A Chasing After the Wind:
Experience in Computer-supported Group Musicmaking

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Improvisational group musics, such as jazz, have their own cultures and conventions of musical interaction. One characteristic of this interaction is the primacy of the *experience* over the musical artefact - in some sense the sound created is not as important as the feeling of being 'in the groove'. As computing devices infiltrate creative, open-ended task domains, what can HCI learn from improvisational group musics? How do we design systems where the goal is not an artefact but a felt experience? This position paper examines these issues in light of an experiment involving 'Viscotheque', a novel group music-making environment based on the iPhone. Some results are presented, as well as a discussion of the difficult problem of reconciling the participant's (subjective) descriptions of the felt experience with the detailed interaction data logged by the system.

Improvisation, Musicmaking, Measurement

1. INTRODUCTION

1.1. Improvisational Interaction

The degree of improvisation inherent in a group activity can be seen to lie along a continuum - some activities are largely pre-scripted, others contain both scripted and unscripted elements, still others are completely unscripted. Groups activities which fall toward the latter end of this spectrum provide specific challenges to understanding their interaction. When roles are fluid and ill defined; when outcomes are not pre-determined but negotiated on the fly - how do improvising groups do what they do?

The canonical example of an improvising group in music is the jazz ensemble. From a simple trio all the way up to a big band ensemble, improvisation is an integral part of what it is to play jazz (see Berliner et al. (1994) for an in-depth study of the role of improvisation in jazz music).

Monson (1996) provides some more revealing insights into the improvising group at work. Monson, herself a jazz trumpeter, conducted long-form interviews with several professional jazz musicians. In these interviews, the metaphor of dialogue or conversation was a strong theme in the way the musicians described their improvisational

interaction. This is a helpful metaphor: conversation connotes an open sharing of ideas, a call-and-response paradigm, the potential for intimacy and shared vocabulary. It is in this interaction between participants that the musicians are stretched, energised and inspired.

Of course, the art of improvisation is not practiced exclusively in jazz. Improvisation is a feature of many other musical styles and traditions, and many non-musical activities as well. And again, when participants in these groups improvise together the nature of their individual contributions cannot be understood in isolation. Sawyer and DeZutter (2009) describe their observations of improvisational theater troupes:

> Improvised narratives are good examples of collaborative emergence because they are so obviously created by the collaborative efforts of the entire group. No single speaker creates the narrative; it emerges from the give and take of conversation. The narrative is constructed turn by turn; one actor proposes a new development for the play, and others respond by modifying or embellishing that proposal. Each new proposal for a development in the narrative is the creative inspiration of one person, but that proposal does not become a part of the play until the other members of the group respond to it, and potentially redefine it retrospectively. In the

subsequent flow of dialogue, the group collaborates to determine whether to accept the proposal, how to weave that proposal into the drama that has already been established, and then how to further elaborate on it.

In open-ended, creative tasks the group's ability to innovate is not strictly a function of the skills and inclinations of the individual members, but of the particular way their contributions are interpreted and built upon as they improvise together.

1.2. The Joy of the Groove

Grooving is a term often used by musicians to describe the feeling of playing together (Doffman 2009). The term does have subtly different meanings depending on usage. It can refer to a specific beat or rhythmic pattern, or the practice of playing early on certain beats and late on others. It is also used by musicians to refer to peak moments in a performance - that elusive feeling when things really *work*. This is the sense of the word groove which we shall consider in this paper.

Grooving is not simply a cognitive state, it has an affective and embodied dimension - it is *felt* (Ashley 2009). Indeed, some musicians are resistant to the idea of over-analysing the experience, feeling that it somehow diminishes the magic (Monson 1996). While this attitude is not shared by all musicians, there is a definite sense in which the feeling cannot be fully captured in a dispassionate, dusty discussion.

Improvising groups do not always reach these lofty peaks - one day a group might really be in the groove, the next day they may be flat. However, the experience of jamming together can provide a sense of connection with others that few other activities can. The sensation of being 'in the groove', while difficult to describe in words, represents a real shared experience prized by musicians across many different musical traditions. The consistent feeling of meaningfulness, of *grooving*, is shared - there is agreement between the musicians whether it is occurring or not (Young and Matheson 2000).

Also useful in terms of understanding 'peak experience' is Csikszentmihalyi's theory of *flow* (Csikszentmihalyi 1991). Although initially expressed in the context of the individual, Sawyer (himself a jazz pianist) has described flow in improvisational groups, such as jazz ensembles (Sawyer 2006) and improvisational theatre troupes (Sawyer 2000). Flow describes the state in which an individual's skill level is commensurate to the difficulty of the complex task being performed. This theory provides an explanation for why some activities are inherently pleasurable and satisfying, even when they provide no discernible reward (outside of this satisfaction). Flow is a theory of *intrinsic motivation*, as distinct from the extrinsic rewards which often motivate participation in an activity.

Improvisational groups are inherently fluid; the actions and roles of the group members are not pre-ordained, but negotiated and re-negotiated on-the-fly. While each member of the group brings their own experiences and sensibilities to the activity, the creative output of the group is not the singular vision of any of the individuals, or even the sum of their individual contributions. In their *interaction* an artefact (either a piece of music or a theatre performance) emerges which is truly an indivisible product of the group. Sawyer argues that in these contexts, the group has the potential to reach beyond the limitations of the individual: "In collaborative improvisation, a creative product emerges that could not even in theory be created by an individual" (Sawyer 2007).

Ultimately, it is immensely satisfying to be a part of a group that's really grooving. *Group flow* is that experience of participating in a complex activity that stretches one's skills and completely envelopes one's consciousness. To be absorbed in the groove - not for any external motivation or reward but because of sheer rush inherent in it - that is what keeps many musicians coming back to jam sessions.

1.3. What does the groove have to do with HCI?

These ideas are increasingly important in HCI because of two parallel trends in computing:

1. computers (particularly mobile devices) are infiltrating improvisational, creative, open-ended task domains (such as musicmaking)

2. we have a greater capacity to generate and analyse log data than ever before

This presents us with a dilemma: how do we reconcile our desire to have a nuanced view of the human, felt experience so central to these systems with our longing as data-driven scientists to crunch numbers, generate metrics, and compare p-values?

This problem is not a new one - it has been foreseeable for a long time. However, the recent explosion of smartphones, with their array of touch-screens and other sensors (Essl and Rohs 2009, contains a good summary), are affording groups of musicians new avenues of creative engagement. Accordingly, researchers in HCI are increasingly interested in the nature of group interaction (Stahl 2009). Musicians are finding new ways to interact, and to share in that familiar

collaborative, improvisational experience. The tools may be different to the jazz band, but at some level the goal - to experience that feeling of the groove - is exactly the same.

For collaborative tasks which involve the production of an artefact, such as a document or other representation of knowledge, the success of the activity can be measured by the quality of the artefact produced. Some collaborative tasks, however, are not primarily concerned with the production of an artefact, and indeed may not result in any tangible output. In these cases, measuring the success of the activity may be more difficult, or may not even be meaningful. This is not a problem *per se*, but it does present challenges - how do we make design decisions without a meaningful metric for comparison?

Here HCI is confronted by a teleological difference between creative, improvisational tasks and more 'prosaic' ones. In a word processor, the goal or the user is the production of a high-quality document. The contribution of HCI theory is to make this task as pleasant an experience as possible. In an improvisational computer-music environment, the goal of the participant is to have an experience: of flow, connection, groove. The musical output of the system is merely a means to that end. In these two different contexts the role of the *created artefact* and the *experience of making it* are reversed. In what ways can the tools of HCI theory still be useful, and where do they fall down?

Research continues into designing computational tools and environments for improvisational music making (for summaries, see Kirke and Miranda 2009; Bernardini and de Poli 2007; Tanaka 2010). Some of this work has attempted to deal with the nature of the interaction in computer-mediated musicmaking. Bryan-Kinns et al. (2007) has discussed the concept of *mutual engagement* in musical collaboration. Engagement is itself a slippery concept, often used in subtly different ways in different fields of study (O'Brien and Toms 2008). Bryan-Kinns and his team have developed a collaborative music software environment called the 'Daisyphone', and have used this environment to study the influence of interface design decisions such as workspace visibility and the availability of textual chat functionality on the amount of engagement that occurs between musicians.

1.4. Summary and Goals of this Position Paper

So is the felt experience of computer-mediated jamming amenable to measurement, evaluation and comparison? What can we learn from the musical interaction between participants to help us detect those moments when they are really in the groove/flow? And how can we set up our user studies to reflect the fact that the 'success' of the interface is determined by it's ability to engender a feeling and experience that in some sense is unmeasurable? Are we just chasing after the wind?

The goal of this position paper is to raise these questions for discussion. As discussed in Section 1.3, these questions are important as HCI increasingly deals with improvisation, creativity and play.

To this end, a recent experiment conducted by the author is presented as a starting point for the discussion. The experiment is a longitudinal study of musicians learning to improvise and interact in a novel, iPhone-based environment called *Viscotheque*. The details of the experimental setup and procedure are given in Section 2.

Preliminary results from this experiment are given in Section 3. This analysis is not intended to be a conclusive answer to the issues raised in the paper, but merely as a starting point for discussion in the workshop.

A discussion of the results and their interpretation, as well as some suggestions for further work in this area, are presented in Section 4.

2. THE VISCOTHEQUE SYSTEM

2.1. Architecture

The Viscotheque system is a computer-supported environment for improvisational group music making. Each participant uses an iPhone [1] to manipulate a sound (either a pre-recorded sample or a synthesizer) in real time. The device runs a custom Viscotheque app, which sends control messages over wi-fi to a sound generation engine running on a laptop on the local network. Participants are co-located in a room with a PA system, and can hear each other's sounds, as well as see a visual representation of the state of all the devices on a large screen. A previous iteration of the Viscotheque system is described in more detail in (Swift et al. 2010).

2.2. Design Philosophy

The primary design goal of the Viscotheque system was to build a system with the capacity to provide the same significant, meaningful experiences of musical connection as are available through conventional instrumental setups. The system, and iPhone interface in particular, are necessarily constrained

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[1] www.apple.com/iphone/

- they allow for certain types of musical expression and not others. However, constraint is a natural part of any instrumental design, and even extreme constraints have been shown to allow for a divergence of creative practices in the hands of skilled musicians (Gurevich et al. 2010).

Fundamentally, the Viscotheque provides a direct mapping between input and output - you touch the screen, you make a noise. Each participant controls their own output - one participant cannot affect another's sound other than to play over the top of them. The number and position of the fingers on the screen causes the sound to be morphed, filtered, pitch-shifted and time-stretched beyond recognition. The basic sonic manipulations available are:

- **0 fingers** - silence

- **1 finger** - lowpass filtering (cutoff & resonance)

- **2 fingers** - time-stretching, volume

- **3 fingers** - pitch shifting

- **4 fingers** - toggle synth and sampler modes

All of these have an immediately perceptible effect on the sound, which closes the feedback loop between the participant and the system, allowing them to explore the extent of their sonic agency. The mappings are designed to be intuitive, using conceptual metaphors wherever possible, such as 'up' and 'down' in relation to pitch and volume (Wilkie, Holland and Mulholland 2010).

While there is no technical reason to impose this restriction, all experiments take place with the participants together in the same room. The feeling of groove is a shared experience for which non-verbal and embodied modes of communication are vital.

2.3. Experimental Approach

We conducted a series of experiments to study the nature of improvisational interaction in Viscotheque. 12 participants were recruited from the Music School, and were divided into four groups of three. Each group, having no initial experience with the system, attended four group jam sessions over a 4 week period. The groups were kept consistent over the four week period to allow the musicians to build a musical rapport.

These jam sessions were recorded in detailed system logs and also with a video camera which recorded the entire session. After the period of jamming, the participants took part in a group semi-structured interview to discuss the experience.

One key decision regarding the experimental design was to leave the sessions as open-ended as possible. The participants were not given any training in using the interface, although they could ask questions about the system in the interviews. No instructions were given to the groups about what they were trying to achieve, although as musicians familiar with 'jamming' they brought with them their own expectations of what to do in an improvisational setting.

The goal of the experiment was to see what patterns and cultures of use would emerge as the groups learned to improvise together in Viscotheque. While the semi-controlled 'laboratory' setting opens the work up to criticisms of sterility and inauthenticity, there are significant advantages to being able to log every finger trace and capture every facial expression. More than this, though, the goal was to see how the participants described the experience, and to see if the groups experienced moments of deep satisfaction and euphoria associated with the best parts of improvisational music making. How did the best bits happen, and what did they *feel* like?

3. RESULTS

These experiments yielded a large quantity of data: hundreds of thousands of interface events (each finger touch on the screen is recorded as a discrete event), and approximately 16 hours of video. Approximately half of this video records the participants as they jam together, while the other half corresponds to the post-performance interviews.

The video recordings of the sessions show encouraging signs of immersion and engagement between the participants. At various points heads were bobbing, shared smiles were visible, eyes were closed - all good (although potentially misleading) indicators of the depth of musical connection and engagement between participants. It may be possible to measure the sympathetic movement of the participants using computer vision techniques, (such as in Wang et al. 2007), but this analysis has not been attempted at this time.

The group interviews provide the participants with a chance to reflect and discuss the experience directly after it occurs. Reflecting on one of their sessions, group 1 described a deep satisfaction and enjoyment reminiscent of that discussed in Section 1.2.

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P1> And then, and then you just, like, kindof
recoup, and go back, and something - like
there's points where there's something where
it just all works, and for a second you just
get that 'holy crap, let's just bottle this
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right now'
P2> (laughing) Yeah
P3> Yeah
P1> Grab it, and just seize onto it, and
figure out what exactly it is, because this
is awesome
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Similarly, in group 2

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P4> For me, it's similar to other experiences
I've had with other musicians, it's that
moment of 'that's really cool', and yeah...
it only really comes from playing music with
other people, but it's like (clicks fingers)
just a feeling where you go 'wow, that's
clicking and that's awesome'.  Yeah.
INT> Do you think it can...
P4> It's something where you're working
together, everyone's contributing to this
really cool sound, yeah.
INT> Yeah, sure.
P5> It was a lot more fun this week.  Last
week was more of a puzzle, trying to work it
out, but this week it was a lot more free.
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Even in moments where the participants were feeling dissatisfied with the experience, they still at times used certain musical expressions to describe what they felt they were falling short of. This time in group 3

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P7> I think we peaked last week...
P8> Yeah, I found this session more
frustrating.
P7> Yeah.
P8> I dunno why.
P7> I think, yeah, we just weren't in the
pocket.
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Each group gave vivid descriptions of the felt experience of jamming together in the Viscotheque. At times this was positive, such as the descriptions provided of the moments which really worked, while at times a negative experience was described - frustration at not feeling the groove on a given day. While a few short excerpts with minimal context taken from 8 hours of interviews cannot convey the whole picture, it is clear that the participants are describing a felt experience akin to that of being in the groove.

4. DISCUSSION: A CHASING AFTER THE WIND

It may seem as though this is an unsatisfactorily shallow look at the results of the Viscotheque experiment. Indeed, if this were a journal paper this would be a fair criticism. However, the purpose of this position paper is to encourage discussion about the way we evaluate improvisational, open-ended systems in HCI. The Viscotheque data is an example of a computer-mediated environment where the felt experience is paramount - the allure of participation lies in the chance to feel something. This introduces the problem of measurement - how do we measure this felt experience? Is it even possible, or is it a fool's errand?

There are a few different approaches which seem to have merit:

- **Expert judgements**: can we have experts assess the participant's activity and assign a score based on their knowledge of the task domain? This is the approach taken by Bryan-Kinns and Hamilton (2009).

- **Unsupervised learning**: should we restrict ourselves to statistical techniques which require no class labels, such as clustering and novelty detection? This way, data can be naively grouped and partitioned, and then the meaning of the groups and patterns can be interpreted by the researcher? This approach can be applied to the text of the interviews as well.

- **Rich data collection**: Another approach is to measure the participants more closely, including biometrics such as EEG (brain), ECG (heart) and galvanic skin response (arousal).

All of these solutions have strengths and weaknesses, and there are potentially other approaches which may prove fruitful as well.

This paper is not a call to be unduly pessimistic about the ability of HCI to deal with these problems. It is merely an acknowledgement that these problems loom as challenges for the future. Indeed, the shift from experience as a means to experience as the chief end of computer-mediated interaction offers many exciting possibilities. It is simply important to acknowledge this shift, and choose our experimental and evaluation methods accordingly.

5. REFERENCES

Ashley, R. *Musical improvisation*. The Oxford handbook of music psychology, 2009.

Berliner, P.F., Bohlman, P.V. and Nettl, B. *Thinking in jazz: The infinite art of improvisation*. University of Chicago Press Chicago, IL, 1994.

Bernardini, N. and de Poli, G. The Sound and Music Computing Field: Present and Future. *J New Music Res*, 2007.

Bryan-Kinns, N. and Hamilton, F. Identifying Mutual Engagement. *Behaviour & Information Technology*, 2009.

Bryan-Kinns, N. Healey, P. and Leach, J. Exploring mutual engagement in creative collaborations. *C&C '07: Proceedings of the 6th ACM SIGCHI conference on Creativity & cognition*, 2007.

Csikszentmihalyi, M. *Flow: The psychology of optimal experience*. Harper Collins New York, 1991.

Doffman, M. Making It Groove! Entrainment, Participation and Discrepancy in the 'Conversation'of a Jazz Trio. *Language & History*, 2009.

Essl, G. and Rohs, M. Interactivity for mobile music-making. *Organised Sound*, 2009.

Gurevich, M., Stapleton, P. and Marquez-Borbon, A. Style and Constraint in Electronic Musical Instruments. *Proceedings of the 2010 Conference on New Interfaces for Musical Expression (NIME 2010)*, 2010.

Kirke, A. and Miranda, E.R. A survey of computer systems for expressive music performance. *Computing Surveys (CSUR*, 2009.

Monson, I.T. *Saying something: Jazz improvisation and interaction*. University of Chicago Press, 1996.

O'Brien, H.L. and Toms, E.G. What is user engagement? A conceptual framework for defining user engagement with technology. *Journal of the American Society for Information Science and Technology*, 2008.

Sawyer, R.K. Improvisational cultures: Collaborative emergence and creativity in improvisation. *Mind, Culture, and Activity*, 2000.

Sawyer, R.K. Group creativity: Musical performance and collaboration. *Psychology of Music*, 2006.

Sawyer, R.K. *Group genius: The creative power of collaboration*. Perseus Books Group, 2007.

Sawyer, R.K. and DeZutter, S. Distributed creativity: How collective creations emerge from collaboration. *Psychology of Aesthetics, Creativity, and the Arts*, 2009.

Stahl, G. How to Study Group Cognition. *Analyzing Interactions in CSCL: methodologies, approaches and issues. Springer, New York*, 2009.

Swift, B., Gardner, H. and Riddell, A. Engagement Networks in Social Music-making. *In Proceedings of OzCHI*, 2010.

Tanaka, A. Mapping Out Instruments, Affordances, and Mobiles. *Proceedings of the 2010 Conference on New Interfaces for Musical Expression (NIME 2010)*, 2010.

Wang, X., Wirth, A. and Wang, L. Structure-Based Statistical Features and Multivariate Time Series Clustering. In *Data Mining, 2007. ICDM 2007. Seventh IEEE International Conference on*, 2007.

Wilkie, K., Holland, S. and Mulholland, P. What can the language of musicians tell us about music interaction design? *Computer Music Journal*, 2010.

Young, J.O. and Matheson, C. The metaphysics of jazz. *Journal of Aesthetics and Art Criticism*, 2000.