

# Inter-Play: Understanding Group Music Improvisation as a Form of Everyday Interaction

Patrick G.T. Healey, Joe Leach, and Nick Bryan-Kinns

Interaction, Media and Communication Research Group,  
Department of Computer Science,  
Queen Mary, University of London, UK.  
[{ph,joel,nickbk}@dcs.qmul.ac.uk](mailto:{ph,joel,nickbk}@dcs.qmul.ac.uk)

## 1 Introduction

Collaborative musical performances constitute a basic and distinctive form of human interaction. Across cultures, the production and enjoyment of music is typically an open, collaborative, activity more analogous to informal conversation than to a formal team work task. Moreover, it is the paradigmatic example of a form of human interaction in which the processes of engagement, innovation, and ensemble co-ordination –rather than outcome– are the goals of interaction. It is more strongly oriented toward mutual-engagement and aesthetic satisfaction than information exchange. It is concerned with ‘internal coherence’ e.g., harmony rather than ‘external meaning or denotation. It is primarily achieved through concurrent rather than sequential organisation of contributions. Lastly, in contrast to ‘individualistic’ cognitive models of creativity and composition, it foregrounds the role of inter-play between individuals in creativity and innovation.

Contemporary music based applications are primarily designed to enable individual editing and composition of music (e.g., Cubase, GarageBand). These applications focus on the human-system interface, providing, for example, tools that enable the manipulation of multiple graphical representations of a piece of music or the automatic, concurrent, production of standard musical notation. They do not, however, provide direct support for collaboration -the human-human interface- other than providing file sharing capabilities.

In effect, these applications incorporate a separation between: composition and performance; between performer and performer; and between audience and performer(s) that limits the potential of technology to enhance and widen the experience of collaborative performance. The effective use of technology to support collaborative performances requires a better understanding of the social and communicative organisation of this form of interaction, not just the design of more accessible or intelligent interfaces for non-expert musicians.

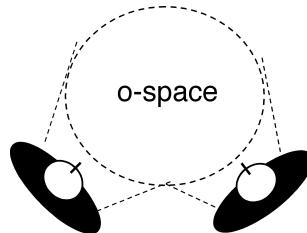
In this paper we describe a detailed empirical analysis of a sequence of free improvisations carried out by a group of moderately expert musicians. The aim of this observational analysis is to examine the communicative organisation of the interaction, in particular, the use of space as part of the joint performance.

We begin by summarising the concept of the F-formation system in conversational interaction which provides the back-drop for our discussion of the musical performances.

## 2 The F-formation System

A ubiquitous organisational feature of face-to-face conversations is the use of space to frame interactions. [1] has described in detail how people actively use the position and orientation of their bodies to collaborate in the management of their conversational interactions. Kendon's F-formations are made up of individual transactional segments: the sector of space in front of a person into which they look, speak or act. This roughly corresponds to a 30 degree angle from the midline of the lower body.

During conversation, participants who are actively engaged in interaction normally align their transactional segments so that they overlap creating a shared interaction space called the o-space. People continually re-adjust their position to maintain this space and a constant distance between one-another. One form of this arrangement is illustrated schematically in Figure 1.



**Fig. 1.** Schematic representation of an 'o-space' created by the overlap of two participant's transactional segments (plan view)

The F-formation can distinguish participants from non-participants and provides a way of identifying different interactions where large groups of people are present. The features of an F-formation can also be used as cues to some of the communicative characteristics of an exchange.

For example, the shape of the F-formation provides cues to the kind of interaction people are engaged in. For two person interactions a vis-a-vis arrangement with people facing each other is preferred for competition and greetings whereas an L-shape is preferred for cooperation. In multi-person interactions a symmetrical arrangement of participants is associated with equal speaking rights whereas someone in a distinguished or 'head' position will usually have, and usually exercise, greater speaking rights. A number of factors can influence the shape of the F-formation including; the number of participants, the arrangement of the

physical space including chairs, tables, walls and so on and the type of joint activity people are engaged in.

Importantly, changes in the organisation of the interaction often correlate with changes in the F-formation. For example, changes in the conversational topic are associated with re-alignment of participant's positions and, on occasion, a sharp turn away from the F-formation before turning back to begin discussion of the new topic.

There are also distinctive procedures for entering and exiting from an F-formation. Candidate participants who wish to join a conversation will normally position themselves in a way that avoids overlap with a current o-space until they are invited to join: referred to as the 'outer' position. On exit from an F-formation people make an initial step-away and then step back in for farewells etc. before moving off. Moreover, when they do exit they rarely cross the o-space, preferring instead to move away from the F-formation before turning towards their new destination. Similarly, non-participants avoid coming too close to an F-formation or, when they do, moderate the perceived intrusion by gestures, ducking or swaying backwards from the o-space.

### 3 Collaborative Interaction in Free Improvisation

In order to obtain a better understanding of musical collaboration as a form of communicative interaction we have made a detailed study of free improvisation amongst a group of musicians.

#### 3.1 Methods

**Participants:** Initially, a violinist known to the authors was approached and asked to assemble a group who would carry out some recorded free improvisation. She recruited six other participants: a trumpeter/double bassist, a flautist/alto saxophonist, a baritone saxophonist, a percussionist, a pianist/percussionist, and a windsyth/tenor saxophonist.

All participants had previously performed in open ended improvisations, and some of the members had also previously improvised together. Not all members had met before, and not all of the members were working as professional musicians. The makeup of the group reflected the variety found in everyday informal social gatherings.

**Procedure** Participants were briefed that the project they were participating in was researching group music improvisation, and that each week their task was to improvise as a group, with the structure and time-course of the improvisation to be determined by the participants themselves. All participants were asked to sign consent forms for subsequent use of the video and audio recordings.

Three approximately 90 minute recording sessions took place on consecutive weeks at a recording studio at QMUL. Sessions were observed by a sound engineer and four researchers. Each session was recorded on video and multi-channel

audio for subsequent analysis. Sound was recorded using four microphones, positioned by the participants themselves, and two video cameras positioned by the researchers to capture front views of all the participants. Following the sessions, the recorded sound and video were merged for analysis.

During the month following the recordings, the players were visited individually at their homes, where they reviewed the recorded footage on a laptop. The structure and quality of the performance was discussed, and subsequently they watched the footage again, following a protocol whereby they stopped playback at points where they substantially changed what they were doing with the others in the room. At each changeover point, they documented whether the preceding section of play constituted a new idea (presentation) or a response (acceptance). Additionally each section was reviewed in terms of outgoing interaction: what the person changed at the start of that section, which people in the room they were responding to (if any), what others were doing that they responded to and how their response related to it.

## 4 Analysis

### 4.1 The Spatial Organisation of Improvisation

Naïvely, we might suppose that musical collaboration is normally or primarily mediated through the musical contributions themselves. However, the first, most obvious, observation about the spatial organisation of the improvisations is that in all three sessions the musicians formed themselves into a circular arrangement (illustrated in Figure 2) and maintained this arrangement while they were playing. This arrangement was not a result of constraints of the study situation. Participants were free to arrange themselves and their equipment in any formation and given no instruction on where or how to position themselves. In addition, the cameras were positioned only after participants had decided on their physical arrangement and therefore did not influence their choice of location or orientation.

Interestingly, in the periods of conversational interaction between improvisations, the overall circle shape was not generally maintained. In these periods participants re-arranged themselves into sub-groups for two or three-party discussions or crossed over to different positions ready for the next improvisation.

*Prima facie* this circular arrangement resembles a co-operative, symmetrical, F-formation of the kind discussed by [1] in which participants have more or less equal ‘speaking’ rights. Although individuals sometimes left and re-joined the circle during improvisation we observed no instances of people playing with their back to the circle. Several further observations suggest that as for conversation, this arrangement has ramifications for the conduct of the collaborative interaction.

**Joining and Leaving:** The physical constraints imposed by some instruments, such as the piano, and the physical layout of the room entailed that only the



**Fig. 2.** Example of Participants Adoption of a Circular Arrangement for Improvisation

wind instruments and the violin could move easily. For these participants, we observed a recurrent pattern of movements when leaving the circle, typically taking place in three stages. Firstly, they stop playing, then they make an initial, small movement back from the circle followed by a larger move away. Conversely, when joining the circle, participants would typically first approach to the edge of the circle, then take a small step forward into the line of the circle and finally move their instrument into position for playing. An example entry sequence of this kind is illustrated for the baritone sax in Figure 3

This organisation of movements around the circle suggests a sensitivity to the importance of entry and exit from the circular arrangement as a signal of changes in participant status [2, 3]. Standing away from the circle seems to correspond to the status of a peripheral participant, such as an overhearer who may listen but does not normally contribute whereas standing in (but not inside - see below) the circle corresponds to the status of a primary participant, such as a speaker or addressee, who actively contributes. There is also an interesting contrast to conversational F-formations in that it appears people could join and leave without explicit ratification from the other participants.

**Taking a Head Position:** During the improvisations people occasionally crossed the centre of the circle, either to retrieve or change instruments or to adjust equipment. However, in the three sessions recorded we noted only one instance of a participant playing from a position inside the circle. Several observations suggest that this was an interactionally marked event. This move into a central position is followed by an extended attempt to engage with another participant through gestures. This fails and is followed by a short lapse. The centrally positioned participant then produces a new contribution that can be heard as a significant departure (in musical terms) from the ongoing improvisation. At this point the other participants successively drop out leaving only the person in the central or 'head' position playing on their own.



**Fig. 3.** Illustration of a Baritone saxophonist (left hand side) stepping-in to play

This incident underlines the role of the circular F-formation in framing this sequence of musical performances as collaborative interactions. Almost all the other observed contributions to the unfolding improvisation were made from a position on the circle. In this one case where there was a clear departure from the jointly maintained circular organisation we also observe a change from collaborative performance to a solo improvisation.

**Presentations and Acceptances:** The discussion so far makes no direct reference to the character of the musical contributions made by participants, only the position from which they were made. In order to explore the role of musical contributions to the organisation of the interaction an additional analysis was made of one six minute sequence of improvisation. To avoid imposing our own understanding of how participants contributions related to the unfolding improvisation the original participants were separately asked to review a video of the sequence to identify:

1. points at which they changed what they were playing
2. what this change was in response to
3. who, if anyone, responded to the change

The results are summarised in Figure 4. Given the length of the sequence analysed, generalisation –even to other sections of the same improvisation– is problematic. Nonetheless, the pattern of contributions suggests that the turnover

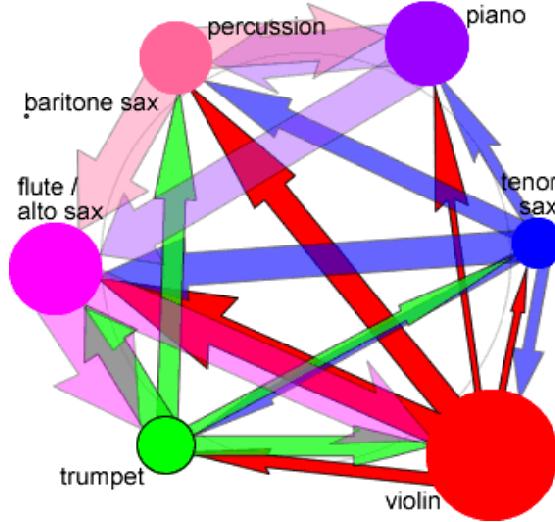
of musical ideas is both orderly and collaborative. With one exception, all participants are active and, of the five who are active, four produced new ‘presentations’ or ‘gambits’ (i.e., a change in what they were doing that was not done in response to others) during the six minute sequence. The onset of these presentations is staggered so that none occur in overlap. In contrast to this, the onset of acceptances (contributions identified as responses to another participant’s presentation) occur early and often in parallel. The analogy to conversational interaction would suggest the operation of an actively managed system of turn-taking in which new presentations are organised in ways that avoid direct competition for the floor [4].



**Fig. 4.** Turnover of Contributions During a Six Minute Improvisation

The pattern of interactions -who responded to whom- for each pair of participants is illustrated in Figure 5. Each participant is represented by a circle, the size of which represents the proportion of contributions, out of the total for all participants, that were made by that player. The arrows represent the distribution of acceptances for each participant with the width of the arrow encoding for the proportion of each participant’s responses that were made to each other participant. As before, this suggests a relatively democratic, dynamic and collaborative structure in which there is high degree of inter-play between participants.

**Anticipating Contributions:** The apparently orderly and quick turn-over of contributions suggests that participants have ways of anticipating both who will make the next presentation and, to some extent, what musical forms it might take. Participants ‘narrative expectations’ about genre and style probably provide useful cues to the likely trajectory of the improvisation. In several sequences there is a suggestion that they were parodying forms, such as ‘latin’, which accessed roles for each instrument that are more predictable than for completely free improvisations.



**Fig. 5.** Pattern of Acceptances Between Participants (Circle Size = Proportion of Total Contributions Made, Arrows = Proportion of Acceptances of Each other's Contributions)

The foregoing observations also suggests that space and orientation also play a role in the orderly production of the improvisation. As noted, contributions were almost always made from positions on the circle. Consequently, participant's location in the room, and the 'staged' exit and entry patterns from the circle provide advance cues as to their likely next action.

There were also a number of cases in which we observed the use of hand gestures for co-ordinating participants activities. Some of these instance of 'by-play' [2] involve relatively conventional editing gestures used to propose, for example, that a piece should end or that the other players should become quieter etc. We also observed the use of gestures as a means of encouraging other participants to contribute.

One final observation was participants also made 'gestural' uses of their instruments to indicate their intentions and to suggest possible modifications to others contributions. For example, on one occassion the trumpet is raised and waved in a moderately exaggerated manner to signal to another participant that they should modify what they are playing.

## 5 Discussion

Our observations highlight the rich interactional structure involved in the musical performances we observed. These improvisations are built out of a complex set of collateral social practices involving the use of space, orientation and gesture. These provide mechanisms that help to maintain the turnover of contributions,

the co-ordination of presentations and acceptances and the overall coherence of the unfolding performance. Our analysis highlights three phenomena through which the interactional organisation of a musical collaboration is sustained:

1. The use of physical orientation and position to maintain a shared ‘virtual’ interaction space or o-space. This is used to provide opportunities to signal moments of (dis)engagement with the collaborative activity and to frame equal ‘contribution rights’ for participants.
2. The orderly, *joint* presentation and acceptance of contributions and its relationship to the structure of the performance and turnover of ideas.
3. The use of anticipatory information to manage the temporal structure of the interaction, including the deployment of instruments, the use of narrative expectations, and gestures.

Many of these interactional mechanisms are jointly sustained. For example, a circular F-formation depends on each participant co-ordinating with each other participant on the maintenance of the spatial arrangement. Although this seems trivial it has an important corollary; innovation and creativity in the performance are as much social as individual acts. Participants jointly determine when and where changes in the musical trajectory will occur. They also form a collective filter through which ideas are either elaborated or abandoned.

Our observations suggest that there are substantial parallels between informal conversational interaction and informal musical interaction. It is unclear whether the mechanisms we describe are essential to improvisation or to what extent they generalise to other kinds of musical performance. However, contemporary music technologies treat composition and creativity as a species of monologue. The pervasive importance of interaction in the performances we observed suggests dialogue may be a more productive metaphor.

Extending participation in, and enjoyment of, musical interactions requires much more than the provision of intuitive, low-skill, instruments or algorithmically guided composition. We need to look beyond the production of music to the interactional organisation of the performance. In particular we need to provide ways to manage the ‘o-space’ through by-play and cross-play and ‘off-stage’ mechanisms to support co-ordination and aid people in predicting the likely actions of others. This should not, we propose, involve a reproduction of current mechanisms by, for example, building a virtual studio, avatars and instruments. This reproduces mechanisms that have evolved to cope with the contingent limitations of face-to-face interactions. In principle, technology allows us to transcend these limitations and develop novel environments that support new forms of mutual-engagement and creativity.

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