Mutual Engagement in Collaboration

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Abstract

Our position is that creative collaboration is characterized by points of mutual engagement between participants. In this paper we outline our concept of mutual engagement, propose design features to support it, and describe a novel interface designed to support mutually engaging remote group music interaction.

Keywords

Mutual engagement, design, novel interfaces

ACM Classification Keywords

H.5.3 Group and Organization Interfaces; H.5.2 User Interfaces: Theory and methods.

Introduction

Our view on the workshop theme is that in order to design artifacts to support creative engagement we need to understand the points at which collaborators *mutually engage* with each other. We propose that these are the points at which people spark together, lose themselves in their joint action, and arrive together at a point of co-action 'where you are when you don't know where you are' [5]. It is our position that in order to identify these points we need to examine the communication between participants rather than constructing cognitive models of their intentions. The key question we are interested in is how

mutual engagement can be supported when collaborators are not located in the same physical space. We explore this question by examining behavior in group music interaction; a key exemplar of an activity which relies on mutual engagement to succeed.

Mutual Engagement

In mutual engagement participants are engaged with both the product at hand and with others in the collaboration, which we could characterize as group flow [2] cf. [3]. Whereas Sawyer's work focuses on ethnomethodological exploration of the group flow evident in interaction, we focus on identifying and manipulating key attributes of artifacts which have an effect on participants' ability to mutually engage with each remotely other through technology. Our position is that mutual engagement is essential to high quality collaboration which constitutes interaction beyond routine tasks or transactions. For example, collaborative design, improvisation, brainstorming, gossip and gaming all involve much high levels of mutual engagement.

Identifying Mutual Engagement

Points of mutual engagement are inherently difficult to identify and measure as the act of reflecting on mutual-engagement undermines some of the characteristic qualities of the experience such as spontaneity. We propose examining the forms of interaction that take place between participants which reduces the reliance on subjective, introspective assessment of participants' feeling state. We propose 4 key aspects of interaction as being useful in identifying points of mutual engagement as outlined in the rest of this section. We have used these features in analysis of naturalistic group music interaction (free improvisation by 7 musicians over three one hour sessions), as well as understanding mutual engagement in technologically mediated interaction as discussed later.

I. The use of physical orientation to maintain a shared interaction space which is used to provide opportunities to signal moments of (dis)engagement with the collaborative activity, and informs the social management of the interaction.

II. The turnover of ideas as indicated by the presentation and acceptance of contributions. This also relates to the participant structure of the performance e.g. who leads, who follows, and how the turnover of ideas is organized. In addition, increased mutual engagement is indicated by increased modification of each others' contributions to the joint production.

III. The use of anticipatory information to manage the temporal structure of the interaction, including the positioning and employment of physical artifacts such as musical instruments, narrative expectation, and the role of editing gestures.

IV. Evidence of *attunement* cf. [4] between participants – where participants respond not only to others' major contributions, but also in a moment-by-moment way to smaller changes. We focus on three levels of attunement: **Acknowledgement** – participants show that they are aware of the contributions of another; **Mirroring** – participants mirror, or reflect, others' contributions thus demonstrating that they themselves are able to produce it; **Transformation** – participants transform each others' contributions, indicating a high level of mutual engagement

Designing for Mutual Engagement

We have identified four design features which we believe contribute to the support of mutually engaging collaborations: **Localization** within the artifact being co-produced; **Mutual awareness** of actions; **Shared and consistent** representations; **Mutual modifiability** of contributions. In order to explore the effect these user interface features have on mutual engagement we used them in the development of a novel collaborative music tool – Daisyphone [1]. Daisyphone is a remote collaborative music environment in which up to 10 remote participants can create and edit a short shared loop of music semi-synchronously. All participants see the same joint product, so providing a *shared and consistent* representation of the joint product. Participants can edit each others' notes and play the same instruments which meets the design feature of *mutual modifiability*. As well as sharing musical contributions, Daisyphone also allows the sharing of graphical annotations on and around the music composition space which provides a form of *localization* within the artifact.

The Daisyphone user interface is illustrated in figure 1. Notes are lower in pitch towards the edge of the circle. As the grey arm rotates clockwise, the notes underneath are played, so each of the spokes represents notes played at the same time. Hues of notes indicate who contributed them (this provides *mutual awareness* of actions), and intensity of color represents the volume of the note. Different shapes represent different instruments including piano (circle), and percussion (diamond). Volume and instrument are modally controlled from the four central spokes.
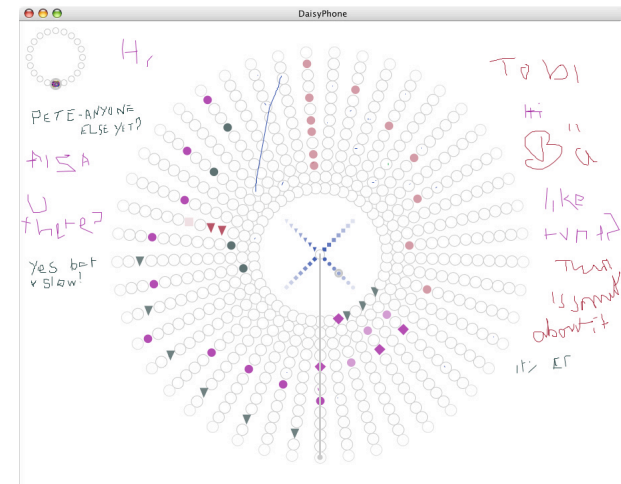

figure 1. The Daisyphone user interface

Studies

We have studied the use of Daisyphone in a number of situations and configurations from public use on the web since its launch on 25 Oct 2003[1] to observational studies involving a range of participants, and recent experimental studies of the effect user interface features have on mutual engagement. We have recently started development of a version for mobile handsets, and a richer version for tablet PCs informed.

Analytic Scheme

In order to identify points and patterns of mutual engagement evident in mutually engaging interaction we developed a coding scheme which operationalizes the 4 key aspects of interaction outlined at the start of

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[1] http://gouda.dcs.qmul.ac.uk

this paper. The scheme is split into four stages which build on each other to move from coding specific contributions to understanding the interaction as a whole. The lower levels of the coding scheme are more domain dependent than the higher levels. As such we believe that the scheme is applicable in other domains if lower levels are replaced by domain specific views such as coding graphical contributions when examining the interaction in shared whiteboard environments.

The basic level of analysis is identification of **contributions** – in this case notes. Then we move on to identifying **units**, or musical phrases using 4 indicators: 1) notes occurring within the same spatial location (this relates to *physical orientation*); 2) notes occurring within the same short timeframe; 3) notes contributed with the same instrument; 4) evidence of similar visual or auditory patterns. These are then categorized and assigned a **type** based on whether they involve melodic or percussive instruments, and whether they involve apparently random contributions or contributions with music or visual intention. Finally we draw **relationships** between pairs of phrases such as whether there is evidence of *attunement* between participants as indicated by transformations of phrases etc. Moreover, patterns of relationships indicate forms of interaction such the use of *anticipatory information*, turn-taking and the *presentation and acceptance* of contributions.

We have used this scheme to analyze the use of Daisyphone with several combinations of interface features. Results from longitudinal studies indicate that providing text chat and graphical annotation often distracted collaborators from their joint action and reduced their mutual engagement.

Summary
Our position is that analysis of the communication between participants allows us to identify, and design for, mutual engagement. Future work will focus on developing interfaces with features such as richer spatial positioning and orientation in order to further explore our proposed characteristics of mutually engaging collaborations.

Acknowledgements

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