EVALUATING CONFLICT MANAGEMENT MECHANISMS FOR ONLINE SOCIAL JUKEBOXES

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ABSTRACT

Social music listening is a prevalent and often fruitful experience. Social jukeboxes are systems that enable social music listening with listeners collaboratively choosing the music to be played. Naturally, because music tastes are diverse, using social jukeboxes often involves conflicting interests. Because of that, virtually all social jukeboxes incorporate conflict management mechanisms. In contrast with their widespread use, however, little attention has been given to evaluating how different conflict management mechanisms function to preserve the positive experience of music listeners. This paper presents an experiment with three conflict management mechanisms and three groups of listeners. The mechanisms were chosen to represent those most commonly used in the state of the practice. Our study employs a mixed-methods approach to quantitatively analyze listeners' satisfaction and to examine their impressions and views on conflict, conflict management mechanisms, and social jukeboxing.

1. INTRODUCTION

The act of listening to music together is ubiquitous. In many situations, the choice of the music to be played for a group is done by an authority, such as a performer or a DJ; in other situations, groups rely on more democratic choices through social jukeboxes. Such devices have varying implementations in industry and have received attention from academia. In the latter, research has observed systems which arbitrate the selection of songs in gyms considering the musical tastes of those attending the gym [15], and systems that democratize the choice of music to be played in parties [10, 17], public spaces [16] and in cars [18]. In industry, Plug.DJ [3] (three million registered accounts), the recently shut down Soundrop [6] (peaked at nearly 49 thousand monthly active users) and the mobile applications Noispot [1], PlayMySong [2], Rockbot [5], and Secret.DJ [7] (all of them with more than ten thousand downloads on virtual stores) are some commercial systems that presently have a significant user base.

Because people are often affected by the music heard in an environment [11], sharing the choice of music to be heard may lead to pleasant or dissatisfying experiences. Indeed, in the presence of diverse musical tastes, it is likely that there will be conflicts in choosing music collectively. In the simplest case, one member of the group may like a genre or specific songs disliked by others. Even for participants that share similar tastes, one of them may be at a given moment interested in relaxing songs, while another participant is interested in increasing arousal. Tory et al. [10] and O'Hara et al. [16] have documented examples of such conflicts in the context of social jukeboxes.

To prevent that conflicts cause unpleasant experiences, it is central that social jukeboxes have mechanisms that manage such conflicts. Some of the aforementioned systems rely on voting to allow users to communicate their preferences. In part of these systems, this feedback also serves as an input to choose music based on the preference of the majority. However, in spite of the necessary and common use of conflict management mechanisms in social jukeboxes, there has been little or no comparative scientific evaluation of such mechanisms.

This work contributes to filling this gap by studying the use of three conflict management mechanisms in the same social jukeboxing system. The three mechanisms studied are present in multiple solutions in the state of the practice of social jukeboxes, and aim to represent significant points in the design space of conflict management mechanisms. Experiments were conducted with three user groups, each using the social jukebox in their natural settings. Our evaluation uses a mixed methods approach combining quantitative measures of user satisfaction and textured impressions stemming from semi-structured interviews in combination with observation reports and chat logs.

By analysing user satisfaction data, our results confirm that in spite of conceptual differences, the three conflict management mechanisms provide a significant gain in user satisfaction when compared to a baseline social jukebox with no mechanism. Moreover, the up/downvoting mechanism provides the highest satisfaction among the mechanisms we experiment with. A qualitative analysis of interviews, observation notes, and chat logs suggests that the effectiveness of voting is related to its interaction demands and the feedback it provides. Furthermore, analysing such data highlights other fonts of conflicts and opportunities for the design of new conflict management mechanisms.

2. ONLINE SOCIAL JUKEBOXES AND CONFLICT

Akin to the jukebox metaphor, in online social jukeboxes users add songs to a queue to be played. This choice of

songs is the primary source of conflict, as users may disagree on the best song to be played in a given moment. Examining the industry and social jukeboxes in the research literature, we identify three mechanisms most often used to manage conflict: *like/dislike* feedback, *up/down voting* of songs in a queue, and a *skip* feature. Like/dislike is present in all systems mentioned except Jukola, up/down voting is used in Soundrop, Noispot, Rockbot and Jukola, and skip is implemented in Plug.DJ, Noispot and Jukola.

These three conflict management mechanisms can be easily evidenced in the observed jukeboxes. Like/dislike feedback is comprised of messages from users about the song currently playing. As such, it does not directly or immediately affect the music playing; in the presence of conflict it only conveys to the person responsible for the song the desire that future choices are different. This is the less intrusive mechanism. Up/down voting, in turn, allows for the group to change the order of songs that will be played next. If users downvote a song, this both communicates their negative preference and delays the song start. This delaying represents a more intrusive approach to manage conflicts by avoiding songs that will not satisfy some participants. Finally, skipping gives the group means to directly interfere in a song that is presently playing.

Allowing users to express their appreciation for some content is a widespread feature in social media. Cheng et al. [13] have found that in large-scale systems, this type of mechanism can lead to significant changes in the author's future behaviour by attaching more quality to the content shared after negative feedback. The mechanism of affecting the next song to be played by up/down voting on the queue items is perhaps the most straightforward mechanism of democratizing music choice. It also resembles approaches applied in different settings such as social Q&A or media aggregating sites such as Reddit [4], where users are able to choose which shared content is going to be most evident in the website by up/down voting posts. The possibility of abruptly stopping a song execution through skip seems to be more specific of social music systems, but has been recognized as valuable to avoid mood-breaking songs [18] and to prevent frequent users from the frustration of hearing the same song multiple times [16].

It is worthwhile mentioning that although there are a number of conflict management mechanisms used in social jukebox systems, to the best of our knowledge there has been no experimental study that compares the effectiveness of conflict management mechanisms for these systems.

3. THREE CHOSEN MECHANISMS IN AN ONLINE JUKEBOX

Given the state of the practice observed in conflict management for social jukeboxes, we opted to experiment with the three mechanisms identified as most often employed: like/dislike feedback, up/down voting and skip. These mechanisms were implemented in a social jukebox developed by the authors and named WePlay, which has its basic interface shown in Figure 1.

WePlay allows for a group of users to synchronously listen to music coming from a shared queue of songs to which all can contribute. Each user can contribute as many songs as desired by searching these songs on YouTube and adding to a queue visible by all. The queue lists songs, but not the users who contributed the songs. Besides features available to the users, WePlay also allows an experimenter to alternate the conflict management mechanism exposed to users at will. The implementation of the three mechanisms is detailed next.

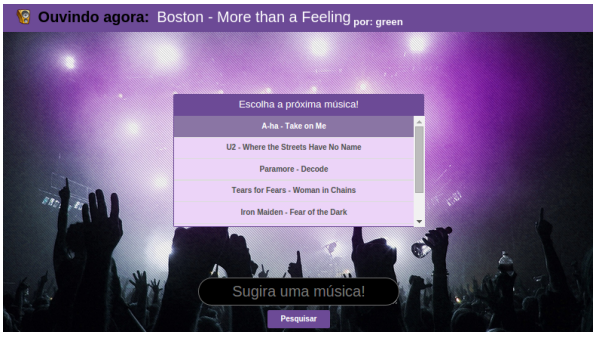

Figure 1. The interface of WePlay, the social jukebox system used in our experiments

3.1 Like/Dislike

Similarly to prevalent mechanisms in online social media, when this mechanism is available, users have access to like and dislike buttons next to the name of the song presently playing, as shown in Figure 2. Similar to the social jukebox systems we observed, this explicit feedback does not directly control which song will play next. Instead, it serves as a message to the user who queued the song stating how welcome that song has been considered by current listeners. In WePlay, only one immutable feedback may be provided per song. Moreover, the number of likes and dislikes is visible for all listeners, but no listener has access to the list of users who liked or disliked a song. Finally, when this mechanism is enabled, users are able to see a list of previously played songs and the feedback they received.

3.2 Up/down voting

By using the up/down voting mechanism in WePlay, users can vote up or down songs in the queue. Users can cast one vote per song, also immutable. After each vote, songs are ordered according to their balance, calculated as the difference between its positive and negative votes. The queue interface is depicted in Figure 3. Neither voters nor current balance are shown in the interface, but the highest-ranked song is always highlighted. In the event of a tie, the timestamp is considered the tiebreaker, awarding highest rank to the song first suggested to the system.

3.3 Skip

This mechanism allows the jukebox users to collectively skip the current song. If enough users manifest such will,

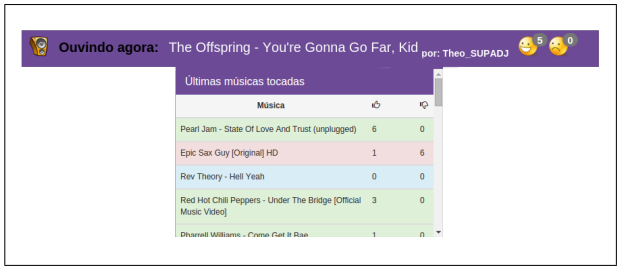

Figure 2. The like/dislike mechanism and the feedback history

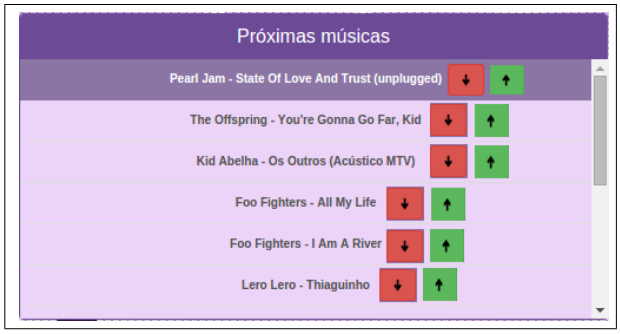

Figure 3. The up/downvoting mechanism

the song is then immediately skipped and the next song from the queue starts playing. To manifest opinions about the song, users can cast positive or negative votes about it. Considering the number of listeners n, the number of positive votes p, and the negative votes s, if the overall satisfaction $o = ((p-s)/n)+1$ of the current song reaches a value below the threshold of 0.5, the song is skipped, following the skip mechanism idealized heuristically by the original authors of a side project which was adapted to result in our WePlay and maintained due to the similarity of the original use of the system and our experimental scenario.

4. EXPERIMENTAL SETUP

Three different groups were recruited to participate in our experiments. Recruitment was done using the social network of authors, primarily targeting groups of potential users of an online social jukebox that would be available over multiple consecutive days for the experiments. Participants from the first two groups are undergraduate students, graduate students or researchers working in the same university as the authors, totalizing 18 participants (16 males and 2 females, average age 25.2). Participants in these groups are work colleagues who used the system during normal workdays, and were collocated in the same or adjacent rooms during the experiment. The third group is comprised by friends of one of the authors (10 males, average age 25) who have known each other for years, work in diverse fields, used the system during leisure time, and were located in different places in a common city. In all three groups, our goal is to study the use of the social jukebox system integrated in the subjects' routine, aiming at the ecological validity in social listening research suggested by North [9].

Each experiment lasted for the period of five days. All participants were submitted to a briefing explaining how the system would work and describing the experiment dynamics (e.g. what conflict management mechanisms would be enabled on each day). None of the participants was aware of the specific details of the research. All participants were informed that the goal of the experiment was to evaluate multiple designs of the social jukebox, and agreed to use the system for the duration of the experiment, and to have data collected during this time to be used in the research. In the week after each experiment, users were interviewed about their experience using semi-structured interviews. Four, seven and seven participants were interviewed respectively on groups one, two and three, totalling 18 interviews. Interviews lasted on average 15 minutes.

During the experiment, each group first interacted with the social jukebox using no conflict management mechanism in a situation we dub baseline. After the baseline, the other conflict resolution mechanisms were available one at a time and in the same order for all groups, for one complete day each. On the fifth day, all three mechanisms were available for participants, in a setting we call combined mechanisms. During the complete experiment, participants and the experimenter shared a text chat room using Google Hangouts. This communication channel was meant primarily for the experimenter to answer questions, but also hosted diverse conversations among participants during the experiments.

The social jukebox used in the experiments is instrumented to provide detailed usage information through logs. Furthermore, to gauge participant's overall satisfaction with the system, the jukebox asked participants to provide every 30 minutes their level of satisfaction through a 5-point likert scale in a form which asked users to explicitly state their *satisfaction with recently played songs*. Although the action of listening to music is often a background task and users could forget to answer this request, whenever a new request was made, participants were reminded to answer the from through the group chat.

5. CONFLICT SITUATIONS

As expected, the interviews and our observation of system usage revealed conflict situations. Overall, our data shows some conflicts related to a participant having an aversion to a song proposed by another participant. Such aversion may be related to one's musical identity [8] (*Everytime she suggested I immediately voted negative, because of her musical taste* [1]) and were perceived to affect satisfaction (*There was a moment when I felt upset about the songs. They were putting some songs like funk, and I don't really like funk. But it was a radio, and it was in a democracy style, so I had to listen to that.* or *In some moments I was very dissatisfied. There were some songs I cannot stand... Some musical styles.*).

[1] Quotes from the interviews are presented henceforth in italics and parenthesis. All quotes were translated from Portuguese to English by the authors.

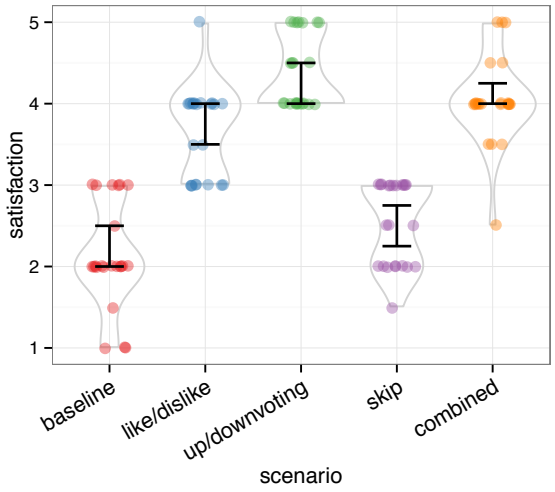

Figure 4. Distribution of median satisfaction reported by users in each of the scenarios. The violin glyphs encode density. Error bars represent 95% confidence intervals for the *medians*. In comparing the intervals, one should take into account that samples are paired; this pairing results in, up/down voting having a significantly higher median satisfaction than the combined scenario, and in skip significantly outperforming the baseline.

A second and minor source of conflict relevant to the mechanisms we experimented with is related to gaming the mechanisms and trolling. Participants reported their tendency to game the voting mechanism, and trolling behavior by users.

6. CONFLICT MANAGEMENT AND USER SATISFACTION

Our quantitative data contains multiple satisfaction ratings for each participant in each of the five different designs: baseline, like/dislike, up/downvoting, skip, and all mechanisms. In the following, each participant's satisfaction is summarized as the median of the ratings provided in each design.

Albeit conceptually categorical, likert scales data in the form employed in our experiment can be reliably used in numerical statistical tests [14, 19]. A normality test however points that the satisfaction data is not normal, (Shapiro-Wilk test, $p < .01$ for all five scenarios). This observation combined with the sample size ($N < 30$ for all samples) leads us to use non-parametric tests to compare participant satisfactions.

Participants' satisfaction and the 95% confidence interval for the median satisfaction across participants are shown in Figure 4. It is readily apparent that like/dislike, up/downvoting, and the combine mechanisms all lead to significantly higher user satisfaction than the baseline system. A rank-sum comparison using Mann-Whitney paired one-tailed tests reveals that all mechanisms provide significantly higher satisfaction than the baseline ($p < .02$ for all designs. Like/dislike: $V = 276$, up/downvoting: $V = 276$, skip: $V = 117.5$).

Comparing the mechanisms among themselves, we see that up/down voting has at the same time the highest median satisfaction and the smallest dispersion in satisfaction values. The overall higher satisfaction of participants when using the voting mechanism is also confirmed by a rank-sum comparison with the combined scenario (Mann-Whitney paired one-tailed, $p = .02$, $V = 75$). Since the participants in group 3 had different backgrounds to those in the other two groups, the previous statistical tests were repeated withholding data pertaining to group 3, The results of this test have similar outcomes.

Next to up/down voting, the combination of mechanisms resulted in the second highest satisfaction scores. This may reflect the availability of the high-performing up/down voting mechanism in the combination. The second best performing sole mechanism is like/dislike. The mechanism that provided the smallest increase in satisfaction in our experiments was skipping.

Finally, Figure 5 compares satisfactions reported by participants in the different groups. The general pattern is the same for all three groups. This is so in spite of the relatively different context in which group 3 used the system.

Together, our quantitative results suggest that the best strategy for a designer considering implementing a conflict management mechanism in a social jukebox system is to focus on up/down voting. In the next section we elaborate on the reasons behind participants' preferences, and on other relevant episodes in the experiments.

7. IMPRESSIONS ABOUT CONFLICT MANAGEMENT

Besides the quantitative data, we now turn to analyze collected interviews, observations taken by the experimenters, and chat history among participants. The qualitative data was explored using Grounded Theory [12] methods for coding and categorizing quotes, and to analyse the emergent themes.

7.1 Mechanisms' effectiveness

An overall positive effect of the conflict management mechanisms reported by users is the possibility of communicating of one's identity and preferences to negotiate a common ground and reduce conflict (... *and I found it very interesting the little window on the bottom of the screen where we could see our latest ratings. It's useful when you're choosing your next song and you don't want to pick a song nobody likes*).

Focusing on up/down voting, this mechanism seems to offer a particularly convenient trade-off between expressing preferences on multiple songs and having to often interrupt other tasks to use the social jukebox (... *and I also thought the songs list* [with the up/ down votes] *very interesting because we could express our opinions and go back to our main activities, avoiding to open the system all the time, focusing on our jobs and still making our voices*

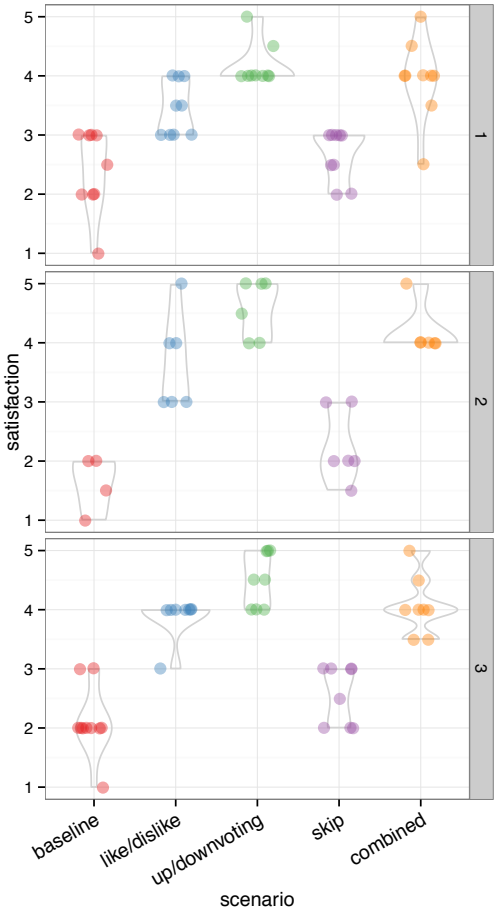

Figure 5. Distribution of median satisfaction reported by users in each of the scenarios, with users divided in the three experimental groups.

active inside the system). Both like/dislike and skip must be performed on a song while it was playing, and thus required more frequent interaction with the system (*I used [the like/dislike feature] on almost all songs, except when I was really busy with work*).

In our experiments, positive feedback was seen as more usual, and negative feedback as related to more extreme cases (*I only used the dislike feature when a song was a really really bad choice or if the other guy was clearly trolling*), or to constantly send explicit messages to users with mismatched musical tastes about the incoherence of their choices (*There's no significant difference between my positive and negative voting, I guess, except that when [a participant's name] suggested. Then I always voted negative due to her musical taste*).

The skip feature as implemented in our experiments had a major limitation related to presence. Our system accounted for listeners as active if they are logged in, and demanded that a proportion of active listeners voted for skipping to actually skip the song. Because music listening was a background activity, and participants interleaved this activity with attention to other tasks or even being temporarily physically away from the computer, there were often insufficient votes for skipping (*It was hard to see the skip feature happening. It barely happened, and in a rare moment when [the song] was skipped I think it only happened because that song had a really big rejection* or *Although I think the skip is a great idea it almost didn't happened, and when it happened I thought it was because our room wasn't full yet and a few negative feedbacks were enough to skip the song, which sadly came to be a song of mine...*).

7.2 Gaming and trolling

Gaming conflict resolution and trolling are two often reported phenomena in online communities. In our experiments, both behaviours happened and were commented on during interviews. For example, one participant reported strategies for imposing their choices on the group: *There were several times when I tried to downvote all songs except mine's, so I could just upvote any of my songs and place them at the top, playing it before the other's choices. It didn't succeed because the guys discovered my strategy and started to downvote my songs. I tried also to dislike all the other's songs, hoping that the system skipped those, but that didn't happen*.

On a different occasion, because participants were mostly friends, there were participants who posted nonsense songs or repeatedly posted a song related to some meme as a joke with the group. Although subverting the rules and joking may reinforce social ties, in our experiments it had detrimental effects (*There was a time when we had a song related to a viral, and because of that the song got repeated over and over again, so as I couldn't handle it I took my earphone off and put it on a little later to hear some new songs, if that was the case.*). Another user clearly stated he was motivated by jokingly annoying others (*It was my fuel. When it annoyed people, I'd put the song again*).

7.3 Design Suggestions

After being exposed to four situations in conflict management, participants were also asked about their views about the design space of social jukeboxes.

A participant suggested that more mechanisms to communicate musical identity may be of use, and that perhaps allowing one to specify such identity explicitly could contribute to reduce conflict by enabling semi-automatic song choice (*I think a good way [to increase conflict management] is to allow user profiling, something like: an user has three musical preferences, so when he starts using the system he could be asked to fill a form stating those three choices, and after that the system could check who is online and select the next song according to the intersection of musical tastes*).

Further room to increase the convenience of expressing preferences in the system when music is a background task was also mentioned. A participant suggested the use of smartphones for enabling interaction in such cases (*It would be great if we have a tool to facilitate the voting process, because we can only vote at the web page, and*

sometimes we are [on our desk but] *not using our PC but we keep listening the songs, so if we could, for example, vote in a song using our smartphone that could make the democratic process even better*).

A more challenging suggestion to experiment with that was mentioned by multiple participants is the possibility of punishing users perceived as trolls (*It came to a point when I had enough of [another participant's name]'s songs. I really wish he was unable to suggest songs, so the system could at least enable the chance of banning a song which received too much negative votes, but actually I think it would be even greater if we could "mute" a specific user, removing the access to the features and only allowing him to listen the songs suggested by the others*).

8. IMPLICATIONS FOR DESIGN

Our experiment evaluates three commonly used conflict management mechanisms in online social jukeboxes. Together, the quantitative and qualitative results point for multiple implications for designers of social jukeboxes.

In our experience, conflicts were relatively easy to reproduce. Participants of all of our experiments were already friends or colleagues, and had multiple communication channels besides the social jukebox. Yet, conflicts related to incompatibility in music tastes and different intentions in listening to music on a given moment were reported to influence satisfaction with the music listening experience.

Quantitatively, all three conflict management mechanisms led to significant improvements in user satisfaction with the music played in the experiments. It is also notable that the mechanisms provided such increase in the presence of conversations both face-to-face and through online chat to manage the same conflicts. This result suggests that simple mechanisms effectively complement more textured social interactions to negotiate this type of conflict.

Comparing mechanisms, our results point that up/down voting songs on the queue leads to the highest overall user satisfaction. Both the median and minimum satisfaction of participants were the highest with this mechanism. A qualitative analysis points that up and downvoting seems to be on a sweet spot of the design space as it allows for conveniently sparse batch interactions with the system, combined with an informative log of past song evaluations. These results, together with the ease of implementing up and down voting recommends that present designers consider this mechanism. Moreover, it suggests that conflict resolution mechanisms for background music listening take into account the frequency of interaction with the system.

With respect to the log of past evaluations, our analysis suggests it has a constructive role in preventing conflicts. Our experiment does not allow for isolating its effect, but suggests this and other mechanisms that allow users or the group to express their taste are likely to contribute to conflict management. Indeed, this direction is similar to the common behaviour of stating group norms explicitly in many online communities.

Other relevant aspects that arose in our analyses were the limited effect of the skip mechanisms and the presence of gaming and trolling. The former is chiefly related to difficulties in detecting and communicating user presence while music was a background task. As a result, the system perceived too many users as active, and participants felt that voting for skipping was not effective. Detecting which users are presently interacting with the system and devising a skipping policy more easily understandable may lead to different results, and our mechanism allow limited conclusions in this perspective.

With respect to gaming and trolling, our experiments highlight that these phenomena happen in social music listening even for small-scale scenarios. From our observations, the mechanisms we experimented with were robust to gaming. Trolling in our setting was related to jokes from a user that reduced the satisfaction of others – which nevertheless were reported as trolling in the interviews. The interviews suggest that mechanisms to regulate such behaviours may contribute to the success of online social jukeboxes.

9. LIMITATIONS AND FUTURE WORK

This work contributes preliminary findings to an understanding of the effectiveness of multiple points in the design space of conflict management mechanisms for online social jukeboxes. In doing so, it has a number of limitations and leaves open questions for future work.

An issue that markedly limits the generalizability of our findings is related to the characteristics of our sample of users. All participants where already acquainted, and by and large male. Replicating our experiment with more groups with different compositions is a direct and necessary extension of this work. This is necessary to examine the degree to which the context, closeness, and size of the group affect our results. Moreover, understanding whether and how direct conversation interferes with conflict management also seems like a promising avenue of research.

Another point that demands further study is the analysis of other policies for each of the mechanisms examined here. Other policies for consolidating votes, skip requests, and like and dislike feedback may be more suitable for certain contexts. Also, experimenting with other policies for skipping seems particularly relevant, given the feedback from the participants in our experiments.

Finally, our experience highlights and commends for future work the benefits of conducting similar research in a naturalistic setting. Observing participants use the system in their normal routine, and participating in social listening with colleagues and friends helped unveil a number of relevant observations in our research.

10. ACKNOWLEDGEMENTS

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