Mutual Engagement in Social Music Making

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Abstract. Mutual engagement occurs when people creatively spark together. In this paper we suggest that mutual engagement is key to creating new forms of multi-user social music systems which will capture the public's heart and imagination. We propose a number of design features which support mutual engagement, and a set of techniques for evaluating mutual engagement by examining the minutiae of inter-person communication. We illustrate these techniques through their use in empirical studies, and their use as part of artistic practice to design and evaluate new forms of collaborative music making.

Keywords. Design, Evaluation, Mutual Engagement, Multi-User, Social Interaction, Human Communication.

1 Introduction

Is music dead? Whilst figures in the commercial music industry bemoan the loss of sense of purpose in contemporary music and the role of the Internet in sidelining music as a political force [9], we contend that new technologies hold the key to reinvigorating music's social role. We accept that music has dropped away from being a driving force behind communication technology innovation, losing out to text based networks such as *Twitter* and *Facebook*, and argue that what is needed are innovative and engaging ways for people to make, share, enjoy, and experience music within the context of the modern, connected, real-time world we live in. To this end, we are exploring ways to understand the role of audio in multi-person interactions from interactive art, music, and performance through to workplace collaborations. We believe that the key to success in this venture will be designing new multi-person audio experiences which are informed by understandings of human communication, and which exploit the unique opportunities offered by new technologies rather than mimicking existing ways of interacting. In short, music *is* dead, long live music!

In this paper we outline our approach to understanding *mutual engagement* in multi-person music making. We first describe a set of design features which we believe will increase mutual engagement in multi-user systems and social music

experiences. We then present a set of techniques for identifying mutual engagement in music making by examining the minutiae of the social interaction between participants. Finally we present a few illustrative descriptions of multi-person mutually engaging systems we have designed, built, and evaluated.

2 Mutual Engagement

Sadly, in interface design, sound has primarily been limited to providing alert cues, or ongoing background awareness in collaborative work situations cf. [1]. Even in the field of New Interfaces for Musical Expression, the evaluation of audio centric interfaces tends to focus on work and parameter manipulation tasks cf. [19] rather than examining the nature of collaborative audio creativity cf. [2] and how these interfaces could support a creative and engaging experience [8]. To address this, we explore the concept of *mutual engagement* – points at which people creatively spark together and enter a state of group flow [5] – and examine how different user interfaces features affect people's levels of mutual engagement. In this way we hope to identify and develop more socially engaging musical experiences which will return music to the core of human experience. The key distinguishing characteristic of mutual engagement is: "it involves engagement with both the products of an activity and with the others who are contributing to those products" [ibid]. These points of mutual engagement are essentially points of group *flow* cf. [7], similar in context to Sawyer's ethnographic descriptions of group flow [16], but we are interested in understanding the minutiae of the group interaction in order to inform design of engaging collaborative systems. In order to achieve this, Bryan-Kinns and Hamilton [5] drew on models of human communication e.g. [6] and CSCW research e.g. [10] to develop a set of design criteria and evaluation measures for mutual engagement which are outlined in the next section.

2.1 Design Features

We have identified a number of design features [5][3] which we believe are important to supporting mutually engaging interaction:

- **Mutual awareness of action** - highlighting new contributions to the joint product, and indicating authorship has been shown to increase mutual engagement.
- **Annotation** - being able to communicate in and around a shared product, and being able to refer to parts of the product helps participants engage with each other.
- **Shared and consistent representations** - participants find it easier to understand the state of the joint product, and the effect of their own and others' contributions when the representations are shared and consistent.
- **Mutual modifiability** - editing each others' contributions increases engagement with each others' product, and the activity becomes more egalitarian.
- **Spatial organization** – allowing participants to layout elements of the joint product in space increases mutual engagement by supporting fluid and improvised privacy and grouping.

The design question then becomes: How are these features used to inform design, especially in audio-only interfaces. Interestingly, in recent studies we found that implementing all the design features could actually reduce mutual engagement, possibly due to cognitive overload.

2.2 Evaluation Techniques

Through our studies we have iteratively refined a set of measures of mutual engagement based on analysis of patterns of participants' interaction, and a robust Mutual Engagement Questionnaire (MEQ) which can be used to compare different interfaces. These measures and questionnaires are suitably generic to be usable across different social music interfaces. Our measures of mutual engagement include:

- Number of **contributions**, **edits**, and **deletions** – excessive numbers of contributions in the music domain actually indicates low levels of mutual engagement between participants.
- Amount of **co-editing** (i.e. editing each others' contributions) – increased co-editing indicates increased mutual engagement.
- Spatial **colocation** – working together in the same part of a virtual space indicates mutual engagement.
- Evidence of **convergence of musical ideas** (i.e. alignment and repetition of musical motifs) indicates mutual engagement.

Measures of musical convergence between participants are problematic. We are currently investigating techniques to reliably identify convergence of musical ideas in social music making including using Music Information Retrieval techniques such as edit-distance and sub-sequence sampling cf. [13]. We believe that although these techniques focus on monophonic sources [11], they could have significant utility in understanding social music interaction in general.

In contrast, our Mutual Engagement Questionnaire (MEQ) is used to compare two or more user interfaces. In this approach participants use a number of user interfaces and then complete the MEQ of twelve questions from four categories (not conveyed to participants): Satisfaction with the product, Feelings of enjoyment or flow cf. [7], Sense of collaboration, and Usability. The comparative nature of the MEQ forces participants into making explicit distinctions between interfaces. Our MEQ would be suitable for comparing different social music interfaces and experiences, and would provide a good indicator of participants' preferences.

3 Explorations of Multi-Person Musical Experiences

We have been exploring mutual engagement in social music through a series of studies from interactive art through to group music composition. The main vehicle for this work has been a series of studies of distributed music making applications referred to as Daisyphone [3] and Daisyfield (forthcoming). We will follow discussion of these systems with a brief description of other multi-person social music systems we have been experimenting with.

3.1 Daisyphone and Daisyfield

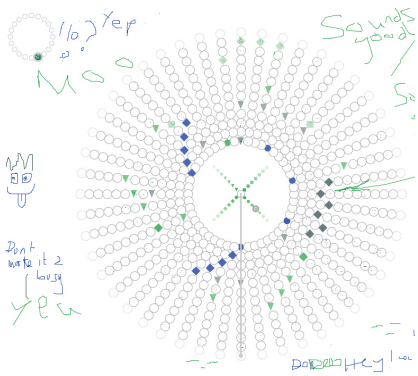

Figure 1. Daisyphone in use

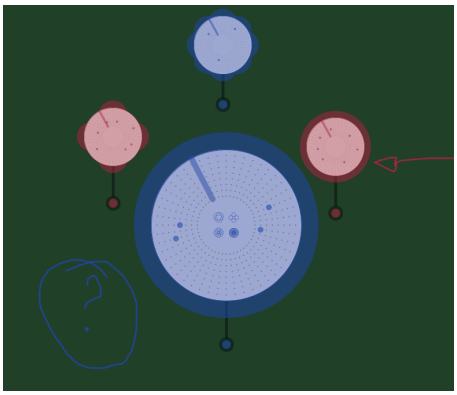

Figure 2. Daisyfield in use

Daisyphone (figure 1) and Daisyfield (figure 2) share a common underlying distributed, client-server architecture, which allows multiple participants to co-create short loops of music (1 minute) without being in the same physical space. At the heart of the user experience are loops which are shared between participants and can be co-edited at will (there are no ownership controls). Loops are represented as Daisys with the notes of the loop laid out in a circular fashion. Daisyphone provides one shared loop, Daisyfield supports up to 12 shared loops, each represented as a separate Daisy arranged across the shared space. Indeed, Daisyfield is a development of Daisyphone which draws on our studies of naturalistic music improvisation [12] and composition [15]. In keeping with our design features, mutual awareness of action is supported by each participant having a unique colour in the interface, annotation is supported through free graphic drawing, and the whole interface is shared consistently between participants. Lowest notes are on the outsides of Daisys, and highest towards the centre (Persian scale of electro-acoustic sounds). The four shapes in the centre of each Daisy allow for selection of different sounds.

Using Daisyphone and Daisyfield we have explored the role of mutual awareness, persistence of musical contributions, graphical annotations, localization of sounds, and spatial arrangements. We have also used them to revise and validate our MEQ. Both systems have a set of features which make them particularly amenable to automated analysis of musical convergence: notes are played at a constant speed, and each note has the same duration. However, the interfaces allow several notes to be played at the same time which increases the complexity of applying pattern matching techniques. We shall be exploring these issues in ongoing research.

3.2 Beyond the Graphical User Interface

Whilst Daisyphone and Daisyfield are unashamedly Graphical User Interfaces, we have also been exploring the mutual engagement in musical user interfaces which are

not visually oriented. For instance, Stowell et al. [18] showed how rigorous HCI approaches could be used to evaluate people's engagement with and through musical interfaces – a novel beat-boxing synthesizer was evaluated using Discourse Analysis, and a live beat-tracking system was evaluated using a version of the classic Turing Test. Both of these approaches provide some insight into the mutual engagement participants enjoyed whilst interacting with these musical experiences, and could be used to further validate and refine our measures and design features.

We have also used our design features to inform the design of interactive art pieces for performance and guerilla interventions. For instance, the *Serendiptichord* [14] is a wearable musical instrument whose design considers exploration of musical space, and the engagement of performer with instruments and audience. Similarly, *uPoi* [17] is a guerilla multi-person interactive audiovisual experience intended to entice and engage participants with each other in unexpected and unusual situations. In both examples, mutual engagement design features were used to inform the creative process of envisioning and realizing the pieces in order to move them beyond responsive interaction, and instead focus on the engagement *between* participants.

In contrast to music *making*, we have developed multi-user systems which focus on music *experiencing*. One of our systems, Sensory Threads [4], is a multi-person mobile experience in which participants sense imperceptible phenomena around them through a responsive real-time soundscape. Groups of four participants wear sensors whose data streams are used as input to an interactive soundscape which participants listen to as they move around a city. We used our ideas of mutual engagement to inform the design of the soundscape, ensuring that it conveyed the identity of participants clearly, and that there was clear auditory and spatial separation between sounds in the emergent virtual space. An interesting issue that arose with this design was the problem of listener fatigue with long (up to an hour) immersive audio experiences.

4 Summary

In this paper we presented our view on mutual engagement as the key to successful multi-person music making. We presented a set of design features and methods of evaluation which we feel could help inform the understanding of social behavior in music, and help to design more mutually engaging musical experiences. Ultimately, we believe that creating musical experiences which are engaging in new and radical ways will help to revive music's place at the heart of our societies, and in order to do this we need to understand the minutiae of the human interaction that comes together in mutual engagement.

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