a group. Based on suggestions collected from users, we propose other potential recommendation domains of CoFeel.

## Categories and Subject Descriptors

H.5.2 [Information Interfaces and Presentation]: User Interfaces –*Graphical user interfaces (GUI), User-centered design*. H.5.3 [Information Interfaces and Presentation]: Group and Organization Interfaces - *Organizational design, Web-based interaction*

## General Terms

Design, Human Factors

## Keywords

Group and Social Recommender Systems, Interface Design, Mobile Interface, Affective Interface, Emotional Feedback

## 1. INTRODUCTION

Nowadays, sharing, coordination, cooperation and communication among group members are becoming indispensable in online environment. Such groups can be constituted by families selecting a recipe together, colleagues working on same projects, and social club members planning a culture event. These are examples of small groups, normally less than hundreds of people. In group environment, group decision-making becomes a problem due to

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information overload. Group recommender systems (GRSs) aim to alleviate information overload by suggesting items to a group of people.

Group recommendation problem is not only “the sum of members” (Jameson, 2004). As the audiences move from individuals to groups of people, challenges arise such as aggregating preferences and arriving at equilibrium point of expectations. Picture yourself sitting together with your friends and selecting a music playlist for a birthday party. The selection process does not only depend on the verbal indication on preferences and choices, but also on various non-verbal channels such as individuals' emotion within the group. Social and behavioral scientists have long been studying the social role of emotion in group environment. Our goal is to set a basic understanding of using emotion for social interaction in group recommenders with a particular focus on the following two questions.

- 1) What are the roles of emotional information in group recommender systems?
- 2) How to design such interface that is useful, easy to use and playful?

To answer these questions, we introduce CoFeel, an affective interface that allows users to provide emotional input in recommender systems. We further implemented CoFeel in GroupFun, a mobile group music recommender system. The rest of the paper is organized as followed. Section 2 discusses existing work and how they related with our work, and particularly, why emotions play an important role in group and social environment. This is followed by design and usage of CoFeel interface in Section 3 and how to apply CoFeel in GroupFun in Section 4. After reporting the results of a small-scale qualitative user study in Section 5, this paper discusses further application scenarios in Section 6 and concludes with limitations and future work.

## 2. RELATED WORK

### 2.1 Social Interaction in Group Recommender Systems

Jameson studied some of the key user issues for group recommender systems (Jameson, 2004) and investigated several measures for promoting collaborating and coordination. These measures mainly aim at designing user interfaces to enhance mutual awareness. Mutual awareness in group recommender systems includes membership awareness, preference awareness and decision awareness.

Membership awareness allows users to check which users are in the group. Being aware of members in a group facilitates users to decide how to behave and thus enhances trust in a group

recommender (Yu, Zhou, Hao, & Gu, 2006).

Preference awareness enables users to be aware of the preferences of other members. A user study on PolyLens reveals that users would like to see each other's preference information, even at the expense of some degree of privacy loss. Preference awareness in group recommender systems are categorized into three levels: zero awareness, partial awareness and full awareness. Zero preference awareness means that users only know their own preferences, as shown in MusicFX (J. F. McCarthy, 1998a). Zero preference awareness systems are simple but do not inspire user trust. Partial awareness in group recommenders allows users to apply preference information from other group members (Kudenko, Bauer, & Dengler, 2003). However, it is prone to social loafing, a phenomenon when people contribute less in a social environment than when they work individually. In full preference awareness, users are aware of other members' preferences. One typical technique for is Collaborative Preference Specification (CPS) (Jameson, 2004), as presented in CATS, PocketRestaurantFinder (J. F. McCarthy, 1998b) and Travel Decision Forum. CPS in group recommender systems enables persuasion, supports preference explanation and justification and reduces conflict. Decision awareness is important in helping users arrive at a final decision. Decision awareness is a status in which users are aware of the decision making process of other members. Existing group recommender systems include the following decision making styles: (1) zero awareness - simply translating the most highly rated solution into action without the consent of any user (e.g. in MusicFX), (2) partial awareness - one or a selected set of representatives of the group are responsible for making the final decisions (e.g. INTRIGUE and PolyLens), and (3) full awareness - arriving at final decision through face-to-face discussions (e.g., CATS) or mediated discussions (e.g., MIAU (Kudenko et al., 2003) and Travel Decision Forum). However, none of the work addresses the role of emotion in decision-making or group interaction.

## 2.2 Interface in Group Recommender Systems

"Group interfaces differ from single-user interfaces in that they depict group activity and are controlled by multiple users rather than single user" (Ellis, J. Gibbs, & Rein, 1991). Therefore, interface adequacy has more requirements in group recommenders compared with individual recommenders. Flytrap (Crossen, Budzik, & Hammond, 2002) visualizes recommended items by using colors and locations. Songs personalized for different users are displayed with different colors, and the closer the songs are to the center, the more likely they will be played. PolyLens (Connor, Cosley, Konstan, & Riedl, 2001) supports three models of visualizing recommendation UI. Group-only interface only displays movies from group recommendation. Composite interface displays a list of recommended movies with both group and individual member predictions. Individual-focused interface shows the items for other individual users' preferences. CATS (K. McCarthy et al., 2006) offers users personal space and group space. In group space, each user has a snowflake with a different color and the size of snowflake indicates preferences of individual users. This allows users to check the interest of other users for a particular resort. Additionally, each icon presents a resort, and its size grows or shrinks in accordance with the preference of the whole group.

Travel Decision Forum (Taylor, Ardissono, Goy, & Petrone, 2003) introduces an animated character for each group member currently not available for communication. By responding with speech, facial expressions, and gesture to proposed solutions; a

representative conveys to the current online users some key aspects of its corresponding offline user's responses to a proposed solution. This is one of the few work that employs non-verbal channels in group environment.

## 2.3 Emotion in Recommender Systems

*Musicoverly*<sup>1</sup> and *Stereomood*<sup>2</sup> have developed an interactive interface for users to select music category based on their mood. *Musicoverly* classifies mood by two dimensions: dark-positive and energetic calm. It uses highly interactive interface for users to experience different emotion categories and their corresponding music. However, such recommender does not support interaction in social group environment. The main goal of studying recommender systems is to improve user satisfaction. However, satisfaction is a highly subjective metric. Masthoff and Gatt (Masthoff, 2005) have considered satisfaction as an affective state or mood based on the following aspects in socio- and psycho-theories: 1) mood impacts judgement; 2) retrospective feelings can differ from feelings experienced; 3) expectation can influence emotion and 4) emotions wear off over time. However, they did not propose any feasible methods to apply the above psychological theories. They also proved that in group recommender systems, members' emotion can be influenced by each other, and this phenomenon is called emotional contagion.

## 2.4 Emotions and Decision Making

Our everyday experiences leave little doubt that our emotions can influence decisions we make. For instance, experiment results (Raghuathan & Pham, 1999) showed that in gambling decisions, as well as job-selection decisions, sad individuals are biased in favor of high-risk and high-reward options, whereas anxious individuals are biased in favor of the opposite. On the other hand, (Isen, 2001) reveals evidence that in most circumstances, positive affect enhances problem solving and decision making, leading to cognitive processing that is not only flexible, innovative, but also thorough and efficient. (Schwarz, 2000) has addressed the influence of moods and emotions experienced at the time of decision making, affective consequences of decisions and the role of anticipated and remembered affect in decision making. (Bechara, 2004) further proves the influence of emotions on decision-making from neurology. (Velásquez, 1997) and (Gratch & Rey, 2000) also modeled emotion-based decision making.

## 2.5 Social Role of Emotions

(Keltner, 1999) integrate claims and findings concerning the social functions of emotions at the individual, dyadic, group, and cultural levels of analysis. On dyadic level (a group of two), emotional expressions help individuals know others' emotions, beliefs and intentions, and thus rapidly coordinating social interactions. Emotional communication also evokes complementary and reciprocal emotions in others that help individuals respond to significant social events. Emotions serve as incentives or deterrents for other individuals' social behavior. On group level, emotions have claimed to help individuals solve the problem of identifying group members. Displaying emotions may help individuals define and negotiate group-related roles and status. Collective emotional behavior may also help group members negotiate group-related problems. Study results from

<sup>1</sup> Musicoverly. <http://musicoverly.com/>

<sup>2</sup> Stereomood. <http://www.stereomood.com/>

(Ketelaar & Tung Au, 2003) are discussed in terms of an “affect-as-information” model, which suggests that non-cooperating individuals who experience the negative state associated with guilt in a social bargaining game may be using this feeling state as “information” about the future costs of pursuing an uncooperative strategy. (Bowles & Gintis, 2002) suggest that prosocial emotions, such as shame, guilt, (K. McCarthy et al., 2006)pride, regret, and joy, play a central role in sustaining cooperative relations, including successful transactions in the absence of complete contracting. (Hareli & Rafaeli, 2008) propose that organizational dyads and groups inhabit emotion cycles: emotions of an individual influence the emotions, thoughts and behaviors of others; others’ reactions can then influence their future interactions with the individual expressing the original emotion, as well as that individual’s future emotions and behaviors. (Barsade, 2001) proved that the leaders transfer their moods to group members and that leaders’ moods impact the effort and the coordination of groups. (Hancock et al., 2008) have investigated emotion contagion and proved that emotions can be sensed in text-based computer mediated communications.

### 3. CoFeel: Providing Emotional Input

#### 3.1 Design Goals

As the first step to investigate the social role of emotions, we design an interface that helps users to provide emotional input. Since this input is also users’ feedback, we cross-use “emotional input” in this paper. We refer to the guidelines for designing recommender systems, proposed by (Pu, Chen, & Hu, 2011). Designing CoFeel should meet the following design principles.

1. **Usefulness.** Users are able to provide emotional feedback using CoFeel.
2. **Ease to use.** Users find CoFeel easy to use and easy to learn.
3. **Playfulness.** Users find it fun, playful and entertaining to use CoFeel.

#### 3.2 What is it?

CoFeel aims to enhance group experience by enhancing self-presence and mutual awareness within a group. By exchanging feelings with other users, CoFeel aims to motivate users to provide feedback on recommended items in a natural and easy way. It is implemented as an infrastructure, which can be easily extended to various group recommendation domains.

We choose Geneva Emotion Wheel (GEW) introduced by Scherer (Scherer, 2005) for users to label emotions, i.e., attitude to recommended items, see Figure 1. Using GEW to label emotion has two advantages: natural tagging of discrete categorical words and the possible mapping of these labels to a two-dimensional space (valance-arousal). In each emotion, users can choose different sized circle. As such, users can assign different intensity values to the emotion they choose.

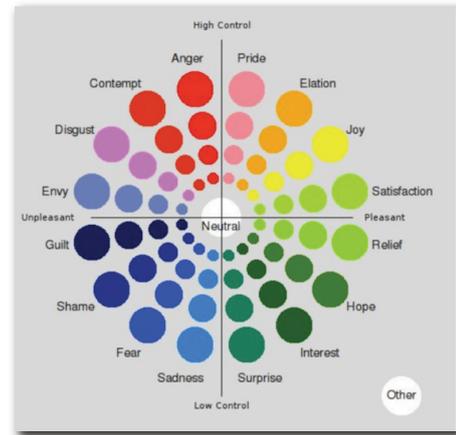


Figure 1. Geneva Emotion Wheel (Scherer, 2005)

We adopt Scherer’s color wheel style and choose 8 emotions for CoFeel Emotion Plate: excited, joyful, surprised, calm, sad, fear, distressed, aroused, as is shown in Figure 2. Each emotion class provides a scale from 1 to 5 indicating the intensity of the emotion. In order to enhance user engagement in interacting with the CoFeel, we design each emotional position as a hole and a ball is rolling on the surface of emotion plate. Users interact with the plate by placing the ball in the hole that corresponding to the emotional state. The aim of using the plate-hole-ball metaphor is to enhance user affordance to interact with the interface.

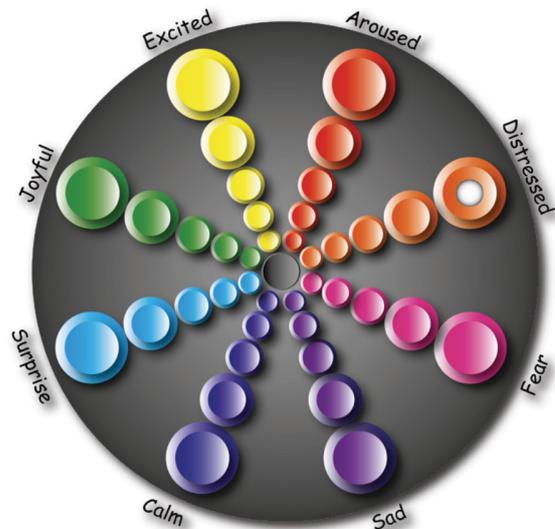


Figure 2. Interface of CoFeel Emotion Plate

#### 3.3 How to use it?

We implement CoFeel emotion plate on mobile phones. Since we have chosen the metaphor of a plate, it is natural that a ball can roll around the surface. Users can select the emotion, i.e., place the ball, by tilting the plate surface. Once users confirm an emotion, they can simply click a ‘track’ button, which is around the emotional plate, see Figure 3. The phone detects user movement and direction of surface plate using sensors on mobile phones, i.e., accelerometer and gyroscope. We designed this way in order to make the proces more fun and engaging. We have also

filtered out constant accelerometer data when users are walking, travelling and etc. In this way, users can input their emotion in a stable way.



Figure 3. Interacting with CoFeel Emotion Plate

## 4. PROTOTYPE

### 4.1 GroupFun: a music recommender system

In order to test the applicability of CoFeel, we implemented GroupFun, a mobile group music recommender system. Its function is to come up with common playlists for user created groups. Users can create groups and share their music taste with their group members by rating songs in GroupFun. When GroupFun generates a common playlist for a group, the criterion is to take into account the music taste of all of its contributing members. Figure 4 shows the group function of GroupFun. Users can use CoFeel for two purposes: 1) providing emotional feedback to a song and 2) leaving mood traces on the timeline of a song.

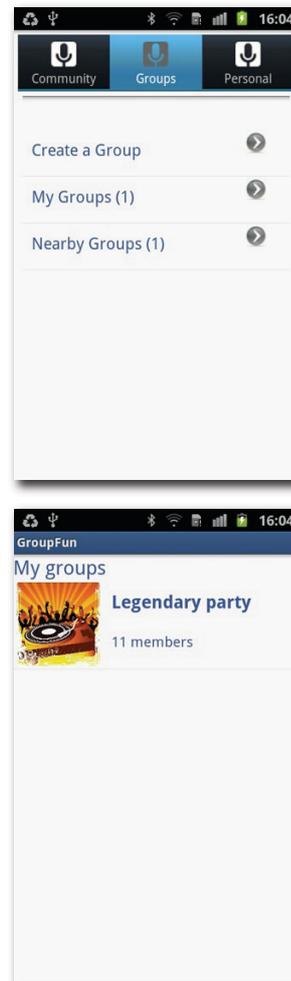


Figure 4. Group function of GroupFun

### 4.2 Providing Emotional Feedback to a Song

Emotional feedback can be used as an explanation interface for rating. Users can choose the emotion category and its intensity using CoFeel, see Figure 5. As we introduced in Section 3.3, users hold the phone and roll around the indicator ball around the surface of emotion plate, as is shown in Figure 6.

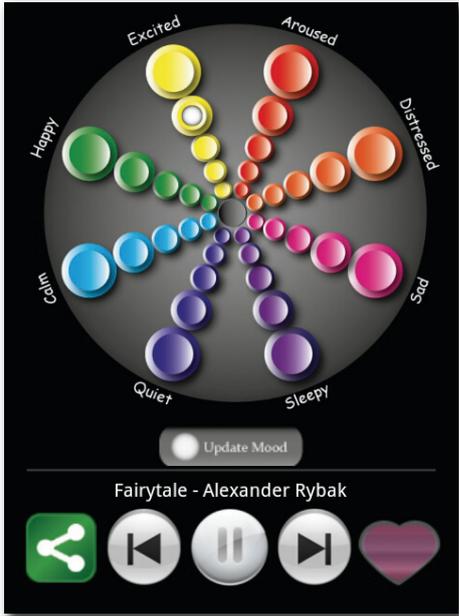


Figure 5. Providing emotional feedback to a whole song



Figure 6. Interacting with CoFeel in GroupFun

After selecting, emotional feedback is recorded with the song, as is shown in Figure 7. The color dots right to the title of a song indicates the type and intensity that users have chosen, which correspond to the colors in CoFeel. The intensity of emotions is visualized with transparency of circles. For example, the song 'We will rock you', is rated as an 'exciting' song, with the level of 3 out of 5.

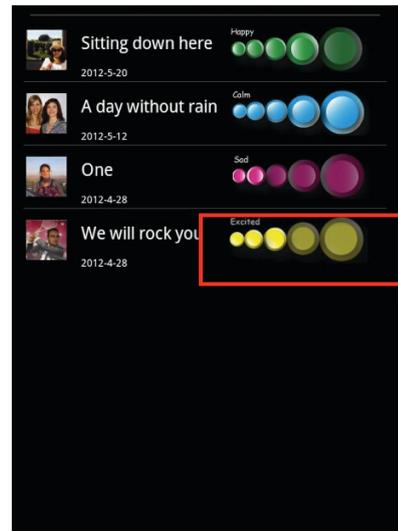


Figure 7. Visualizing friend's emotional feedback in GroupFun

### 4.3 Emotional Traces in Timeline of a Song

Users can also leave emotional traces throughout the timeline of a song. Figure 8 is an example way to visualize the traces as music score. User emotions are distinguished by different colors, corresponding with colors in CoFeel. Intensities of emotions correspond to the line. The position of dots in the lines represents the relative position of the moment when user leaves emotional comments. For example, a user is listening to "Paradise" from Coldplay. The last two red dots represent users' emotion towards the end of the song: aroused with different levels of intensities.

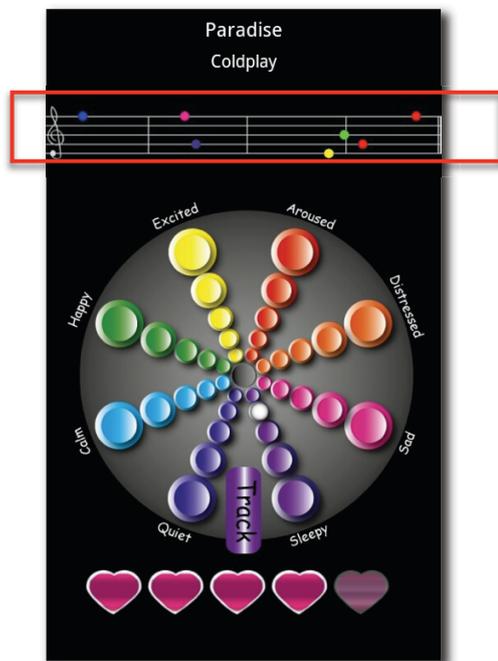


Figure 8. Leaving emotional comments in a timeline for a song

## 5. Experiment

### 5.1 Goals

To the best of our knowledge, our work is the first to propose providing emotional feedback in group recommender systems. Therefore, the main purpose of evaluation is not to prove its superiority to other means of feedback or replace them. Rather, we aim to understand users' opinions towards emotional feedback and the design of CoFeel interface, including their degree of acceptance and suggestions. To be more specific, we aim to investigate two research questions:

- 1) Is emotional feedback useful for social interaction in group recommender systems?
- 2) Has CoFeel successfully been designed as an effective and playful interface to provide emotional feedback?

### 5.2 Design and Procedure

In order to answer the above questions, we carried out a small-scale qualitative user experiment, with emphasis on learning from users through active listening, inspection and observation. In addition to normal users, we also showed GroupFun to domain experts. Based on the above two types of interviewed users, we divide the experiment to two steps.

#### Step 1: Evaluate with normal users

The goal of evaluate with normal users is to observe how they interact with CoFeel, particularly whether they have encountered any usability problems. However, we evaluate CoFeel interface using GroupFun, *without* explicitly telling users what we were evaluating and observing.

Four users participated in the experiment. Each user is distributed with an Android phone installed with GroupFun. Before experiment, we assigned each participant with a specific group with 11 members. The 11 members come from his/her Facebook friends. Each group is recommended with a music playlist. Since the accuracy of recommendation is out of scope of this paper, we use choose most popular songs, i.e., top 40 songs in the experiment week.

Before exposing users with application and systems, we ask the following questions to warm them up.

- 1) How often do you listen to music?
- 2) In which context do you listen to music?
- 3) Which kind of device do you use to listen to music?
- 4) What do you think about the relation between music and emotion?
- 5) Do you share music among friends?

During the experiment, the participants explore and experience GroupFun freely, with particular focus on CoFeel interface. We observe how they interact with GroupFun and CoFeel, the whole process of which is recorded. In the meantime, they can ask any questions and raise their concerns. After the experiment, we ask for users' comments.

#### Step 2: Interview domain expert

Different from experiment with normal users, the goal of interviewing domain experts is to understand the role of emotions in social and group environment and whether CoFeel contributes to this purpose. Additionally, the focus shifts from observation to listening for their feedback and suggestions. We invited a doctor

in the field of social psychiatry and interviewed them for feedback in emotional design. They first briefly play around with GroupFun and CoFeel then commented on the design from the theoretical function point of view.

## 5.3 Results

### Step 1: Evaluate with normal users

We summarize the demographic information as below in Table 1.

ID	User 1	User 2	User 3	User 4
Occupation	Student	Student	Student	Consultant
Gender	Male	Female	Male	Female
Age	22	26	25	32
Music exp. (App.)	>12 h/day	>8h/day	2 h/day	2-4 h/day
Devices for listening	Mobile phones and laptop	Computer, car, MP3 player	Computer	Mobile phones
Music context	Studying, designing, walking	Working, cooking, driving, before sleep	Relaxing	Travelling, meditation, music lessons
Sharing music with friends	Spotify, Facebook	Facebook, Twitter, Google +	Google+, Facebook, Email	CDs, DVDs

Table 2. Demographic information of interviewed users

From the interview process, we discovered some interesting phenomenon.

1. They hardly notice that music is more frequent in their life than their perception. When asked how often they listen to music, 3 out of the 4 interviewed users answered: not very often. However, when we ask them to recall the last song they listened to recently, they finally discover much more scenarios and time that they listen to music. This implies that users tend to use listening to music as background tasks.

2. The methods they listening to music tend to be mobile and pervasive. From user evaluation, we found that 3 out of 4 users listen to music on the go. Such mobile devices can be smart phones, mp3 players, laptops, in-car entertaining system and etc.

3. They choose music based on different context. When asked what types of music they listen to. Their answers usually start with "er", "well, depends...". Then they elaborate how they choose music in different contexts, e.g., studying, driving, cooking etc.

4. They are intrinsically willing to share music among friends. Surprisingly, all interviewed users share and discuss about songs among their friends. As one user mentioned, "I share a song with friends, either because I like it, or I think my friend may like it, or it include our shared memory, or it suits the current context."

We further observe users when they are playing around CoFeel emotion plate in GroupFun. Not surprisingly, we observed some common phenomenon during their interaction with system.

1. During the whole process they interact with GroupFun, they spend the majority of time exploring CoFeel, out of curiosity and fun.

2. The first time when they saw the interface, their mental model of choosing emotion is by clicking. After few seconds, they realized how the ball is moving.

3. They learnt to use CoFeel to keep track of their mood in very short time.

This implies that given the fact that CoFeel is a novel interface, users enjoy playing with it and can learn how to use it in short time.

After using interacting with the system, we further interviewed them for feedback on the design of CoFeel and its usage in GroupFun. We received both many encouraging and promising comments as well as suggestions.

Overall, users were excited to talk about CoFeel emotion plate. As users commented: “The plate reminded me of a game I played when I was young, very intuitive and entertaining.” “It is simply artistic and charming.” “I like the visual effect. It is beautiful”. From the received comments, users are generally impressed by the visual effect of CoFeel.

When asked whether CoFeel, i.e., emotional feedback, is useful in GroupFun, all of them agree it is useful. “It is interesting way to comment on a song.” “In this way, my friend understand why I like this song and I also know their styles and favorite songs better.” “I used the emotional re-tweeting function in one micro-blogging system, which is a fast and convenient way to express multi-dimensional meanings.” “Sometimes I don’t know how to express my feeling and comments for a song. They are abstract and I’m a person of few words. Emotional feedback looks like I’m choosing my comments from a set of words. It is a take-away style. Everything is predefined and very quick.”

At the mean time, they suggest further application scenarios for using CoFeel in social interaction. “It will be interesting to see a music messaging system where people communicate emotions via music.” “What about an interface for mixed emotions?” “Re-tweeting a song attached with emotions would be cool!”

From the qualitative analysis above, we conclude that CoFeel has fulfilled the goals we have set in Section 3.1: *usefulness, ease of use and playfulness*.

### Step 2: Interview domain expert

Furthermore, we interviewed a doctor in children and adolescent psychiatry. From mental health perspective, he pointed out that discussing with friends with/using music is also used to enhance people’s mental health. This process is called music therapy. Music and mood is by nature connected. Meanwhile, encouraging discussion about mood among a social group also brings benefit to enhance users’ mental state, under the condition that the process should be fun. This method is also known as social therapy. He also commented on GroupFun with CoFeel as followed. “Your software, I find it very interesting, especially the idea of self-regulation by the music and the group’s involvement even if it is a virtual interaction. In short, fun and social group, they are two very important elements, not just for people with depression, but also for everyone who is interested in this type of language. Every day, we all have moments of frustration and we all seek for self-solutions and be content with a group that gives us support and sense of belonging.”

From the interview results, we find that theoretically providing emotional feedback has a positive effect on encouraging group interaction and engagement. A further discovery is that social interaction that takes place within a group also enhances user mood and mental state.

## 5.4 Implications

We summarize the findings from the above user study about providing emotional feedback in group recommender systems.

1. Providing emotional feedback enhances **mutual awareness** of user preferences within a group. Users know the reasons their friends like a song.

2. A well-designed interface for emotional feedback offers social affordance and invites **users engagement** in the system. When users know the items their friends like and the reasons of liking, they are more likely to experience the recommended items, i.e., music. This encourages users to be more engaged in the system.

3. Social interaction in turn strengthens users’ sense of **social belonging** and enhances their emotional state.

## 6. LIMITATIONS AND DISCUSSIONS

This work has some limitations that we would like to continue in the future. First of all, CoFeel collects explicit emotions reported by users. Sometimes, users are not aware of their emotional attitude. Thus we also aim to consider users’ implicit emotional feedback. Additionally, the study is limited within individuals with manipulated friend groups instead of users within a group. Furthermore, as an in-depth qualitative user study, we only invited a few users and domain experts. In order to further validate our hypotheses, we need more groups and users and conduct larger scale user studies for quantitative analysis. It would also be interesting to let users use GroupFun with their friends in real life and observe their behavior and attitude.

Despite of the limitations, using emotions for social interaction implies a much broader usage context. CoFeel not only applies in music recommender systems but also various other domains. Based on feedback received from interviewed users, we propose the following example domains where emotional feedback can be useful: movies, tourists, product, hotels, food and etc. One thing in common in the above domain is the capability for the items to elicit emotions. This has been cross validated by social and behavioral scientists.

## 7. CONCLUSIONS

We hypothesize that using emotion to enhance social interaction in group recommenders. We have implemented CoFeel, with the goal of designing an interface that is easy to use and enjoyable for users to leave emotional attitude. We further applied CoFeel in GroupFun, a group music recommender system in mobile phones. CoFeel can be used in two modes in GroupFun: elicitation of emotional attitude towards a whole song or emotional traces in the timeline of a song. We then conducted an in-depth qualitative experiment with users, observing their interaction with GroupFun and CoFeel, followed by interviews with them. Besides normal users, we also showed our prototype to domain experts and received positive feedback from them, both theoretically and practically. Results show that providing emotional feedback not only enhances mutual awareness of user preferences, but also encourages social interaction. In essence, providing such social affordance using emotions in group environment in turn promotes users’ enthusiasm in interacting with system. Based on discussion with users, we are more convinced that emotional feedback, i.e., CoFeel, applies not only in music domain, but also in many others, such as travel, movie and product recommendations.

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