Play Fluency in Music Improvisation Games for Novices

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ABSTRACT
In this paper a collaborative music game for two pen tablets is studied in order to see how two people with no professional music background negotiated musical improvisation. In an initial study of what it is that constitutes *play fluency* in improvisation, a music game has been designed and evaluated through video analysis: A qualitative view of mutual action describes the social context of music improvisation: how two people with speech, laughter, gestures, postures and pauses negotiate individual and joint action. The objective behind the design of the game application was to support players in some aspects of their mutual play. Results show that even though players activated additional sound feedback as a result of their mutual play, players also engaged in forms of mutual play that the game engine did not account for. These ways of mutual play are descibed further along with some suggestions for how to direct future designs of collaborative music improvisation games towards ways of mutual play.

Keywords
Collaborative interfaces, improvisation, interactive music games, social interaction, play, novice.

1. INTRODUCTION
With interfaces such as the iphone®, the Nintendo Wii® controller, X-box Kinect® there is a potential that music consumption can evolve from being a relatively passive activity to being an active social and expressive activity. The actual musical content can be influenced by the way that people engage with musical expression through a variety of music oriented software and hardware interfaces. Rock Band® and Guitar Hero® are examples of music based game applications where players can engage in music performance, however on a *theatrical* level that does not involve co-creation of improvised music. By theatrical, we mean that players engage with precomposed music through avatars. However, there are several examples of collaborative music interfaces that involve more *dramatic* ways of engaging with music performance: Blaine, Fels and Weinberg have discussed mapping of joint user action in networked interfaces [1][16].
Many collaborative music applications also take advantage of commercial interfaces like the iphone that have built-in sensor capabilities and can be added to a network. Some examples are presented in [10][15][11][12]. These kinds of collaborative music interfaces and interface applications could define a new kind of "casual games", where the auditive, and not the visual is in focus, and where the joy of play replaces the idea of a 'high score' [6].
This paper discusses the role of a music game application and how it encourages players to 1) establish mutual awareness towards each other's actions and joint attention towards the object of music creation, 2) engage in varied forms of individual and mutual expression and 3) engage in *play fluency*. By the term *play fluency* is meant meaningful musical expression perceived by players and a potential audience. Play fluency could be a sign of flow and the music game could potentially be intrinsically rewarding because it inspires players to engage in *autotelic* activity [2]. In the Continuator interface, Pachet has investigated how a player engages in a flow experience while improvising together with a music application as a 'co-player' in turn taking sequences [9]. This paper presents how two players improvised together when their musical performance was triangulated with a music application – if and how the music application facilitated play fluency. The main objective of this study was to see if a music-based game application that captured limited and specific aspects of mutual play was able to give appropriate sound feedback when two players managed to establish play fluency together.

2. GAME DESIGN
The music game was programmed in Max Msp [8] for two Wacom Intuos4® pen tablets [14]. This kind of interface has previously been used as an expressive electronic music instrument [18]. The game application borrowed the idea of drawing in order to make it easy to play for novices: Two players could either draw dots and lines, scratch movements and circles, where the sound feedback would differ according to these draw styles (see the sections 2.1-2). Players would get additional sound feedback if they chose to draw the same draw style and were able to synchronize and time their movements with each other. The game design was inspired from the idea of musical grounding, a concept presented in the field of music therapy that describes how a music therapist can establish a sort of musical and communicative understanding of a client by for example reflecting aspects of the client's play style [17]. Here, the game application was designed to notice only limited aspects of two players' mutual grounding: choice of playstyle synchronization and timing.

2.1 Sound Feedback: Individual Action
Measured x and y pen positions were translated into simple draw styles: dots/lines, scratch movements and circles (see figure 1-3). One player's individual string instrument sound was based around high frequencies, and the other player's individual string instrument sound was based around the low frequencies. All frequencies were fixed around a Balinese Pelog scale. It did not matter where on the tablet the draw styles (dot/line, scratch movements and circles) were made. Some features connected to the draw styles were detected: Size and

speed, line and scratch degree (360) and circle drawing direction (cw/ccw). The shape detection was relatively simple, so the application could detect the draw movements in real-time (within a sample rate of 20 to 200 milliseconds). The extra features determined which combinations of tones were activated. In addition the pen's x and y tilt angle influenced the length and volume of each activated tone.

2.2 Sound Feedback: Mutual Action

When two players chose to use the same draw styles (dots/lines, scratch movements or circles) in pairs, and when they drew at the same speed, they would activate an additional sound layer: Piano chords were played back on top of each individual player's sounds. The rhythm of the piano chords was at the same pace as the mutual pace of the two players. If players kept drawing at the same speed, the rhythm structure of the piano would elaborate around the rhythm that the two players had found together. If the offset time between scratch peak points and circle top points was low, the two players activated high pitch chime sounds.

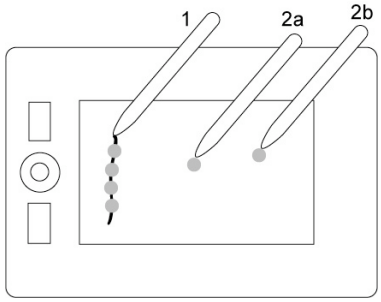

Figure 1: Dots and lines. The grey dots = tones activated along a line (pen1), or tones activated when the pen touched the tablet (2a and 2b).

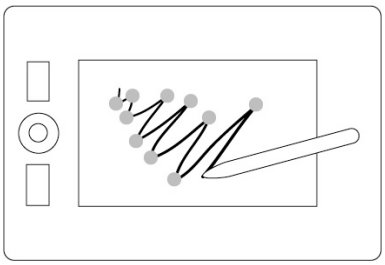

Figure 2: Scratch movement. Grey dots = tones activated at the points of direction change. Scratch area and degree in 360° was also noticed by the game engine.

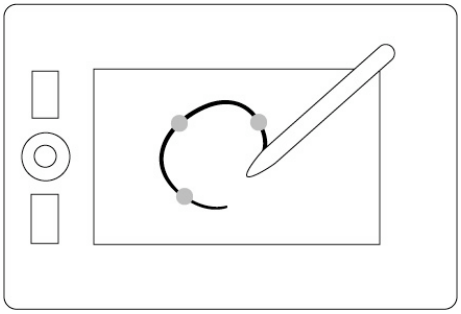

Figure 3: Circle movement. Grey dots = tones activated along the curved line of the circle. Circle area and clockwise /counter-clockwise movement was also noticed.

3. EXPERIMENT PROCEDURE

In nine game sessions we documented how two players played together. The teams consisted of either two females (4 teams total) or two males (5 teams total). Documentation happened in two ways: A video camera filmed the two players from the side, while the game application logged all incoming pen data and metadata generated by the game application. (see figure 4).

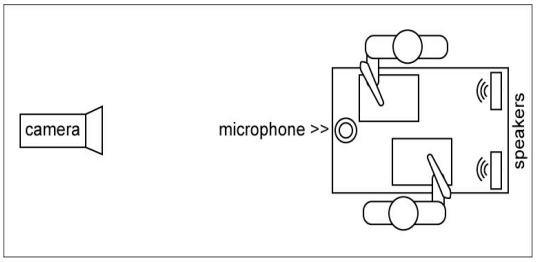

Figure 4: Two players sat at a table opposite each other with the pen tablets in front of them. A microphone was placed on the table to record what the two players said. Speakers next to each player played individual sound feedback. The sound feedback that happened as a result of joint action was centered or panned between the two speakers.

When the experimenter introduced the game and the different draw styles, the players were asked to find 'additional sounds'. They were told to collaborate, but not what to do in order to find the additional sounds. When each player had explored his/her individual sounds, the two players could play together as long as they wished.

4. DOCUMENTATION AND MEASUREMENT OF USER ACTION

The video documentation of all game sessions provided material for qualitative analysis of individual and mutual player action and the social context that surrounded this action. In order to see how players negotiated mutual play and engaged in sequences of play fluency with each other, we used conversation analysis - see [3][4][5][7][13]. The video was analyzed on several levels: Did players for example use utterances, gestures and gaze to negotiate play? Was there a special rhythm or hierarchy of actions? Could individual and mutual pauses be related to the way players understood the sound feedback, especially the additional sound feedback that happened as a result of mirrored play style and common speed and timing?

5. RESULTS

This section presents first some video examples of characteristics of play fluency that we found in the nine game sessions. In general, it was impossible to find a single way in which two players engaged in play fluency together. Players were very inventive, and each player team acted differently. What all player teams had in common was the process of establishing play fluency:

First, in order to find a shared focus and start a musical relationship, players either mirrored each other by doing the same (getting the additional sound feedback), or one player tended to accompany the other player (see appendix, video 2a, 3b, 6d, 7a-c, 8a, 8h, 9a-e). At most times, the player who initiated a draw style ended up playing solo, while the other player entered their relationship through accompaniment (see appendix, video 1a, 1d, 4a, 5a). However, in session 6 and 8, the player who introduced a relationship, introduced a background for a possible solo (see appendix, video 6a-c, 8g).

Second, there were many different kinds of relationships in terms of draw style. No matter which combination of draw style players engaged with, players tended to explore a variation of a found relationship shortly after it was clear that they had

established a relationship (see appendix, video 3a, 3c, 8a, 8b, 8e, 8d, 9b, 9c). In one case (see appendix, video 1f), players changed the tempo as a way of varying a found relationship. It seemed like there was a hierarchy in that players needed to first agree on draw style combination before they started to engage in an exploration of e.g. pen position, pen tilt and play speed.

Third, players repeated each other's utterances in a turn taking relationship (see appendix, video 1c, 1e, 4b, 8f, 8h). In the case of 1e, players ended up sharing the same timing, whereafter they started to play different play styles simultaneously, exploring other ways of playing together. In 4b it is clear that the additional sound feedback did not support turn taking.

Fourth, players tried to make sense of the additional sound feedback that sometimes happened as a result of their mutual play. Perhaps this was because players acknowledged that their task 'find additional sounds' was done. Some players also looked at the computer screen in order to find an answer. Some players ignored the additional sound feedback.

Fifth, play fluency seemed to arise, when two players managed to stay focussed on very limited ways of expression, often repeating a sequence of tones with slight variations (see appendix, video 1d). In a few cases, players negotiated a play relationship verbally (see appendix, video 9a-e). Some considered very sophisticated relationships that regarded the graphical layout of pen actions (see apendix, video 3e-f and 8e and figure 5).

Video 3f:

Right player: "Try to drive around, then I put dots around."

Video 8e:

"What now if we keep moving across a specific point,
for example here, and then you run across that?"

Figure 5: Transcription of player utterances in video 3f and 8e (see appendix).

6. ANALYSIS

In general, the two players shifted between individual exploration and joint expression. The types of player engagement shifted between the three types of engagement presented by Ben Swift et al.: individual, unilateral and bilateral engagement [3]. In some cases, while one player engaged in individual exploration, the other player followed along without the first player was aware of it. In other cases both players were mutually aware of each other's actions. The mutual player awareness (or problems in finding it) was visible in the following types of communication:

6.1 Talk and Utterances

None of the teams talked very much while exploring joint improvisation. Usually smiles and laughter was used to indicate if players had found a shared form of expression. They also sometimes commented on the sound feedback with single words like "hmm" and "ah". When a few teams did talk, it was because they needed to negotiate some very specific pen actions with each other, and here some players used deictic gestures to explain.

6.2 Gestures and Postures

None of the teams used gestures that were related to musical expression. This was perhaps because they, unlike trained musicians, had no formal gesture vocabulary to use. However, when a player wanted to be very explicit about his/her actions, s/he tended to lift the pen higher than usual. This also happened at the end of each phrase that a player introduced. Players used body postures to direct each other's pen movements (this is very clear in video 9a-e, see appendix). Players tended to move their bodies more, when they were engaged in play fluency. In the two examples, the player who introduced the leading musical content was very explicit about what s/he did. In 1d Right moved his torso along with the arm movements when he scratched and drew circles. In 4a Right introduced a melody by nodding along with the first couple of tones.

6.3 Gaze

In general, female teams tended to exchange gaze more than male teams. Players often switched between looking at their own tablet and the other player's pen and tablet. In the following two examples gaze patterns in successful play fluency sections from a male and a female team, are covered in order to understand how play fluency was negotiated: In section 1d Right did not look at Left before towards the end of the found relationship. This was in order to indicate a desire to 'take the floor' by coming up with new material. In section 4a the two players looked at each other in turns. This could be to check if the other player was following along, and if the player who guided their mutual play had noticed that the other player was following. In both sections, gaze and pauses were intricately connected: In 1d Left looked at Right's pen and tablet a moment before Right introduced the first phrase - perhaps in order to get an idea of timing. Perhaps it was easier for Left to follow Right's movements, because Right is left-handed? In general, Left checked more with gaze what Right was doing than vice versa. When Right then looked at Left's pen and tablet before phrase 3 where Right introduced circles, Right's gaze was a guidance. Then Left checked what Right did, when he actually switched to drawing circles. Left's phrases 3 through 5 could be interpreted as one long phrase that was an elaboration on phrase 1 and 2. In the entire video clip, the game application did not provide any aditional sound feedback. The game application was not designed to interpret this type of play relationship as 'meaningful'. In 4a both players started to look at each other's pen and tablets in order to find a common relationship together. Right looked at Left when introducing the first tones of a melody, while Left responded by looking at Right's pen and tablet while smiling. When Right doubled the tempo she looked at Left when she realized that Left followed her quite well.

7. DISCUSSION AND FUTURE WORK

This paper has presented a qualitative evaluation of how a music based game application supported players in establishing play fluency. On one level, the game application did successfully support players in improvising together. By providing players, who were not trained musicians, with a recognizeable physical interface and two kinds of string instrument sounds, there was enough material that players could use to relate to each other with. It was easy for the players to understand the three draw styles, and most players intentionally used combinations of those. However, the game application did not succeed in triangulating the two players mutual play. Very often players did not understand the additional sound feedback that happened when players used the same drawstyles and played those at the same speed and timing. Although the game application could measure the combinations of different draw styles, and all the features of the pen movement connected to these draw styles, only a fraction of these individual and joint interaction data were mapped to sound output. It was very clear that players expected more sound feedback as a result of even small changes in their mutual actions. The game application had too many expression

possibilities: Players could combine the different draw styles, and they could vary them with pen tilt, pen position, drawing direction and size. The variations in mutual draw styles were so big that no single description of how they played together was sufficient. It would have been a big task to design a game that could provide sound feedback on all the three kinds of draw styles and their related features. Instead, in future music based games, we suggest to narrow down the expression possibilities, so that it is possible to map all play combinations and features to some sort of musical and/or sound effect output.

7.1 Play Fluency in Joint Improvisation

As most of the video examples show, play fluency happened when players focussed on a few ways of expressing themselves with the available sounds. One player's focus and repetitive movement gave the other player a chance to grasp what was going on and try out ways of attuning his/her actions to the first player's actions. A game application that only asks players to draw lines could afford more focus on how players draw lines with each other. This would also focus the two players attention towards varying a found relationship even more, because a game application could support all types of line drawing in the sound feedback. The results and the analysis of the game application presented in this paper offered a glimpse into a wide variety of ways in which players chose to establish play fluency. Future designs could elaborate on a selected set of means of expression that were logical to players while engaging in play fluency together.

7.2 The Role of the Game Application

It was clear that the idea of musical grounding that was implemented in the game application was too narrow. It did not embrace the wide variety in which players established musical grounding through all the available expression possibilities. The idea of a triangulation of two players mutual play should be re-evaluated according to what a game application in fact can measure out of the entire embodied interaction of the social act of musical improvisation. It was seen that there was a hierarchy in how players explored the draw styles and draw features. A game application could be designed to give and vary sound feedback according to how: 1) draw style combinations are chosen, 2) variations of draw styles are made and 3) mutual timing and speed is negotiated among players.

8. ACKNOWLEDGMENTS

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10. Appendices may follow the references

The following nine web addresses are links to selected video sequences of the nine game sessions where 18 persons participated. In order to see the videos, this following password is needed: AMSH5research. The selected videos show sequences where the teams established mutual play fluency. The sub-section times are indicated on the website below the video.

Video 1a-f: http://vimeo.com/19119476
Video 2a-b: http://vimeo.com/19119262
Video 3a-g: http://vimeo.com/19119134
Video 4a-b: http://vimeo.com/19118761
Video 5a-c: http://vimeo.com/19118652
Video 6a-e: http://vimeo.com/19118358
Video 7a-b: http://vimeo.com/19117874
Video 8a-i: http://vimeo.com/19117700
Video 9a-e: http://vimeo.com/19116889

On the following two links pen x and y positions for the examples 1d and 4a are presented as time/color diagrams.
Pen positions I: 1d/left player: http://vimeo.com/19384019
Pen positions II: 1d/right player: http://vimeo.com/19384067
Pen positions III: 4a/left player: http://vimeo.com/19384161
Pen positions IV: 4a/right player: http://vimeo.com/19384216