Chapter 9
Mutual Engagement in Digitally Mediated Public Art

Nick Bryan-Kinns

Abstract This chapter examines the socially constructed responses that emerge through interaction with works designed for collective experience. The focus here is on the moments of creative spark that emerge between people as they mutually engage through collective art forms. These art forms exploit digital social infrastructure to create socially empowering public digital art forms where the emphasis is on the enjoyment of being creative together rather than art per se. The fluidity of such interaction allows for micro-creativity: that is, digitally mediated creative activities which can be carried out as a number of fleeting collaborative interactions over an extended period of time, and in a wide range of interaction contexts from galleries to mobile phones. The public art in these situations is in the experience, not the physical artefact itself which often does not exist in any case. In this chapter, we are particularly interested in experiences in which people actively construct public art within the boundaries created by the artist. In particular, where people both experience and contribute to the creation of the collective artwork. The key to evaluating the experience of collective artworks is to identify points at which people mutually engage in micro-creativity together. This involves identifying the birth, development, and sustenance of micro-ideas, or memes as they propagate through the socially constructed experience. We first outline which it might mean to be mutually engaged with other people, and then go on to explore the concept of micro-creativity and the emergence of memes. Finally, we describe visualisations which help us to explore the value judgements of participants engaged in micro-creativity through memetic evaluation.

N. Bryan-Kinns (✉)
Interactional Sound and Music, Centre for Digital Music,
Queen Mary University of London, London, E1 4NS, UK
e-mail: n.bryan-kinns@qmul.ac.uk

L. Candy and S. Ferguson (eds.), *Interactive Experience in the Digital Age: Evaluating New Art Practice*, Springer Series on Cultural Computing, DOI 10.1007/978-3-319-04510-8_9,

9.1 Introduction

The subjective and deeply personal nature of art appreciation makes evaluating any one person's response to artworks not only problematic, but also counterproductive, destroying the very visceral experience that is under the microscope. There can be no rules about what makes 'good' art (cf. Kandinsky); instead, this chapter examines the socially constructed responses that emerge through interaction with pieces designed for collective experience. The focus here is on the moments of creative spark that emerge between people as they mutually engage through collective art forms which exploit new forms of digital social infrastructure to create socially empowering public digital art forms where the emphasis is on the enjoyment of being creative together rather than art per se. The fluidity of such interaction allows for *micro-creativity* – digitally mediated creative activities, which can be carried out as a number of fleeting collaborative interactions over an extended period of time, and in a wide range of interaction contexts from galleries to mobile phones. The public art in these situations is in the experience, not the physical piece itself which often does not exist in any case.

Digitally Mediated Public Art uses technology to create situations in which multiple people interact in an artistic experience. In this chapter, we are particularly interested in experiences in which people actively construct public art within the boundaries created by the artist – where people both experience and contribute to the creation of the collective artwork. The key to evaluating the experience of collective artworks is to identify points at which people *mutually engage* in micro-creativity together. This involves identifying the birth, development, and sustenance of micro-ideas, or *memes* as they propagate through the socially constructed experience. In this chapter, we first outline what it might mean to be mutually engaged with other people, and then explore the concept of micro-creativity and the emergence of memes. Finally, we explore visualisations which help us to explore the value judgements of participants engaged in micro-creativity through *memetic* evaluation.

9.2 Mutual Engagement

Mutual engagement occurs when people creatively spark together, lose themselves in their joint action, and arrive together at a point of co-creation (Bryan-Kinns and Hamilton 2009; Bryan-Kinns 2012). It is imprinted in the moment-by-moment contributions of people when they are engaged in micro-creativity. In collective art, the artist creates pieces which provide the opportunity and boundaries for participants to mutually engage with each other as part of the experience of the work. 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. Furthermore, as the points of interaction are

fleeting it is difficult to assign value or worth to individual points of micro-creativity. The most important characteristic of mutual engagement is that it involves engagement with both the collective artwork *and* with the other people who are engaging with the work. Engagement is the point at which people feel that they are able to change and appreciate changes in the artwork (cf. Douglas and Hargadon 2000) – it involves appreciation of possible contributions and anticipation of their outcomes. This is similar to descriptions of flow (Csikszentmihalyi 1991) that is, optimal experiences in which "attention can be freely invested to achieve a person's goals" resulting in a merging of action and awareness and consequent lack of self awareness and distortion of sense of time. Collective artworks do not usually have explicit goals (e.g. to score the highest points, or perform an activity the quickest); instead, the artist creates experiences and opportunities which provide implicit goals such as making a funny picture, or creating a nice tune. In mutual engagement, people are engaged with the product at hand, and also with others in the collaboration (Bryan-Kinns and Hamilton 2009), which is similar to *group flow* (Sawyer 2003), but the focus is on the moment-by-moment interaction rather than experiences lasting hours or days.

Understanding mutual engagement in collective art involves identifying points at which there is:

- Evidence of engagement with the collective artwork itself. For example, people's reports of feeling engaged with the output of the artwork, a high quality joint composition, focused contributions in the interaction, or demonstrations of skills and expertise in creating contributions.
- Evidence of engagement with others in the artwork. For example, more reports of feeling engaged with the group, coherent final joint products, making contributions close to other people, mutual modification of contributions, discussions of quality of the joint product, repetition and reinterpretation of others' contributions. Clearly these forms of engagement rely on people's skills and expertise with the digital mediation of the experience.

9.3 Mutual Engagement and Music

Music is an artistic activity which relies heavily on mutual engagement – the riffing and jamming on musical ideas generates new forms of creative expression which convey emotion without words or pictures. More importantly, music is a basic form of human expression found in all cultures: it is both a cultural expression and a result of personal creativity. Indeed, music making is fundamentally social, collaborative, and open in nature (cf. Titon 1996), whereas the Western Art Music tradition has typically focussed on high artistic and technical virtuosity. Music conveys emotion, and can transport us to different times and places. Digitally Mediated group music experiences allow for artistic creativity on many levels: as a participant who makes music within the experience, as the artist who creates the environment

for the experience, and as audience who may appreciate recordings and reuse of the music at a later point. Trying to differentiate between the composition of music, its performance, and improvisation is problematic (cf. Bowers 2002), and many practising musicians would argue that writing about music is counter-productive (cf. Laurie Anderson). However, by identifying the birth, development, sustenance, and propagation of musical ideas (or memes, cf. Dawkins 1976) in mutually engaging micro-creativity, we believe that we can begin to understand and evaluate the creativity that goes on in these collective art experiences, and this will help to inform the design and creation of future Digitally Mediated Public Art.

9.4 Micro-creativity

The emergence of new forms of digital social infrastructure including social networks such as Facebook and micro-blogging tools such as Twitter illustrate the populist potential of digital technologies to provide increased opportunities for collective creativity. These on-going creative activities where the emphasis is on the enjoyment of being creative with other people are referred to as *micro-creativity* and have the following features:

- Digitally-mediated creative activities
- Carried out as a number of fleeting collaborative interactions
- Happen over an extended period of time
- Take place through a wide range of digital mediation from desktop computers to mobile phones

For example, people use micro-blogging tools to play word games over periods of weeks, or to engage in collective (micro) drawing by uploading and iteratively editing small shared sketches, or even to programmatically create music. Similarly, artists have used and subverted social networking to create digitally mediated collective art works, which rely on micro-creativity between participants to socially construct the artistic experience.

Clearly different media and artistic intent foster different forms of memes, from musical memes to graphical sketches or even new forms of dance. As discussed above, music is particularly interesting as an art form as it is a collective experience without words or visual images; it requires skill to produce beautiful music, yet anyone can be emotionally touched by music. In this way, music is both inclusive and exclusive, and acts as a cultural memory. Moreover, digital technologies now empower us with the ability to make and share music wherever we may be, and provide unique opportunities to explore new forms of music making.

In contrast to 'telematic' musical experiences (e.g. Chap. 8 ("The Network Unveiled: Evaluating Intercultural Musical Interaction"), Mills and Beilharz 2014), in micro-creativity we are interested in new forms of music making in collective art experiences which extend over longer periods of time and may not require highly skilled, virtuosic performances, as illustrated by some of the developments in the

field of New Interfaces for Musical Expression (NIME; Poupyrev et al. 2001). For example, Ocarina (Wang 2009), and Daisyphone (Bryan-Kinns 2004) are mobile phone Apps for social music making. Ocarina supports micro-creativity by allowing people to create short pieces of music using a simple four key interface. These musical contributions are then shared with a global community of users who can tag and rate them. In contrast, Daisyphone allows direct co-editing of short loops of music, but little support is provided for social interaction beyond the music.

9.5 Exploring Mutual Engagement in Micro-creativity

In order to explore mutual engagement in micro-creativity, the author has developed and studied a number of collective music making software environments. These systems provide a shared environment in which the seeding and evolution of memes and mutual engagement can be studied between people in the same place, and across the world. It is important to note that these are not Public Art pieces per se, but rather systems in which people can create music together over time, and their actions and reactions be observed, analysed, and interpreted to help understand how the interactive characteristics of the shared experience change the micro-creativity. These understandings could be used to inform artists' creative practice and reflections on collective and public art. The systems provide a peek into the future of what interactive public art could be experienced as. This contrasts practice-led research such as (Costello and Edmonds 2007) where the emphasis is on reflection on the artists' practice and technology: these systems place the emphasis on exploring how micro-creativity emerges and is sustained which we argue is vital to socially constructed artistic experiences.

The key environments discussed in this chapter are Daisyphone and Daisyfield (referred to collectively as Daisy*). Both environments allow co-editing of short loops of music by co-located and online groups of users through web and iOS interfaces in focused sessions or over extended periods of time. Daisyphone was launched in October 2003 (Bryan-Kinns 2004), and at launch it received between 4 and 18 players per day from all over the world. Logs of interaction have been collected since its launch, and there are now 160 Mb of log files, or approximately ten million individual interactions.

In Daisyphone, there is a shared loop of music (5 s; 48 beats) chosen to be the most reduced and constrained piece of shared creativity that still contains scope for expression, which can be edited by up to ten networked people at the same time. Each person can create notes using four different voices, can edit any notes, and can draw on a shared drawing area to allow for some social communication beyond the music. Figure 9.1 illustrates Daisyphone in use on an Apple iPhone; the score is represented by the circle of dots, and the currently played set of notes is indicated by the grey line radiating from the centre which rotates clockwise over the period of 5 s. Shapes represent different kinds of sound (ambient electronic sound palette in C major scale consisting of bass, lead, wash, and percussion). The shapes in the

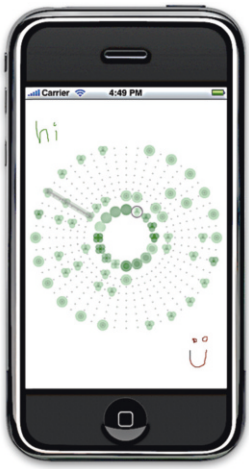

Fig. 9.1 Daisyphone

Fig. 9.2 Daisyphone co-located

centre allow participants to select which sound type and volume they create notes with. Colours can be assigned to people to provide a sense of identity as discussed later. Figure 9.2 illustrates two co-located people using Daisyphone at the same time.

Daisyfield is a development of the Daisyphone concept which allows multiple loops (i.e. Daisys) to be played concurrently, and for participants to arrange their Daisys in a two dimensional space. Again, a single shared score of 48 beats is created form the individual Daisys, and each participant hears the same audio output. Figure 9.3 illustrates the Daisyfield interface with three Daisys shown, the larger one is opened for editing. The aim of this interface is to provide a richer musical and communicative user interface for exploring mutual engagement in micro-creativity.

By undertaking controlled studies in laboratory situations we have studies the interaction between people engaging in group music making with Daisy* in

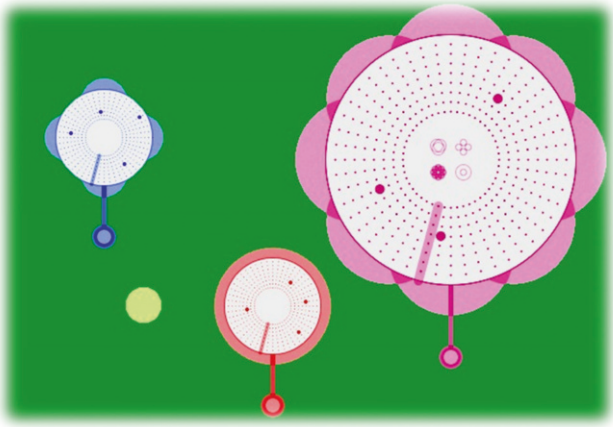

Fig. 9.3 Daisyfield

co-located and online settings. We correlated the results of these experiments with a reliable questionnaire for identifying mutual engagement in interaction (the Mutual Engagement Questionnaire (Bryan-Kinns 2012)) to show the following (see Bryan-Kinns 2004, 2011, 2012; Bryan-Kinns and Hamilton 2009):

- Providing cues to identity increases mutual engagement between participants
- Providing additional communication channels beyond the shared music increases mutual engagement
- More focussed interaction indicates mutual engagement between people, rather than more interaction per se
- Persistent music supports learning; transient music supports skilled expression
- When mutually engaged, participants move their music closer to each other and produce better quality music

Whilst these results are useful and significant, they are the result of controlled laboratory studies which do not give us an insight into the experiential aspects of mutual engagement in public art. They help us to design interaction which is more mutually engaging, but they do not expose the underlying experience of art in public, nor do they explore the micro-creativity over extended periods of time. Instead, we need to take a more observational approach to understanding the mutual engagement. Observing participants in co-located settings such as museums, or even specially created observation spaces in museums such as Beta_space (Turnbull and Connell 2011) would provide more insight into the co-located experience, but not the online experience over extended periods of time. Indeed, research has examined how musical ideas are generated and built on by participants in group music improvisations (Healey et al. 2005), using Video Cued Recall techniques as discussed in Chap. 3 ("Evaluation and Experience in Art", Candy 2014), but these would be impractical for use over extended periods of online activity.

Instead, what we are interested in is identifying the birth, development, sustenance, and propagation of musical ideas (or *memes*, cf. Dawkins 1976). This gives us a window into the experience of public art on land, online, and over extended periods of time, identifying what people make within the artists' boundaries, exploring how people value each others' micro-creativity in the collective artistic experience.

The rest of this chapter shows how memes can be tracked over extended periods of time through case studies of 10 years of public online music making. Extensive studies show that mutual engagement relies on shared awareness of collective creativity, and that focussed interaction results in the most compelling and engaging memes. Subjective measures of engagement and enjoyment have also been shown to be correlated with coherent and high quality contributions to the shared experience. Examining memes allows us to:

- Observe "art as experience" as discussed in Chap. 3 (Candy 2014) – observing the fundamental evolution of the art within the boundaries set by the artist.
- Expose participants' evaluation of their own, and others' contributions to the collective art – appraising and judging the worth of memes cf. judging worth discussed in Chap. 3 (Candy 2014) – to understand which memes participants judged to be valuable enough to repeat, modify, and repurpose.

9.6 Visualisations of Memes

Observing the evolution of memes over times requires visualisations which collapse the interaction across space and time. These visualisations expose the inter-personal micro-creativity and allow us to observe how memes cohere in mutually engaging experiences, fragment as the engagement decreases, and can be tracked over time and space.

The first step in tracking the birth and growth of memes in micro-creativity is to be able to algorithmically identify them in the on-going interaction. This is no mean feat as micro-creativity extends over time and involves multi-faceted interaction. Identifying and tracking memes by hand would take an impractically long time. Instead, we use pattern matching approaches to discover musical structure and repeating patterns (cf. Dannenberg and Hu 2002), using the following heuristics as the basic characteristics of musical memes:

- At least three notes (not pauses), and
- No more than two pauses between notes.

From this definition of musical memes we can collapse the data across the following dimensions to provide useful visualisations of the mutually engaging interaction:

- Time: when the meme was made and also when it was modified. Varying the granularity of the time dimension allow memes to be tracked as they develop.

Fig. 9.4 Development of a meme

- Participant: who started the meme, and who contributed to its on going creation. More co-editing indicates greater mutual engagement between participants.
- Spatial location: where the meme is located in the user interface. Closer memes indicate more mutual engagement (Bryan-Kinns 2012).
- Musical range of the meme: whether the meme is monophonic or polyphonic, and whether there is a wide dynamic of notes in the meme.
- Density of musical meme: what percentage of musical pauses are used in the meme. This allows us to track musical style in the music.

Removing the spatial dimension, and laying memes out sequentially allows us to visualise their development over time. Figure 9.4 illustrates the development of a musical meme by one participant. The meme starts from a sequence of two pairs of notes in the leftmost box, after four iterations, the meme has become an interesting musical meme composed of a three descending notes followed by three rising notes.

Figure 9.5 illustrates the memes identified in 15 min of interaction between four participants using Daisyfield. This is fairly representative of the typical progression of memes in the extensive studies undertaken. In the figure, several memes are seen emerging (time is laid out from left to right, top to bottom), for example the meme illustrated in Fig. 9.4 is clearly seen in Fig. 9.5 as it develops and is repeated. Figure 9.5 also shows the persistence, or popularity (as participants can delete notes they are unhappy with), of certain memes such as the descending sequence of notes, which is repeated throughout most of the 15 min interaction.

Figure 9.5 also illustrates points at which participants complement each other's contributions and co-create musical memes together. For example, on the fifth row down the green and red participant co-create a musically harmonious meme together as summarised in Fig. 9.6. This shows high levels of mutual engagement as the participants feed off each other's contributions. Other examples are shown in the second and third rows to the bottom of Fig. 9.5. These examples are important as they illustrate participants' evaluation of their own, and, importantly, each other's contributions, by assessing the value and worth of contributions participants co-create the memes over time.

Such visualisations can also be applied to co-located Public Art such as Digital Live Art (Sheridan 2006), for example iPoi (Sheridan et al. 2007) in which participants were observed developing and propagating interaction memes of 'trading pauses' and 'emphasising beats' through the use of technologically augmented poi. These interaction memes were not designed for, but instead were

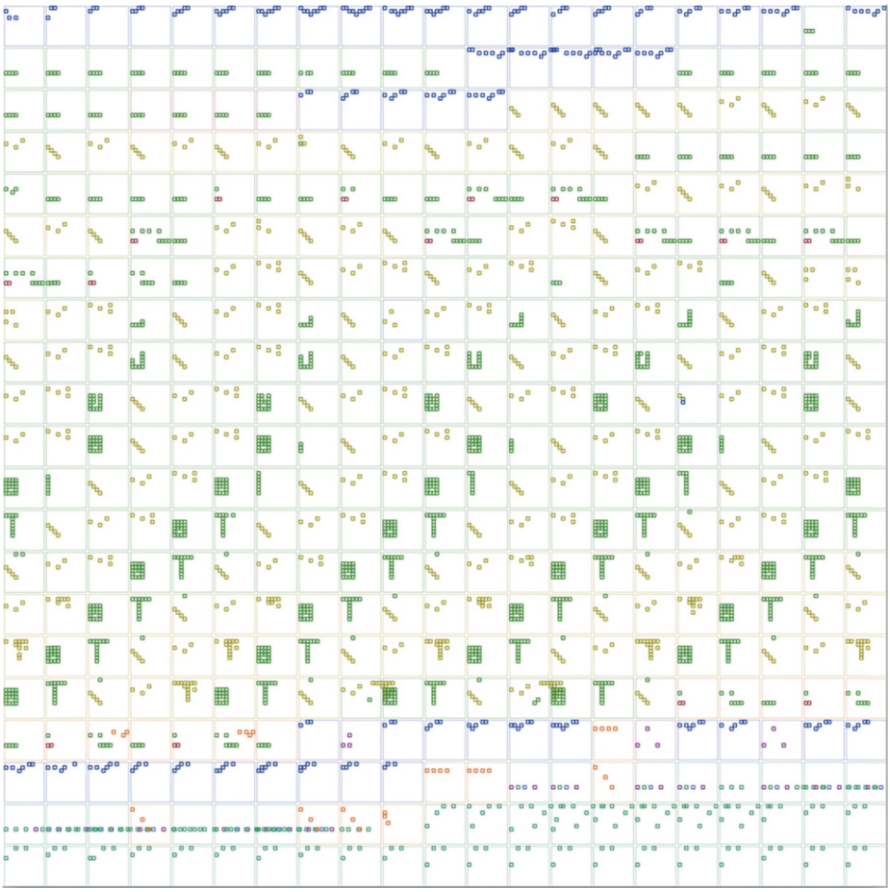

Fig. 9.5 Typical 15 min of four people's memes

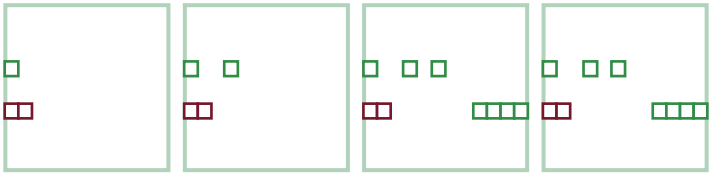

Fig. 9.6 Complementary development of meme

observed emerging in the interaction between skilled participants. Tracking the development and sustenance of such memes would be an ideal application of the visualisations above.

However, these visualisations quickly become overly complex when larger data sets are examined. Instead we need to abstract away from the content of the meme,

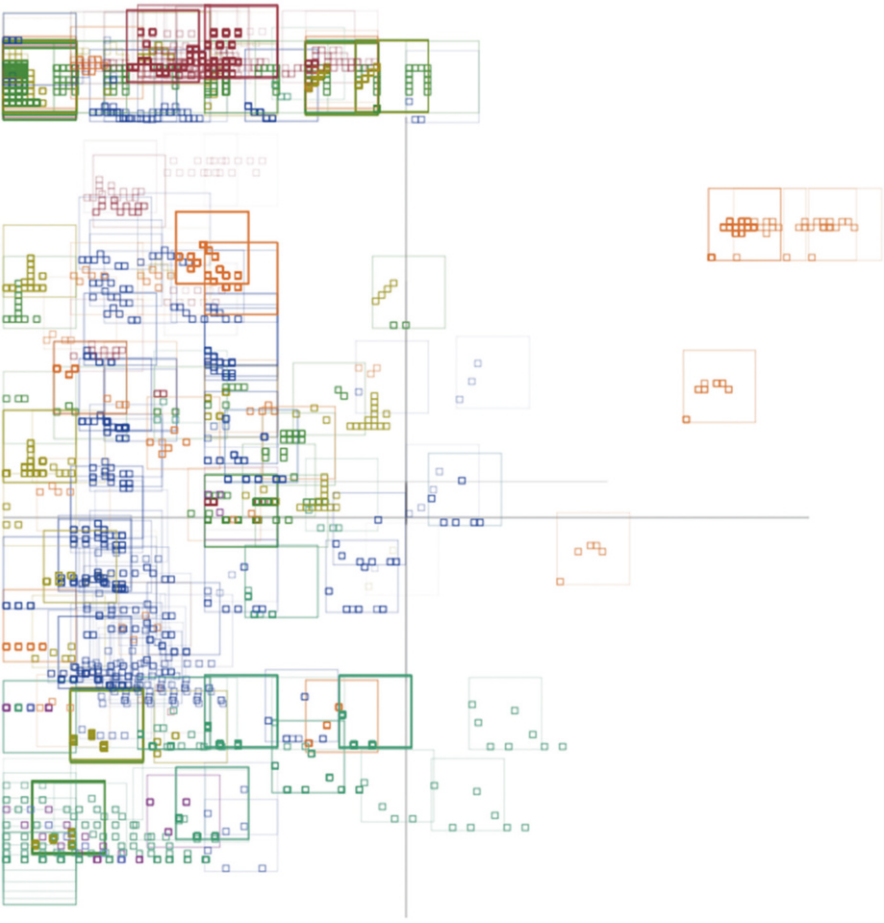

Fig. 9.7 Laying out memes by musical properties

and focus instead on the characteristic properties of memes. Musical features such as complexity and rhythm can be algorithmically identified and mapped to visual dimensions to provide a richer visualisation of the emergence of memes. Figure 9.7 shows the same set of memes illustrated in Fig. 9.5, but with x mapped to musical complexity, and y mapped to musical rhythm. This provides a visualisation which allows us to spot styles of musical contribution, and to identify whether these are tied to specific participants. In Fig. 9.7, it is clear that the orange participant has the most unique musical style – quite musically complex with only a few pauses in their memes, demonstrated by their memes being in the right side of the visualisation. The dark green participant predominantly made memes with no pauses (top left quadrant), whereas the light green participant predominantly made memes with half the beats as pauses (bottom left quadrant). Overall, it can be seen that most participants created quite monophonic memes (containing notes predominantly of the

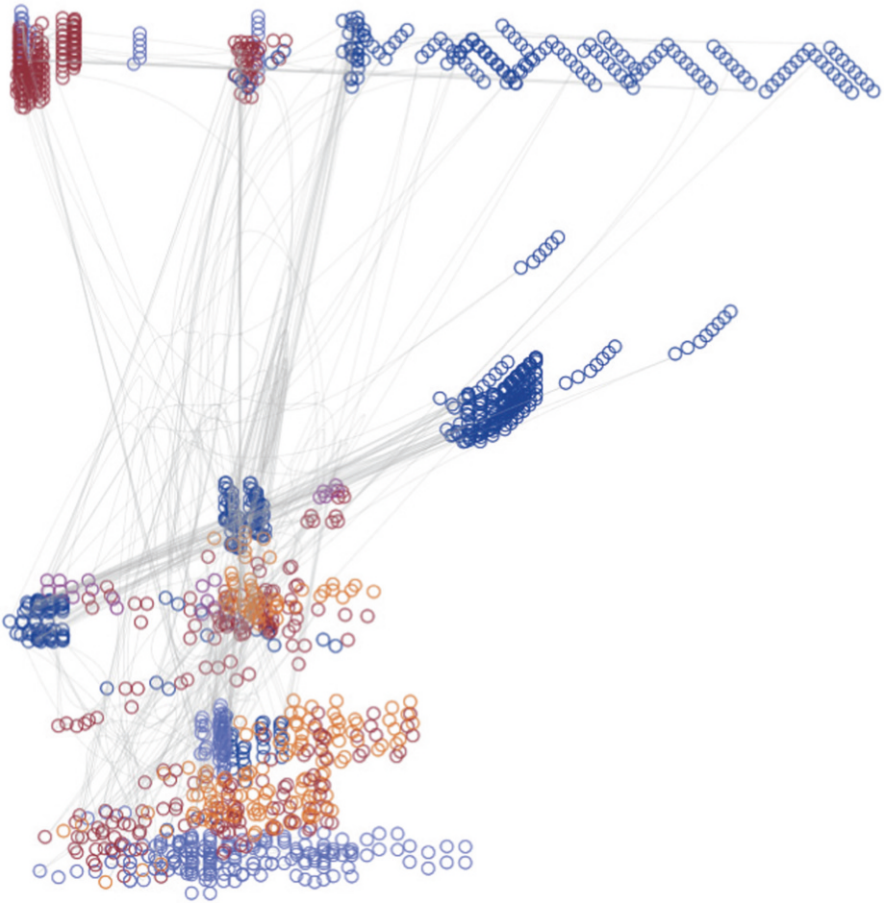

Fig. 9.8 Adding time to musical properties – group A

same pitch). This is may in part be use to the ambient nature of the music which may favour simple memes. It would be interesting to explore whether the same pattern is found with other musical styles, or other levels of musical experience of participants. The interesting aspect of such pieces of interaction is that we can see that participants are making different kinds of memes, and if we switch to spatial layout of visualisations, we see that they are making these contributions in different spatial locations, but at the same time. So, space and musical features are similarly differentiated between participants. The interactive nature of the visualisations allows us to easily explore such connections.

Whilst Fig. 9.7 illustrates the kinds of memes developed in a typical 15-min session, it has lost the sense of time, or, the development of memes. Figures 9.8 and 9.9 add to the visualisation of memes laid out by style by adding temporal connections between memes as grey lines connecting memes in temporal sequence. In Fig. 9.8, the grey lines indicate that there were frequent moves

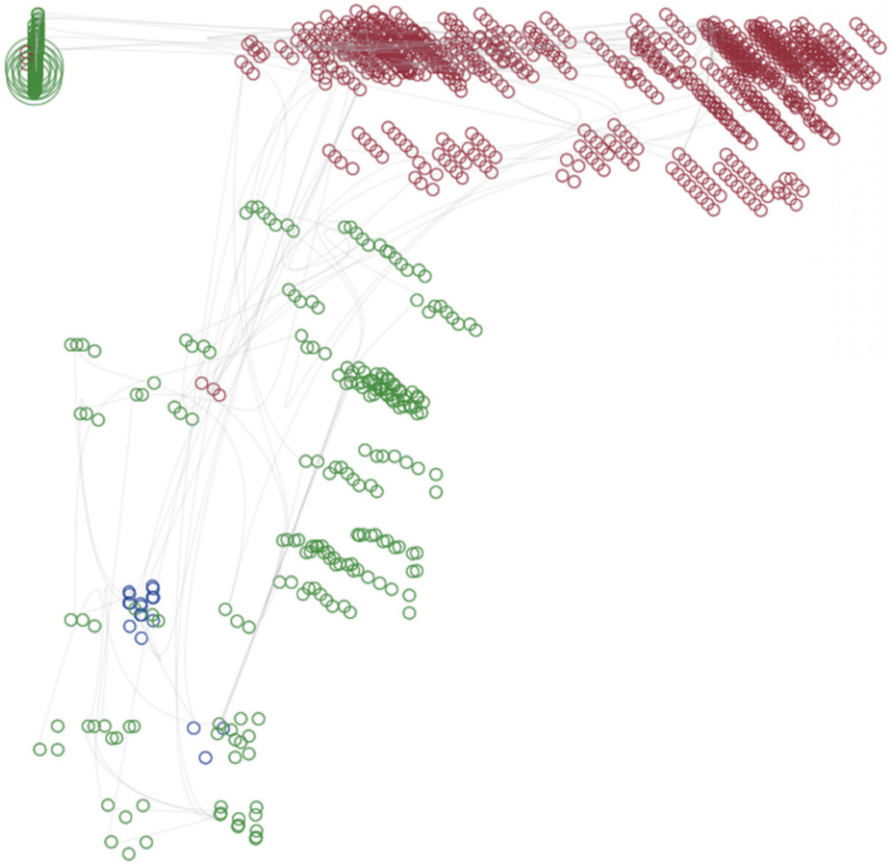

Fig. 9.9 Adding time to musical properties – group B

between memes of low rhythmical complexity (top of figure) to those with high rhythmical complexity (bottom of figure), for the group of participants. Most of the movement left-to-right in the figure (low musical complexity to high musical complexity) appears to be the work of the blue participant between their two main groups of memes. These two observations indicate:

1. That participants engaged in micro-creativity with different rhythmical patterns at the same time, some of which converged e.g. the red, orange, and light blue converge at similar rhythm and complexity at the bottom left of the visualisations. This indicates that three of the participants were mutually engaged and building on each others' contributions – using their value judgement to evaluate each others' contributions to inform their own contribution.
2. That over time the blue participant spent quite a bit of time experimenting with musical complexity which was not picked up by other participants. This indicates that one participant was engaged with his own personal activity (and the creative output), but not mutually engaged with others in the collective creativity.

In contrast, Fig. 9.9 illustrates the development of memes in a different group (B). In group A, each participant saw their musical contributions in a unique colour, whereas in Group B, all musical contributions were displayed in the same colour. Group B does not appear to converge on a shared musical style: the red participant focuses on simple descending sequences of notes, whilst the green participant explores more rhythmical musical structures. There are significantly fewer grey lines connecting the memes over the same period time as group A, indicating that participation was more turn-taking rather than overlapping. These observations from the visualisations support with the findings of previous research on the role of identity in mutual engagement (Bryan-Kinns and Hamilton 2009; Bryan-Kinns 2012), providing a richer, more explanatory account of the interaction.

These observations would lead us to investigate the interaction further and ask why one participant's experiments were not taken up by other participants, especially as the other three participants did converge on a particular musical style. It is a question of understanding participants' value judgements in their socially constructed musical composition. These value judgements are beyond the scope of visualisation – they require a more reflective evaluation technique, some akin to Video Cued Recall (Chap. 3) exploiting the interactive nature of the visualisations. The visualisations may provide a complementary source of data for evaluating telematic music making (e.g. Chap. 8) where rich video recordings of group music making could be enhanced by examining how musical memes propagate and develop across time. Similarly, musical memes could be automatically identified in technologically support group music making in co-located systems such as Polymetros described in Chap. 12 ("In the Wild: Evaluating Collaborative Interactive Musical Experiences in Public Settings", Bengler and Bryan-Kinns 2014).

Tracing and visualising the trajectory of memes has parallels in the Human Computer Interaction domain with the understanding of Interaction Trajectories (cf. Blandford et al. 2001). In the HCI domain, we are interested in tracing how a single user navigates the possible interaction with a single device, and whether they take deviate from an ideal path. Interactive visualisations discussed in this chapter could be used to explore multiple users' individual trajectories projected into one time and space domain. This would allow us to identify common and reoccurring patterns of interaction through the clustering approaches discussed in this chapter. Moreover, the visualisations discussed in this chapter could be much more powerfully applied to multi-user interaction, in particular, large-scale multi-user interaction such as social media networks. Applying the memetic analysis and visualisation to twitter feeds and Facebook networks would provide a rich interactive view of how large numbers of people engage in micro-creativity, and how they mutually engage over extended periods of time. The memes in these situations would be words and images requiring different ways of identifying memes, but exploiting the same visualisation approaches.

Public Digital Art Evaluation often considers evaluation of the Art by Audience or Artist: see for example, Chap. 2 ("Human Computer Interaction, Experience and Art", Edmonds 2014). In contrast, mutual engagement is about understanding the interaction between people whether they are audience

members, participants, or artists. In this chapter, we have explored the mutual engagement between participants engaged in a public creativity activity, which provides an orthogonal, or counter-balancing evaluation of Public Digital Art. The visualisation approach could usefully be employed to understand how people engage with each other through physical interaction in the Tweetris experience (Chap. 11 ("Blending Art Events and HCI Research"), Reilly et al. 2014) and body positions could be interpreted as memes and visualised across time to help us understand the social elements of the piece.

9.7 Conclusions

This chapter explores how we can identify mutual engagement in collective art. We considered how this could be applied to micro-creativity in on-going interactive Public Art, and considered some visualisations of the birth, growth, and development of musical memes. Whilst the work in this chapter predominantly focuses on musical interaction, we argue that this fundamental form of interaction provides us with insights which could be applied to other forms of interactive Public Art such as Digital Live Art.

It is important to remember that by examining the inter-personal interaction that emerges in Public Art we remove ourselves from the question of what is 'good' art, and focus instead on what makes for mutually engaging experiences which touch our soul which, after all, is the purpose of art.

Acknowledgments Supported by EPSRC Design Patterns for Inclusive Collaboration (EP/J017205/1), EPSRC Engaging Collaborations (GR/S81414/01), EPSRC Platform Grant: Digital Music (EP/K009559/1). With many thanks to Ernest Edmonds and Linda Candy for supporting my appointment as Honorary Visiting Fellow at the Creativity and Cognition Studios, Faculty of Engineering & Information Technology, University of Technology, Sydney Australia.

References

Bengler B, Bryan-Kinns N (2014) In the wild: evaluating collaborative interactive musical experiences in public settings. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 169–186

Blandford A, Stelmaszewska H, Bryan-Kinns N (2001) Use of multiple digital libraries: a case study. In: Proceedings JCDL 2001. ACM Press, New York, pp 179–188

Bowers J (2002) Improvising machines. M.S. thesis, Masters in Music by Research, University of East Anglia, Norwich, UK

Bryan-Kinns N (2004) Daisyphone: the design and impact of a novel environment for remote group music improvisation. In: Proceedings of DIS 2004, Boston, USA, pp 135–144

Bryan-Kinns N (2011) Annotating distributed scores for mutual engagement in Daisyphone and beyond. Leonardo Music J 21:51–55

Bryan-Kinns N (2012) Mutual engagement and collocation with shared representations. Int J Hum Comput Studies 71:76–90

Bryan-Kinns N, Hamilton F (2009) Identifying mutual engagement. Behav Inf Technol 31(2):101–125
Candy L (2014) Evaluation and experience in art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 25–48
Costello B, Edmonds E (2007) A study in play, pleasure and interaction design. In: Proceedings of the 2007 conference on Designing Pleasurable Products and Interfaces (DPPI'07). ACM, New York, pp 76–91
Csikszentmihalyi M (1991) Flow: the psychology of optimal experience. Harper Collins, New York
Dannenberg R, Hu N (2002) Pattern discovery techniques for music audio. In: Proceedings of 3rd international conference on Music Information Retrieval (ISMIR), Paris, France
Dawkins R (1976) The selfish gene. Oxford University Press, New York
Douglas Y, Hargadon A (2000) The pleasure principle: immersion, engagement, flow. In: Shipman F (ed) Proceedings of hypertext 2000. ACM, New York, pp 153–160
Edmonds EA (2014) Human computer interaction, experience and art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 11–23
Healey PGT, Leach J, Bryan-Kinns N (2005) Inter-play: understanding group music improvisation as a form of everyday interaction. In: Proceedings of less is more — simple computing in an age of complexity. Microsoft Research, Cambridge
Mills R, Beilharz K (2014) The network unveiled: evaluating intercultural musical interaction. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 109–122
Poupyrev I, Lyons MJ, Fels S, Blaine T (2001) New interfaces for musical expression. In: Tremaine MM (ed) CHI'01 extended abstracts on human factors in computing systems, Seattle, USA. ACM, New York, pp 491–492
Reilly D, Chevalier F, Freeman D (2014) Blending art events and HCI research. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 152–168
Sawyer KR (2003) Group creativity: music, theater, collaboration. Psychology Press, Mahwah
Sheridan JG (2006) Digital Live Art: mediating wittingness in playful arenas. PhD thesis. Computing Department, Lancaster University, Lancaster, UK
Sheridan JG, Bryan-Kinns N, Bayliss A (2007) Encouraging witting participation and performance in digital live art. In: Ball LJ, Sasse MA, Sas C, Ormerod TC, Dix A, Bagnall P, McEwan T (eds) People and computers XXI – design for life: proceedings of 21st British HCI Group annual conference, Lancaster, UK. Springer, Berlin, pp 13–23
Titon JT (1996) World of music. Schrimer Books, New York
Turnbull D, Connell M (2011) Prototyping places: the museum. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publishing, Faringdon, pp 79–93
Wang G (2009) Designing Smule's iPhone Ocarina. In: Proceedings of the international conference on new interfaces for musical expression, Pittsburgh