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Crowd-composition: Exploring the Qualities of Collective Creativity

by

Joseph Philip Manghan

ORCID ID: orcid.org/0000-0002-1638-7858

Thesis for the degree of DOCTOR OF PHILOSOPHY

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Crowd-composition is the practice of outsourcing a creative task to a crowd, leading to a new musical composition that is assembled and shaped by collective input. Crowdsourcing is a key stimulus. However, whilst crowdsourcing has become a commonplace and well-researched practice, crowd-composition itself remains largely unexplored. This project aimed to consolidate, add to and develop the field. Its central research concern was to investigate properties relating to participation, and in doing so asked:

- How can crowd-composition facilitate meaningful experiences for participants?
- How can crowd-composition lead to musical works or perspectives that are distinct from sole agent composition?

This led to four original crowd-composition works, submitted as the portfolio component of this doctoral project, which are built on a process of experimentation that sought to explore these questions. The works utilised voting techniques as the primary mechanism for collective decision-making. Analysis demonstrated the effectiveness of a number of particular elements, as well as insights into distinct outcomes of crowd-composition. A central finding was the importance of engaging and managing the attention of crowds, which was shown to be an essential factor in the success of the aforementioned works. To this end, the project led to a number of lessons to share for enhancing this aspect.
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<td>Children</td>
<td>Dec, 2018</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>Second study</td>
<td>ElectroQuiz 3</td>
<td>Children</td>
<td>Mar, 2019</td>
</tr>
</tbody>
</table>
# List of Accompanying Materials

## Workshop performance packs*

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>‘HyperCello’ [main study] performance pack</td>
</tr>
<tr>
<td>2</td>
<td>‘It Wasn’t All Yellow’ [second study] performance pack.</td>
</tr>
<tr>
<td>3</td>
<td>‘ElectroQuiz’ [second study] performance pack.</td>
</tr>
</tbody>
</table>

* These materials can be considered the scores of the three interactive workshops submitted in the portfolio component of this doctoral project.

## Audio recordings

<table>
<thead>
<tr>
<th>Track</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>‘ElectroQuiz’ [main study] completed melody.</td>
</tr>
<tr>
<td>2</td>
<td>‘HyperCello’ [main study] final score and improvisation.</td>
</tr>
<tr>
<td>3</td>
<td>‘It Wasn’t All Yellow’ [first study] final score.</td>
</tr>
<tr>
<td>4</td>
<td>‘It Wasn’t All Yellow’ [second study] final score.</td>
</tr>
<tr>
<td>5</td>
<td>‘ElectroQuiz’ potential output variety.</td>
</tr>
<tr>
<td>6</td>
<td>‘ElectroQuiz’ [first study] completed materials.</td>
</tr>
<tr>
<td>7</td>
<td>‘ElectroQuiz’ [pilot] completed materials.</td>
</tr>
<tr>
<td>8</td>
<td>‘ElectroQuiz’ [second study] completed materials.</td>
</tr>
</tbody>
</table>

## Video footage

<table>
<thead>
<tr>
<th>Video</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Workshop footage compilation*.</td>
</tr>
<tr>
<td>2</td>
<td>‘HyperCello’ [main study] full recording.</td>
</tr>
<tr>
<td>3</td>
<td>‘It Wasn’t All Yellow’ [first study] full recording.</td>
</tr>
<tr>
<td>4</td>
<td>‘It Wasn’t All Yellow’ [second study] full recording (partial).</td>
</tr>
<tr>
<td>5</td>
<td>‘ElectroQuiz’ – controllers demonstration.</td>
</tr>
<tr>
<td>6</td>
<td>‘ElectroQuiz’ [first study] full recording.</td>
</tr>
<tr>
<td>7</td>
<td>‘ElectroQuiz’ [second study] full recording.</td>
</tr>
</tbody>
</table>

* Specific clips are occasionally referenced in the text, using the following format:

*NAME OF WORK [iteration] – Clip # timestamp*
<table>
<thead>
<tr>
<th>Data DOI</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="https://doi.org/10.5258/SOTON/D1210">https://doi.org/10.5258/SOTON/D1210</a></td>
</tr>
</tbody>
</table>
Research Thesis: Declaration of Authorship

Print name: Joseph Philip Manghan

Title of thesis: Crowd-composition: Exploring the Qualities of Collective Creativity

I declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. None of this work has been published before.

Signature: ........................................................................................................ Date: ..............................
Acknowledgements

First, my thanks go to my supervisors, Dr Benjamin Oliver, Dr Matthew Shlomowitz, and Dr Mark Weal. Their advice and guidance has been invaluable in the creation of this portfolio and its accompanying commentary. I also need to express my thanks for having received the Vice Chancellors’ Strategic Project Award in Music, which generously funded this project.

My gratitude must be extended to the performers who have contributed to this doctoral project. Their enthusiasm, patience and advice was instrumental in shaping the portfolio: Oliver Coates, Filipa Botelho, Tom Pauwel, Dr Benjamin Oliver, Adam Stockbridge, Dr Ben Jameson, and Harry Matthews. Similarly, I will forever be grateful to the various participants, both in the form of Web users and audiences, that have played such a pivotal role here.

My thanks also goes to those that were kind enough to provide incredible opportunities to perform my works: the University of Southampton’s Music Department, OUT-TAKE ensemble, SÓN, and their Artistic Director Robin Browning, the John Hansard Gallery, and the Southampton Music Service.

Finally, there are a number of strangers, colleagues, friends, and family members who have been an invaluable source of support over the years. In this regard, my thanks goes particularly to Dr Alexander Glyde-Bates, Mark Wiseman, George Howell, Austin Kennedy, Clare and Marco Belli, and Ann and Robert Higgs. Each have, in their own way, helped me traverse the minefield of postgraduate study. Last of all, I must thank my family – my parents and sisters – without whom this undertaking would not have been possible.
## Definitions and Abbreviations

<table>
<thead>
<tr>
<th>Term</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acorn</td>
<td>A foundational string ensemble in the Southampton Music Service.</td>
</tr>
<tr>
<td>Author</td>
<td>The creator of a crowd-composition project. The term is used as a distinction between the creator, and the compositional process that takes place within a project. The latter invites crowds to be composers, and so referring to the author as composer creates confusion.</td>
</tr>
<tr>
<td>Composition data</td>
<td>Three categories of data produced by the crowd-composition works in the portfolio: voting data, survey data, and impressions.</td>
</tr>
<tr>
<td>Concert-environment</td>
<td>One of the mediums in which my portfolio works took place. Concert-environment works took place in live, concert settings, over a focused period of time.</td>
</tr>
<tr>
<td>Crowd agency</td>
<td>The level of control a crowd has in a crowd-composition work.</td>
</tr>
<tr>
<td>Crowd cohesion</td>
<td>The combination of majority strength and the crowd’s perception of influence in a portfolio work.</td>
</tr>
<tr>
<td>Crowd creation</td>
<td>The practice of outsourcing creative tasks to a crowd.</td>
</tr>
<tr>
<td>Crowd wisdom</td>
<td>The practice of harnessing a crowd’s knowledge in order solve problems or predict future outcomes.</td>
</tr>
<tr>
<td>Crowd-composition</td>
<td>The practice of outsourcing a creative task to a crowd, leading to a new musical composition that is assembled and shaped by collective input.</td>
</tr>
<tr>
<td>Crowdfunding</td>
<td>The practice of funding a project or venture by raising monetary contributions from a large number of people.</td>
</tr>
<tr>
<td>Crowdsourcing</td>
<td>The practice of obtaining information or services by soliciting input from a large number of people, typically via the internet.</td>
</tr>
<tr>
<td>Crowdvoting</td>
<td>The practice of using voting techniques to determine the collective opinion of a crowd, or to make collective decisions.</td>
</tr>
<tr>
<td>Differential majority</td>
<td>When the theoretical probability is subtracted from majority strength, this leaves the differential majority.</td>
</tr>
<tr>
<td>Elgar</td>
<td>An intermediate string ensemble in the Southampton Music Service.</td>
</tr>
<tr>
<td><strong>Definitions and Abbreviations</strong></td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Instrumentalist</strong></td>
<td>One of the performative roles in my concert-environment portfolio works. The instrumentalists performed the developing and completed score for the crowd, as well as showcase poll options.</td>
</tr>
<tr>
<td><strong>Internet music</strong></td>
<td>Musical activities that are facilitated through the Web and other networks.</td>
</tr>
<tr>
<td><strong>JHG</strong></td>
<td>John Hansard Gallery.</td>
</tr>
<tr>
<td><strong>Majority strength</strong></td>
<td>The percentage of votes that each majority vote received.</td>
</tr>
<tr>
<td><strong>Majority vote</strong></td>
<td>The primary voting rule implemented in my portfolio works. Participants were tasked with selecting one from a list of options in any given poll, and the option with the most votes was selected as the collective decision.</td>
</tr>
<tr>
<td><strong>Mean majority</strong></td>
<td>Majority strength data is tallied and divided, categorised by the number of options each poll presented, and used to produce a list of arithmetic means. For example, a 3-option mean is the mean majority strength of polls in a portfolio work that presented 3 options.</td>
</tr>
<tr>
<td><strong>Mean overall majority</strong></td>
<td>Each mean majority is used to produce a mean for all polls completed in the work.</td>
</tr>
<tr>
<td><strong>Moderator</strong></td>
<td>One of the performative roles in my concert-environment portfolio works. The moderator led the workshops, acting as a conduit between the instrumentalists, operator, crowd and voting mechanism.</td>
</tr>
<tr>
<td><strong>Multiple majority</strong></td>
<td>When two or more options received an equal majority vote.</td>
</tr>
<tr>
<td><strong>Narrative</strong></td>
<td>The term used to refer to the unique path that participants take through the decision tree of select works in the portfolio.</td>
</tr>
<tr>
<td><strong>Navigational choice</strong></td>
<td>The term used to refer to instances where participants reach a crossroad in the decision tree of select works in the portfolio.</td>
</tr>
<tr>
<td><strong>OED</strong></td>
<td>Oxford English Dictionary.</td>
</tr>
<tr>
<td><strong>Operator</strong></td>
<td>One of the performative roles in my concert-environment portfolio works. The operator materialised the crowd’s decisions into a live score for all to read.</td>
</tr>
<tr>
<td><strong>Participant turnout</strong></td>
<td>Recorded attendance data.</td>
</tr>
<tr>
<td><strong>Definitions and Abbreviations</strong></td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>(The crowd’s) Perception of influence</strong></td>
<td>Survey data that reveals how critical to collective decision-making individual participants felt.</td>
</tr>
<tr>
<td><strong>Poll</strong></td>
<td>An instance when votes are cast by a crowd.</td>
</tr>
<tr>
<td><strong>PPT</strong></td>
<td>Microsoft PowerPoint.</td>
</tr>
<tr>
<td><strong>Relative frequency</strong></td>
<td>Relative frequency is used to refer to the number of option quantity categories that were utilised within a crowd-composition work.</td>
</tr>
<tr>
<td><strong>Sense of authorship</strong></td>
<td>Survey data that reveals whether the crowd-composition process led to participants having a sense of authorship over the resultant music.</td>
</tr>
<tr>
<td><strong>SMS</strong></td>
<td>Southampton Music Service, part of Southampton City Council’s Children and Families Service, is responsible for supporting music in schools, for peripatetic instrumental and vocal tuition and for the bands, choirs and orchestras in the city available to children and young people.</td>
</tr>
<tr>
<td><strong>Survey data</strong></td>
<td>Participant feedback to questionnaires, distributed following the completion of each work, taking the form of both multiple-choice and open-ended questions.</td>
</tr>
<tr>
<td><strong>Theoretical probability</strong></td>
<td>The percentage of votes that each option would receive if all votes were distributed evenly within a poll.</td>
</tr>
<tr>
<td><strong>UGC</strong></td>
<td>User-generated content. UGC is any form of content, such as blogs, videos or advertisements, uploaded to the Internet, often via social media websites.</td>
</tr>
<tr>
<td><strong>Voting data</strong></td>
<td>The tallied votes for all polls in a portfolio work.</td>
</tr>
<tr>
<td><strong>Web-environment</strong></td>
<td>One of the mediums in which my portfolio works took place. Web-environment works existed on the Web, over an extended period of time.</td>
</tr>
</tbody>
</table>
Chapter 1  Introduction

This doctoral project explores existing and novel techniques to create compositions with large groups, which requires participants to engage in, and develop an understanding of, a creative process. In the commentary I refer to this emerging field as *crowd-composition*: a form of musical collaboration that draws on crowdsourcing models. The Oxford English Dictionary defines *crowdsourcing* as “the practice of obtaining information or services by soliciting input from a large number of people, typically via the internet”\(^1\). Similarly, crowd-composition is the practice of outsourcing a creative task to a crowd, leading to a new musical composition that is assembled and shaped by collective input. As an example, in *Crowdsound* (2015-17), Brendon Ferris developed a Web-application through which 67,000 participants were able to collectively write a melody, with each successive note determined by an online poll. The portfolio component of this project adds a number of new works to this emerging practice.

The central research concerns of the project have been:

- How can crowd-composition facilitate meaningful experiences for participants?
- How can crowd-composition lead to musical works or perspectives that are distinct from sole agent composition?

These questions have helped to examine the unique attributes that distinguish crowd-composition from other approaches to composition, as well as assess the degree to which the process can be regarded as valuable for both participant and author. Another interest has been exploring the extent to which agency can be devolved to crowds. This has led to considerations of different forms of interactional techniques and methods for maintaining participant interest. Key challenges have been evaluating whether techniques are feasible within specific environments and timescales, whether they are accessible, and whether they are engaging for participants. To these ends, my portfolio reflects a process of experimentation, in that I have explored a succession of systems and approaches, each building on evaluation from previous works.

Whilst crowd-composition is growing and the practice now features a number of examples, academic scholarship in the field is scant and under-theorised. This doctoral project contributes to

knowledge through providing a review of crowd-composition works, identifying key areas of concern in this burgeoning field, and developing a framework for understanding what distinguishes the practice. To these ends, the research focuses on investigating properties relating to participation – how participants respond to crowd-composition systems and what their interactions produce. This is a subject that, in particular, has received little academic attention in the literature.

The project also contributes through the four crowd-composition works submitted in the portfolio. These were built on a process of experimentation that is documented and reflected upon in the commentary, ultimately leading to: the development of original techniques for facilitating crowd-composition; new insights into the outcomes of crowd-composition through discussion centred on the research questions; and a number of discoveries on the effectiveness of particular elements (for example, the impact of various option quantities in polls), which will ideally form the foundation for future work.

1.1 Core texts informing the project

The term crowdsourcing was first used by Jeff Howe in an article for Wired magazine, *The Rise of Crowdsourcing* (2006). Here, Howe observes that in crowdsourcing, “distributed labour networks are using the Internet to exploit the spare processing power of millions of human brains”. The author outlined four categories, providing an example for each:

1. The Professional – iStock is a business that offers photos produced by amateurs, as stock photography, at a far lower price than existing stock photography firms.
2. The Packager – *Web Junk 20*, the hit show of American cable television network VH1, was the first show to repackage Internet content, showing the 20 most popular videos making the rounds online in any given week.
3. The Tinkerer – companies such as InnoCentive, that outsources research and development problems to a crowd.
4. The Masses – Amazon Mechanical Turk is a crowdsourcing Internet marketplace that enables businesses to coordinate the use of human intelligence to perform tasks. A key difference between this example and the others is that whilst “InnoCentive and iStock are labour markets for specialised talents, just about anyone possessing basic literacy can find something to do on Mechanical Turk”.

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3 Formally known as iStockphoto.
These examples demonstrate a range of crowdsourcing applications, revealing that crowdsourcing can encompass both amateurs and specialists. Howe also emphasises that the practice takes place across a range of disciplines and therefore “is not inherent to any particular field” ⁴.

Howe subsequently published a monograph, *Crowdsourcing: How the Power of the Crowd is Driving the Future of Business* (2009). Unlike its predecessor, this included a definition of crowdsourcing: “the act of taking a job initially performed by employees and outsourcing it to an undefined, generally large group of people in the form of an open call” ⁵. My preference is the OED definition because it is more inclusive. However, Howe’s interpretation and analysis was fundamental in building a clearer vision of the practice. The book explores the origins of crowdsourcing, before proceeding to illustrate a range of examples from the growing field. He identifies four crowdsourcing approaches: crowdfunding, crowd wisdom, crowd creation, and crowdvoting. I draw on these terms to structure my overview of crowd-composition in Chapter 4.

Another text underpinning the project is *The Wisdom of Crowds: Why the Many are Smarter Than the Few* (2004) by James Surowiecki, which examines the intelligence of large groups in a variety of instances. He draws on a host of experiments relating to crowd intelligence, particularly those conducted by American sociologists and psychologists between 1920 and 1950. This includes Jack Treynor’s well known ‘jelly-beans-in-the-jar’ experiment, where he invited a university class to guess how many jelly beans a jar held. The jar held 850 beans, and the group’s mean estimate was 871. The striking finding was that only one of the fifty-six participants made a more accurate guess than the mean. Surowiecki points to a number of similar outcomes, showing that “there is no evidence in these studies that certain people consistently outperform the group” ⁶. In short, for Surowiecki at least, crowd opinion is more reliable than expert opinion.

Surowiecki outlined four conditions that characterise a wise crowd: diversity of opinion (the crowd must contain a range of backgrounds), independence (the opinions of individuals in the crowd should not influence one another), decentralisation (individuals in the crowd must be allowed specialisation and to be able to draw on local and personal knowledge), and an aggregation system (there must be a mechanism to turn private judgements into collective decisions). Whilst a crowd can be wrong, incoherent, or unreasonable, Surowiecki argued that if a crowdsourcing system satisfies these conditions, then its decision is likely to be accurate.

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Chapter 1

_Crowdsourcing for Music: Survey and Taxonomy_ (2012), by Carlos Gomes, Daniel Schneider, Katia Moraes and Jano de Souza, has also been important. This paper surveys examples of musical projects that make use of crowdsourcing, and places them in six distinct categories:

1. **Music Co-Creation**: occurs when a crowd has a part to play in the creative process.
2. **Decision Support**: occurs when the music industry issues an open call to the public to make decisions about music artists, albums, songs and concerts.
3. **Crowdsourced Music Collection and Management**: a category where platforms leverage crowd judgement to organise and manage their music collection.
4. **Marketplace**: a category for platforms that provide crowdsourcing services.
5. **Release**: refers to social networking services, such as Facebook and YouTube, that have functions for promoting music.
6. **Crowdfunding**: the practice of funding a project or venture by raising monetary contributions from a large number of people.

Most relevant here is the idea of _music co-creation_. The authors cite James Surowiecki’s argument that “under the right circumstances, groups are amazingly creative and often are more creative than the most creative person inside”\(^8\). However, the authors were not able to explore this field in any depth, and in discussing future research agendas, conclude:

_We observed during this research paper that the engagement of individuals in creative processes and how these processes are conducted may be factors that directly affect the music-related products generated, so we want to pay attention to studies involving the exploration of creativity in crowds._\(^9\)

My own project engages with this research agenda.

Finally, _Techniques for Interactive Audience Participation_ (2002), by Dan Maynes-Aminzade, Randy Pausch and Steve Seitz, provides guidelines for interactive works\(^10\). These are:

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\(^7\) Such as [www.voices.com](http://www.voices.com), which allows a user to request vocal services from a range of freelancers.

\(^8\) Surowiecki, _The Wisdom of Crowds: Why the Many Are Smarter Than the Few_, 11.


• “Focus on the activity, not the technology”. While people are initially amazed at the technology allowing the interaction to occur, within 30 seconds they lose interest if the activity is not inherently entertaining.

• “You do not need to sense every audience member”. What matters is what the audience thinks is going on, not what is really going on.

• “Make the control mechanism obvious”. It is important that audience members understand how their actions affect the game activity. Audience members will not continue to participate in an activity if there is no immediately clear indication that they are affecting it.

• “Vary the pacing of the activity”. A pacing that alternates moments of intense activity with periods of relaxation is best.

• “Ramp up the difficulty of the activity”. Scaling up the complexity of the activity presented to the audience, avoiding a tedious training phase.

• “Play to the emotional sensibility of the crowd”. Make sure everyone is engaged and present.

• “Facilitate cooperation between audience members”. Cooperation is key to engagement, which in turn is key to success.

I draw on this guidance when designing and assessing the works submitted in the portfolio component of this project.

1.2 Commentary structure

The Web has long been ubiquitous in my musical life and is the primary medium of my music consumption. Additionally, I am drawn to the opportunities the Web presents for creativity and communication, as well as the artistic applications it affords. My decision to pursue an interdisciplinary study between music and Web Science grew from a recognition that Web-based music had the potential to establish an entirely new era of artistic endeavours. I aspired to play a part in this movement by producing a portfolio that would add to and develop the creative output of this medium. The structure of this commentary reflects my personal journey through the doctoral project, as I sought to identify and develop a niche within which to produce novel composition research.

My studies began with exploring internet music, and this initial investigation is presented as a review of works in Chapter 2, where three fundamental categories of internet music are described.
Chapter 1

This includes the category *networked environments where communities become central components of a creative process*, which was later abbreviated to crowd-composition. Chapter 3 considers the history and impetus behind the practice of crowd-composition by exploring the four approaches to crowdsourcing provided by Howe, and defining key terminology.

Chapter 4 reviews examples of crowd-composition. It begins by coining a new term used to refer to the level of control a crowd has in a crowd-composition work: *crowd agency*. The chapter continues by analysing crowd-composition works in terms of the amount of crowd agency employed. Also pinpointed here are relevant examples of crowdsourced art. It concludes with a comprehensive case study analysis of two works from the review – *TweetDreams* by Dahl et al., and *Crowdsound* by Brendon Ferris.

Chapter 5 contains reflective commentaries on the four original crowd-composition works submitted in the portfolio component of the project: *CrowdComp, HyperCello, It Wasn’t All Yellow* and *ElectroQuiz*. All feature a specific crowdsourcing model – crowdvoting. These are presented chronologically, as the experimental thread that ties them together is shown to be a crucial aspect of their formation.

The portfolio works are then evaluated through the lens of the research questions in Chapter 6. This chapter draws on literature relating to meaningful experiences, and calls upon comparisons to musical fields with similar aesthetics, in order to unpack the outcomes of my crowd-composition experiments.

The conclusion summarises the research journey and shares lessons learned through the process of experimentation that led to the submitted works. Lastly it proffers some concluding remarks on the field, particularly as it pertains to crowdvoting.
Chapter 2   Reviewing internet music

2.1   Introduction

Internet music encompasses a host of musical activity that is facilitated through the Web and other networks\textsuperscript{11}. The term, however, does not refer to streaming services, social listening applications, or other alternative forms of dissemination. Rather, it relates to interactive, creative practices for which networks are intrinsic tools. The purpose of this chapter is to provide an overview of key areas in internet music, representing the initial stage of my doctoral project, as I searched for a field within which to produce novel composition research.

Internet music has been developing for many years, and over time it has been categorised in several ways. One example is given by Andrew Hugill, who lists five forms of internet music:

1. *Music that uses the network to connect physical spaces or instruments*;
2. *Music that is created or performed in virtual environments, or uses virtual instruments*;
3. *Music that translates into sound aspects of the network itself*;
4. *Music that uses the internet to enable collaborative composition or performance*;
5. *Music that is delivered via the internet, with varying degrees of interactivity*\textsuperscript{12}.

In the first category, Hugill describes examples in which a conventional, collaborative performance practice is embedded within networks. Central to this is adapting to issues with asynchronicity and co-location. The second consists of examples where co-located musical creativity is directed through either a shared virtual instrument, or a multi-user virtual environment. The third refers to music, created by a sole author, that evokes the form of the internet, or data derived from it. In the fourth, the asynchronicity and co-location of the medium are embraced, generally leading to "more formalistic and less improvisatory"\textsuperscript{13} approaches than is the case in other categories. Finally, the fifth category describes non-collaborative musical projects through which Web users are free to explore, without the need to produce a fixed, resultant material (such as soundtoys and online music games).

\textsuperscript{11} Andrew Hugill, “Internet Music: An Introduction”, *Contemporary Music Review* 24, no. 6 (2005): 432, [https://doi.org/10.1080/07494460500296094](https://doi.org/10.1080/07494460500296094).
\textsuperscript{12} Ibid., 433-435.
\textsuperscript{13} Ibid., 434.
Jason Freeman presents a second framework for internet music categorisation:

1. **Improvisation systems**: live performers share a physical space, but their performance is influenced by the co-located input of Web users.

2. **Composition systems**: Web users contribute creative materials, and these materials are then organised in advance of a concert to influence a fixed score.

3. The third category represents a fusion of the above two, in which the symbiosis between participants and music within *improvisation systems* is combined with the foresight of *composition systems*. To demonstrate this, he describes his work *Graph Theory* (2005), where the interactions of Web users, acting as sole agents, are recorded and merged to produce a score that has been moulded by the inputs of many.

Another classification is *music co-creation*, which allows for “crowds of people from anywhere in the world to collectively produce music without having to be professionals in the area”\(^\text{15}\). However, those that coined the term were unable to provide examples that comfortably fit this description, as they go on to detail environments for small groups of co-located experts to collaborate, within applications such as Kompoz and Ohm Studio.

Whilst a comprehensive list of categories is presented above, I propose that these can be simplified and consolidated into three fundamental forms that internet music can take:

1. **Networked environments for experts to engage with performance and compositional practice**;

2. **Networked environments where participants influence the creativity of experts**;

3. **Networked environments where communities become central components of a creative process**.

With a focus on the collaborative nature of each, based on their author’s understanding, the table below demonstrates how my proposed categories subsume previous ones:

---


Table 1 - Internet music categorisation

<table>
<thead>
<tr>
<th>Networked environments for experts to engage with performance and compositional practice</th>
<th>Networked environments where participants influence the creativity of experts</th>
<th>Networked environments where communities become central components of a creative process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music that uses the network to connect physical spaces or instruments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music that is created or performed in virtual environments, or uses virtual instruments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music that translates into sound aspects of the network itself</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music that uses the internet to enable collaborative composition or performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music that is delivered via the internet, with varying degrees of interactivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improvisation systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Composition systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fusion of improvisation systems and composition systems</td>
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<td>Music co-creation</td>
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A review of works from each of these proposed categories follows in the next section.

2.2 Review

2.2.1 Networked environments for experts to engage with performance and compositional practice

Works in this category tend to engage with more conventional practices, though collaboration in such works is facilitated by networks nonetheless.

One performance-based example is The Hub, and their eponymously titled 1989 album. Early adopters of networked environments, The Hub are often cited as a staple of internet music\textsuperscript{16}. In The Hub, performers shared a physical space, but their contributions fed into a network, producing a data flow that impacted on the output of the other performers. Networked music performance

has, however, progressed since 1989, now allowing for co-located performances. This is the case with *Diaspora: Explorations in Intercultural Tele-Improvisation* (2014) by the Ethernet Orchestra. Here, musicians across the globe collaborated simultaneously, with the latency inherent to their co-location incorporated as an intrinsic part of their improvised work.\(^{17}\)

A more static example of a co-located networked performance is the ‘virtual choir’ edition of *Sleep* by Eric Whitacre (2011). For this work, Whitacre invited internet communities to submit renditions of individual vocal parts from his choral work *Sleep* (originally published in 2006). These were compiled to create a virtual choir of over a thousand singers.

Finally, networked environments can also allow for collaboration more akin to conventional composition practice. This is the case with Kompoz and Ohm Studio, in which small numbers of musically trained Web users collaborate in cloud-based Digital Audio Workstation (DAW) environments. These applications work much like more familiar and sophisticated DAWs (such as *Sibelius* or *Ableton Live*), which is why their use is largely limited to the musically trained. However, what sets Kompoz and Ohm Studio apart is that they enable multiple composers to simultaneously cooperate in shared environments.

### 2.2.2 Networked environments where participants influence the creativity of experts

Works in this category have varying degrees of participant influence. Examples that feature a small amount of participant influence are *DialTones (A Telesymphony)* by Golan Levin (2001), *Decomposing Autumn* by David Casal (2010), and *The DNA Project* by J.viewz (2014).

*DialTones* was a 30-minute performance based solely on the choreographed ringing of 200 audience member mobile phones.\(^ {18}\) The choreography of ringing in this example was predetermined. However, audience members were encouraged to select the ringtones that were played, affecting the music in a small way.

*Decomposing Autumn* was built on a “component-wise decomposition” of an *Autumn in Warsaw* recording, the sixth in the second book of *Piano Études* by Ligeti (1988-94). Participants were tasked with interpreting slices of this recording as vocal performances, and the resulting components were then used to create a semi-improvised composition. Casal argues that contributions featured “re-

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composition”, and therefore some amount of influence, as it was necessary for participants to be creative in interpreting the piano recording¹⁹.

The DNA Project was a website documenting the creative process that led to a subsequently released album, 401 Days (2016). Along with regular updates from the artist, this project featured interactive opportunities, where fans were able to influence isolated components of various songs. There were opportunities to submit samples that could be included in the artist’s music (such as ambient sounds, heartbeats, and drum patterns²⁰), and assist in lyric writing and song naming. Although contributions in this example were largely superficial, some elements of the resultant 401 Days were dependent on participant influence.

Other works in this category provide participants with relatively greater influence. Examples include the live act performed by Tin Men and the Telephone (2009-) and X You by Avicii (2013). These can generally be characterised by utilising participation in a more purposeful way, particularly by incorporating more musically developed contributions.

When performing live, Tin Men and the Telephone invite audiences to download and operate their bespoke app, ‘Appjenos?!’. Through this app, participants can suggest and trigger “melodies, rhythms, and chords using a graphic programme”²¹, which are then embedded into the group’s improvised performance. Audiences can also “decide what style the band should play in, design rhythm sections and leave voicemail messages on the basis of which the band can improvise songs”²². Thus, participant influence is able to play a central role in this example.

For X You, Avicii asked fans to submit materials, which were used to construct a new composition. The work received thousands of contributions, across a range of textural layers. Although Avicii certainly acted as arbiter, retaining agency in assembling the work, many of its components are credited to participant contributions²³.

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2.2.3 Networked environments where communities become central components of a creative process

Works in this category support synergistic relationships between participation and a creative process, where resultant musical materials aim to be representative of collective input. Two notable examples are WIKI-PIANO by Alexander Schubert (2018-) and Crowdsound by Brendon Ferris (2015-17).

WIKI-PIANO is a Web-based application in which users are able to visit and edit an online score. The work presents 49 interactive modules that collectively offer enormous participatory variety. Some modules involve notation and so require experienced musical ability, whereas others ask for YouTube videos, audio samples and drawings to be submitted – tasks that allow for wider participation. Participants have extensive control within WIKI-PIANO, though there is little cooperation, in that each Web user interacts with the work independently and asynchronously.

Crowdsound utilised a more cooperative approach to group participation. It featured a polling system that enabled participants to collectively write a melody. Polls presented pitch options for participants to vote on, and the majority vote from each poll determined sequential notes in a melody, one quaver a time. Over 67,000 people voted to determine the 410 notes of the Crowdsound melody. Whilst WIKI-PIANO presents an aggregation of disparate contributions, Crowdsound produced a material that conveyed collective opinion.

2.3 Collaborative models

The composer or artist is often stereotyped as a “lone seeker of creative inspiration”25. Margaret Barrett challenges this concept through highlighting the social nature of music: “the artist… works in the centre of a network of cooperating people whose work is essential to the final outcome”26. Collaboration is, of course, pervasive throughout the world of music, and this section aims to relate common collaborative models to those found in internet music.

To begin with, collaboration is fundamental to the field of jazz. R. Keith Sawyer discusses how improvisation in jazz is a form of musical communication and explores how this interaction requires

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26 Ibid., 198.
the musicians to know and understand the “language” utilised. This language is part standard, requiring, for example, a knowledge of jazz theory. However, it is also part unique to the ensemble, requiring a shared familiarity with each other’s musical interests.

To demonstrate this, Sawyer references a conversation between Ingrid Monson and jazz drummer Ralph Peterson. In this exchange, Monson played Peterson a recording of a live performance Princess, a composition by Peterson. Monson notes several instances in which the pianist Geri Allen and drummer Peterson traded ideas with each other. Whilst listening to the recording, Monson recognised that one of the conversational exchanges appeared to be based on Dizzy Gillespie’s famous performance of Salt Peanuts. Peterson responded with:

Yeah! ‘Salt Peanuts’ and ‘Looney Tunes’ – kind of a combination of the two. [Drummer] Art Blakey has a thing he plays. It’s like [he sings a rhythmic phrase from the song]. And [pianist] Geri played: [he sings Allen’s response]. So I played the second half of the Art Blakey phrase: [he sings the second part of Blakey’s drum pattern].

This example shows how improvisation is characterised by a series of encounters that act much like a conversation through shared language, in this case through their musical understanding, and knowledge of the Art Blakey motif.

This collaborative model is found in the improvised music of both The Hub and the Ethernet Orchestra. For example, Scot Gresham-Lancaster documents various communicative ingredients in improvisations by The Hub, such as knowledge of the idiosyncrasies of circuit board design, or an ability to interpret data streams from uniquely designed software and hardware. These tools are analogous with those found in the Ralph Peterson example.

In the case of Ohm Studio, Kompoz and X You by Avicii, these too exhibit a familiar collaborative model. The sharing of compositional responsibilities amongst a group of people, each with clearly defined roles, is prevalent in music. In classical music, there is the opera Muzio Sevola (1721), for which Filippo Amadei, Giovanni Bononcini and George Handel composed separate acts. There is also Rhapsody in Blue (1924), composed by George Gershwin and orchestrated by Ferde Grogé; and West Side Story by Leonard Bernstein (1957), for which Stephen Sondheim was the lyricist. Similar

28 Sawyer, “Group creativity: musical performance and collaboration”, 149.
models are also seen in the popular music industry, such as in *Firework* by Katy Perry (2010). *Firework* is credited to five artists: Katy Perry, Mikkel Eriksen, Tor Hermansen, Sandy Wilhelm and Ester Dean. Additionally, two further names are credited as producers: StarGate and Sandy Vee.

Whilst these represent a division of labour between composers, as is the case in Ohm Studio, Kompoz and X You, there can also be a division of labour between composers and performers. This is found in the employment of musicians to interpret and perform the notation of a fixed score, which is a ubiquitous performance standard. *Sleep* by Eric Whitacre and *Decomposing Autumn* by David Casal are analogous with this model.

A further collaborative model can be found in music that incorporates audience participation. Such works may “invite the audience to shape the music performed by live musicians rather than creating sounds that are part of the performance.” This is the case in live performances by pianist Paul “Harry” Harris, who incorporates verbal contributions from an audience, ranging anywhere from reggae to cartoon theme tunes, in order to create an improvised quotation piece.

Other examples take this a step further by embedding the audience within the performance. Bobby McFerrin frequently does this in his performances, inviting audiences to sing repeating motifs that accompany his own voice. *DialTones* by Golan Levin, Tin Men and the Telephone, and *The DNA Project* by J.viewz, all engage with this notion. *The DNA Project* is distinct, however, in that it facilitates audience participation asynchronously.

The works explored up to this point largely exhibit a clear “separation of roles between the audience and the composer/performers.” However, in *WIKI-PIANO* and *Crowdsound*, those divisions are less distinguishable, as these works invite the audience to have a creative role with greater agency. In one sense, their collaborative models are reminiscent of aleatoric music, in which a composer makes key decisions, but many elements of the composition are left to chance, or some other form of indeterminacy.

One example is *Klavierstück XI* by Stockhausen (1954), which includes 19 notated fragments to be performed in a sequence determined by a pianist. Other examples include *Available Forms I* by Earle Brown (1961), in which a conductor determines the order of fragments, cueing the musicians accordingly; and *Mirrors* by Saariaho (1997), a work explored through a CD ROM application, in

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which listeners create their own version of the composition by dragging musical fragments onto a timeline. These works are relevant because the composers have devolved more creative agency to auxiliary agents than is typical in conventional practice.

Discussing works with a similarly collective aesthetic to *WIKI-PIANO* and *Crowdsound*, Atu Tanaka et al. note that:

> Despite these changes or shifts in the role of the author, composer, or artist, this does by no means obviate their existence nor put in question the notion of an artistic work... Instead, the act of authoring for such systems requires the artist to conceive of open forms that nonetheless articulate his original creative vision, that become an act of creative expression all the while letting go of absolute control.  

A key observation here is that the role of author in these works cannot be understated, in that their musical output was entirely constrained by predeterminations. However, it is also clear that these works are distinct from aleatoric music for two reasons. Firstly, their systems are less restricted, particularly by providing compositional opportunities on a more micro-level, and therefore they arguably devolve greater creative agency. Secondly, the output of their systems feature the amalgamation of numerous contributions, and so the agency of a lone agent is expanded to the agency of a collective.

For these reasons, crowdsourcing – the practice of outsourcing a task to a crowd – provides a collaborative model more applicable to *networked environments where communities become central components of a creative process*. One example of a crowdsourcing system is the e-commerce clothing website, Threadless, founded in 2000. What sets Threadless apart is that, rather than making its own designs, it asks its community to submit designs in weekly competitions. That same community then votes to choose their favourite 10 designs, which are printed onto clothing and other products. Though crowdsourcing certainly has a relationship with works from the second category, *networked environments where participants influence the creativity of experts*, it is most attuned to examples like *WIKI-PIANO* and *Crowdsound* because of their greater dependency on the collective, such as in the Threadless example.

In this chapter I have reviewed collaborative models that utilise networked environments. Though the use of networked environments produced unique opportunities – particularly in enabling co-

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located collaboration – for the most part, its advantages did not impose any significant departure from conventional practice.

However, by harnessing the inputs of the collective, I believe that the WIKI-PIANO and Crowdsound models represent more progressive and idiomatic utilisations of the Web’s capabilities and culture. In that sense, networked environments where communities become central components of a creative process (abbreviated to crowd-composition henceforth in this commentary) was a category that arguably exhibited the most innovative model within internet music.

This potential for innovation was one of the fundamental reasons I decided to focus my composition research on crowd-composition, although there were others:

1. I saw a potential for crowd-composition to elevate the connection between audience and music beyond that of traditional means. This was partly inspired by my appreciation of the many performative and attendant musical activities I have undertaken over the years – performing, ushering, page turning, etc – which have always heightened the musical experience for me. I wanted others to share in these experiences, especially those without musical training, for whom many participatory activities may be inaccessible. In addition, as a peripatetic music tutor, I was keen to explore the role this benefit could have in sharing musical knowledge.

2. Crowd-composition had received the least amount of academic attention, and in particular, a search of the literature found no empirical studies investigating properties relating to participation. As participation is a central component of crowd-composition, I was keen to explore this element in greater depth.

3. Finally, my choice was also shaped by my personal interests, temperament and skill-sets. I recognise that I am a social, Web 2.0 generation, video gamer, trained musician, composer, electronic music producer and peripatetic music tutor. Accordingly, I am constantly experiencing, creating and sharing content, and so I see my attraction to crowd-composition as an extension of that predilection.
Chapter 3  
Crowdsourcing

This doctoral project considers crowdsourcing to be a foundational platform for what I have termed crowd-composition. In order to build a framework to better understand the history, language and intentions of crowd-composition, this chapter explores crowdsourcing from a broad perspective. Introduced here is how crowdsourcing and related terminology came to be coined, followed by a review of crowdsourcing initiatives, structured by the four approaches presented by Jeff Howe.

3.1  
Introduction

Prior to the publication of Jeff Howe’s Wired article, *The Rise of Crowdsourcing* (2006), where the term crowdsourcing was coined, the author noticed an explosion in user-generated content (UGC). UGC is any form of content, such as blogs, videos or advertisements, uploaded to the Internet, often via social media websites. As a Wired writer, he had been examining MySpace: a social networking website that once held over 20 million registered users, and was particularly notable as a platform for sharing original music.

Discussing how he came to coin the phrase crowdsourcing in a podcast for WhatIs, Howe noted that in MySpace, “there wasn’t much of a company there at all. The content was being produced by users.” He realised that UGC was beginning to play a significant part in Internet culture. He also found that UGC had made its way into advertising models. In particular, he cites the Converse Gallery Campaign as an important marker. In 2000, the Converse brand Chuck Taylor was declining in sales. Converse approached advertising agency Butler & Schein to revitalise the brand, who suggested they ask their consumers to make their own ads. Converse agreed – it would be cheap after all – and so consumers were invited to make 20-second long commercials for Chuck Taylors. These user-generated commercials were “viewed as a smashing success by both the company and the advertising industry”, and were featured in many major TV spots in the 2000s.

What Howe recognised as distinctive about MySpace and the Gallery Campaign, was the use of a crowd to create content that would traditionally be created by paid experts. Following this, his

36 WhatIs, "Podcast: What is crowdsourcing?".
37 Howe, *Crowdsourcing: How the Power of the Crowd is Driving the Future of Business*, 5.
Chapter 3

Wired article, and subsequently published monograph, drew on several contexts in which tasks were outsourced to large groups, and he organised these under one umbrella term: crowdsourcing.

Since the coining of the term, crowdsourcing has proliferated, becoming a commonplace application in many fields. Lakhani and Boudreau, for example, state that crowdsourcing has entered “areas as diverse as genomics, engineering, operations research, predictive analytics, enterprise software development, video games, mobile app [development] and marketing”\(^{38}\). In addition, crowdsourcing platform eYeka claims “85% of the 2014 Best Global Brands have used crowdsourcing in the last ten years”\(^{39}\). From the app store on one’s phone, to the burgers at McDonalds\(^{40}\), crowdsourcing seems to be everywhere. Clay Shirky argues that it was inevitable that crowdsourcing would have such an impact, highlighting that humans have always worked in large groups, and that any enhancement of that group dynamic would have “profound ramifications”\(^{41}\).

3.2 Approaches to crowdsourcing

In *Crowdsourcing: How the Power of the Crowd is Driving the Future of Business* (2009), Howe outlines four approaches to crowdsourcing: crowdfunding, crowd wisdom, crowdvoting, and crowd creation.

3.2.1 Crowdfunding

Crowdfunding is the practice of funding a project or venture by raising monetary contributions from a large number of people. A key benefit of this approach is that it allows creators to circumvent usual sources of financial investment and so protects the independence of the product. This is useful if seeking to avoid external forces acting on a product, or if a product concept has failed to be acquired by a firm.

This idea of independence is, according to Howe, why people invest in crowdfunding projects\(^{42}\). Through crowdfunding, consumers can fund products that are meaningful to them, and in doing so, hold creators to design and manufacture promises. It is also a common practice to present funders...

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\(^{42}\) Howe, *Crowdsourcing: How the Power of the Crowd is Driving the Future of Business*, 253-254.
with tangible rewards and/or experiences in exchange for their pledges\textsuperscript{43} – an additional reason for consumers to support a crowdfunding endeavour.

To return to a creator’s perspective, these consumer motivations can greatly benefit dissemination, as consumers are likely to be enthusiastic about the products they support, and often show their support by sharing it amongst their communities, bolstering the profile of the creator and product. Crowdfunding can also be a predictor of success. Through crowdfunding, a creator is able to gauge how successful their product may be prior to its release by assessing the level of support the product received.

A popular crowdfunding platform is Kickstarter. Creators in Kickstarter make a page for their product, and set a funding goal, which is the minimum amount of money they need to fund their product. Participants are then invited to pledge money, which is only charged if the page reaches its funding goal. A musical example from this platform is Amanda Palmer’s Kickstarter campaign (launched in April, 2012) for her \textit{Theatre is Evil} album (September, 2012). This earned $1.2 million – of a $100,000 goal\textsuperscript{44} – making it the largest music-related crowdfunding project at the time\textsuperscript{45}.

Through Kickstarter, Palmer funded the album without a record label. Palmer believes that what made this particular project so successful was her dedication to community engagement\textsuperscript{46}. All project pledging rewards (such as receiving exclusive merchandise, tickets to private performances, etc.) were designed to enrich the reception of the resultant music, and underpin their indispensable role in its creation. This arguably enhanced their desire to fund the project, increasing the amount they were likely to pledge, and drove their impulse to share it within their communities. This propagation boosted support for the project, which in turn brought it to a larger audience. Initiatives such as these are built on the acknowledgement that crowds have an increasing desire to have power over what they consume.

\section*{3.2.2 Crowd wisdom}

Crowd wisdom attempts to harness a crowd’s knowledge in order solve problems or predict future outcomes. This approach is found in InnoCentive’s model – a crowdsourcing company that

\begin{itemize}
\item Troy A. Voelker and Robert McGlashan, “What is crowdfunding? Bringing the power of Kickstarter to your entrepreneurship research and teaching activities,” \textit{Small Business Institute Journal} 9, no. 2 (October 2013): 14.
\item Amanda Palmer, “The Art of Asking” (New York: Grand Central Published, 2015), 3-4.
\end{itemize}
commissions its users to solve engineering, computer science, mathematics, and science research and development problems. Rather than funding internal R&D departments, a company can put the problem to InnoCentive, who in turn presents the problem to their freelance users. InnoCentive’s freelancers earn substantial compensation for completing a task, earning “anywhere from $10,000 to £100,000 per solution”\textsuperscript{47}. One aspect that contributes to the success of InnoCentive is its diverse and decentralised user group. As Lakhani found, “the strength of a network like InnoCentive’s is exactly the diversity of intellectual background”\textsuperscript{48}. Interestingly, InnoCentive finds that most solutions come from those working in unrelated fields\textsuperscript{49}. For instance, the company reported that one of their posted problems, which concerned devising a novel way of mixing large batches of chemical compounds, was solved by a patent lawyer\textsuperscript{50}.

3.2.3 Crowdvoting

Crowdvoting is the practice of using voting techniques to determine the collective opinion of a crowd, or to make collective decisions. One example of this approach is the use of audience opinion in TV show gimmicks, such as the polling used in \textit{The X Factor} and \textit{Big Brother}. Crowdvoting has also been a part of many consumer research models. As crowdsourcing can be a low-cost alternative to conducting extensive market research, a number of companies have employed crowdvoting to discover community opinion and evaluate ideas\textsuperscript{51}.

Crowdvoting is also used to organise content on the Internet. Crowdfiltering is a form of crowdvoting, and this leverages the community’s judgement to organise, filter and stack-rack content\textsuperscript{52}. The users of websites whose product is the delivery of UGC, such as Reddit and YouTube, upload huge amounts of information. For instance, YouTube reports that 400 hours of video are uploaded to their site every minute\textsuperscript{53}. Howe argues that this UGC is “90% crap”\textsuperscript{54}, and that crowdfiltering is necessary to filter out the good from the bad. When a Web user engages in content with likes, shares, and comments, they are contributing their opinion as a form of vote. More

\textsuperscript{47} Howe, “The Rise of Crowdsourcing”.
\textsuperscript{48} Ibid.
\textsuperscript{49} Lakhani and Boudreau, “Using the Crowd as an Innovation Partner”, 64.
\textsuperscript{50} Howe, \textit{Crowdsourcing: How the Power of the Crowd is Driving the Future of Business}, 149.
\textsuperscript{52} Howe, \textit{Crowdsourcing: How the Power of the Crowd is Driving the Future of Business}, 223-225.
\textsuperscript{53} “An update on our commitment to fight terror content online”, Official Blog, YouTube, August 1, 2017, \url{https://youtube.googleblog.com/2017/08/an-update-on-our-commitment-to-fight.html}.
\textsuperscript{54} WhatIs, “Podcast: What is crowdsourcing?”.
conventional voting mechanisms can also be employed. It is through interactive mechanisms such as these that content is ranked and displayed on UGC websites.

### 3.2.4 Crowd creation

The final approach outlined by Howe is crowd creation, which involves the outsourcing of creative tasks to a crowd. Chapter 2 outlined one example of this approach in the e-commerce clothing website, Threadless. Another example is the online stock photography firm, iStock. iStock offers millions of stock photos, illustrations, videos and audio tracks for companies to purchase for $0.20-$10. When iStock was founded in 2000, it vastly undercut the existing stock photography industry by more than 99%\(^55\). That pricing was down to the fact that iStock employees are not professionals. They are hobbyists who, largely due to the democratization of technology, have the capability to take photographs that rival the quality of professional stock companies. Due to the large size of this newly employed amateur workforce, and the fact that as hobbyists they did not require substantial reimbursement, iStock was able to charge low prices for their products and turn over a considerable profit. iStock is an example of how a crowd can contribute their own original work in a crowdsourcing business model.

Crowd creation has been used in this way across a scope of applications. For example, in advertising, Frito-Lay crowdsourced their 2007 Doritos Super Bowl advert by asking consumers to submit their own 20 second advert, which they then polled amongst those consumers to find the favourite\(^56\). This is similar to the Converse Gallery Campaign.

Crowdsourced content has also made its way into video gaming. Second Life, for example, is an online virtual world developed by Linden Lab, launched in 2003. Whilst its 1 million users would consider it a game, Linden Lab emphasises that Second Life is not strictly a game as there is “no manufactured conflict, no set objective”\(^57\). Second Life is more akin to a toolbox. One can explore cities, visit furniture stores and play arcade games, and every object and story in the virtual world has been made by its users.

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\(^55\) Howe, “The Rise of Crowdsourcing”.

\(^56\) Howe, *Crowdsourcing: How the Power of the Crowd is Driving the Future of Business*, 231.

Chapter 3

3.3 Summary

This chapter considers an array of instances where the power and wisdom of crowds has been utilised to create innovative models. These are all examples of crowdsourcing, that is, the outsourcing of a task to a crowd. Threadless asks its crowd to design their clothing. YouTube asks its crowd to create and organise its content. Linden Lab asks its crowd to create their game.

Cynically, it could be suggested that crowdsourcing exploits users to create the content that they themselves consume, for a lower-cost. However, more positively, as Howe argues, “labour can often be organised more efficiently in the context of a community than it can in the context of a corporation” in a way that is beneficial to the consumer as well as to the company. YouTube, for example, can only organise its content with the help of users, and InnoCentive has produced numerous, innovative solutions to problems through their freelancers.

It is also clear from reviewed examples that consumers want increased control. The success of Amanda Palmer’s *Theatre is Evil* crowdfunding campaign, as well as the popularity of YouTube and other UGC websites, indicates that crowds do not just want to have a say, but also play a part in creating the products they consume. It is this impulse to take part in a creative process that is explored further in the following chapter, which reviews crowd-composition works.

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58 Howe, "The Rise of Crowdsourcing".
Chapter 4  Crowd-composition

4.1  Introduction

Structured through the crowdsourcing approaches discussed in the previous chapter, of which crowd creation and crowdvoting are most relevant, this chapter reviews works facilitated by crowd-composition (networked environments where communities become central components of a creative process) techniques. It is important to highlight the emphasis here on communities (as) central components of a creative process, rather than another category covered in Chapter 2, networked environments where participants influence the creativity of experts, as both incorporate crowdsourcing models with varying degrees of participant agency. The works reviewed here not only outsource creative tasks to crowds, but also invite the crowd to influence the final output of their systems. For instance, X You by Avicii utilised a crowdsourcing model (crowd creation), as it incorporated contributions from fans. However, as Avicii acted as arbiter in producing the work’s music, X You is not considered in this review. On the other hand, in Crowdsound, Brendon Ferris utilised crowdvoting to determine a melody. Thus, it was the crowd that had the final say over this system’s resulting music, and therefore, Crowdsound features here.

With that preoccupation in mind, this review is interested in locating systems that devolve the greatest amount of agency to participants. To express this, a new term is introduced: crowd agency, which denotes the level of control the crowd has in crowd-composition works. This chapter explores works with various levels of crowd agency, frequently simplified as low, mid-level or high crowd agency. This levelling provides a reference guide for comparative purposes. A low-level crowd agency has, in general, a small, or insignificant amount of control over the music. A mid-level crowd agency is more substantial, but the depth of participation may still be limited. Finally, a high-level crowd agency is one in which crowds have considerable control over the music, where, compared with a mid-level crowd agency, more critical decision-making is incorporated.
4.2 Review

4.2.1 Crowd Creation & Crowd Agency

The works discussed in this section invite participants to contribute materials. Although a resultant music will reflect the collective input of the crowd, participants generally act independently in these works.

4.2.1.1 TweetDreams

TweetDreams (2011), by Luke Dahl, Jorge Herrera & Carr Wilkerson, was a performance work that featured the “real-time sonification and visualisation of tweets”⁵⁹. Tweets were posted by audience members within a performance. These were retrieved from Twitter, along with globally-sourced tweets, via the use of hashtags. Related hashtags were used to build networks of associated tweets, and these networks governed the creation of digitally-produced melodic motifs. In TweetDreams, predetermined motifs were assigned parent hashtags, and any tweets subsequently appearing that utilised this hashtag would extend that network and algorithmically generate a variation on the parent motif, creating a family of motifs (Fig. 1). A new retrieval tag would create a new parent, and so a new family. As

![Image of TweetDreams network](image_url)

Figure 1 – ‘TweetDreams’, “family” of tweets.

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hashtags were retrieved and, in turn, motifs generated, visual counterparts were displayed to participants. Participant contributions were given special musical and visual prominence.

Crowd agency in TweetDreams was limited by the fact that onstage performers led the performance, overseeing the influx and association of hashtag retrieval. The resulting music is still reliant on contributions from the crowd, in that participants had agency to trigger materials and introduce new ones. However, the performer component left participants with little control over the shape of the composition, nor did they have a critical understanding of oncoming motifs. Furthermore, whilst part of the performance was governed by the tweets of the in-house audience, much was governed by tweets retrieved globally. These Twitter users were not consciously participating and so their agency is less meaningful. For these reasons, I consider TweetDreams to have a low-level crowd agency.

4.2.1.2 WIKI-PIANO

A second work utilising crowd creation is WIKI-PIANO (2018-) by Alexander Schubert. Part of Schubert’s work cycle, “Community Pieces”60, WIKI-PIANO invites Web users to compose its music via a number of interactive modules on www.wiki-piano.net, with the objective to build a score for piano performance. The entirety of this webpage is treated as a score – the opening text reads: “the pianist performing this piece reads and plays everything that can be found on the internet page, from top to bottom. All elements are either to be spoken or to be performed by the player”. WIKI-PIANO is a work that continuously evolves. Scheduled performances present the work as it exists at that given moment, but this does not interrupt participation.

The WIKI-PIANO score employs 49 modules, together offering a diverse range of interactive methods (Fig. 2). Some modules invite participants to create notated materials by dragging notes and dynamics from a toolbar onto a stave. Other modules incorporate more depictive materials, allowing participants to contribute videos, images, drawings and audio. Finally, there are modules for text to be written and spoken in performance, and modules for dictating gestural actions. In addition, participants are free to arrange these modules in any order. They may also disable modules, which would omit them from a potential

performance. Web users act independently of one another, and are limited to 10 actions per visit, which resets after a fixed length of time.

Figure 2 – ‘WIKI-PIANO’ modules: notation (above), audio (middle), action (below).

*WIKI-PIANO* accommodates a wide variety of interactive techniques, altogether offering considerable creative depth and freedom. Accordingly, the work exhibits a high-level of crowd agency. Further to this, its design conveys an attention to inclusivity, a notion that is reinforced by the opening text on the website: “You – the visitor of the website – are invited to edit and change the piece however you like. There are no wrong choices”. Therefore, a high-level of crowd agency is sustained, despite the sophisticated medium of the work, because its agency is accessible to all participants.
This conclusion, however, is potentially weakened by the independent nature of participation in WIKI-PIANO. Notably, because one action erases another, there is a concern that the system will culminate in a score more representative of a sole agent than of a collective. Fortunately, the 10-action limit that restricts each Web user resolves this issue somewhat, as it makes it difficult for one sole agent to dominate the work.

### 4.2.2 Crowdvoting & Crowd Agency

One of the defining characteristics of TweetDreams and WIKI-PIANO was an individualistic mode of participation. Through crowdvoting, this section will explore a more cooperative model, where systems leverage crowd opinion, and so have the capacity to produce a collectively determined composition.

#### 4.2.2.1 No Clergy

Crowdvoting was used in No Clergy by Kevin Baird (2005), a composition for 2-5 musicians and audience. In No Clergy, a computer algorithm was used to stochastically generate a page of notation for musicians, which was then altered in subsequent pages based on votes cast by audience members. Participants voted on musical characteristics (such as high or lower pitch) and the range of those characteristics (such as a wider or narrower range), with each poll gauged on a scale of 1-10. This information was transferred to a Markovian matrix, which in turn altered the existing page of notation. This task was completed multiple times to produce successive pages of a score. Explained simply, the Markovian matrix acts like several dice, with their faces holding decisions such as ‘higher pitch’ or ‘softer volume’. These dice are then rolled for each event (a pitch or rest) on the original page of notation, altering each one. The votes create a multi-layered probabilistic distribution, with the most likely probability reflecting the majority opinion of the crowd. All participant votes were collected before a new score was produced, and the number of times this could be completed was indeterminate.

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Though the opinion of the crowd in *No Clergy* may not be represented within individual events, an overall new page of notation will. Therefore, in theory, the crowd has considerable control in this work. However, there are two factors that undermine this promise. Firstly, whilst fascinating, the probabilistic system is incredibly complex. If participants are not able to comprehend the impact of their interaction, then crowd agency is potentially diminished. Secondly, there is an indirect nature to the use of probability as a mechanism for crowd agency, in that, to a point, collective opinion is downgraded from decision-making to guidance. It is due to the superiority of technology in *No Clergy* that it has a mid-level crowd agency.

4.2.2.2 Crowdsound

A second example of a crowdvoting system is *Crowdsound* by Brendon Ferris (2015-17). The work was a Web-based application through which over 67,000 participants voted to construct a 410-note melody. Divided into quaver intervals, *Crowdsound*’s polls presented pitch options, used to determine sequential notes in a melody – seven pitches and a rest option at first, and later ten pitches and a rest. These pitch options were colour coded to assist with comprehension, and participants could test what each option sounded like within the melody before voting (*Fig. 4-6*). Individual participants could vote once per poll, and each
poll closed after it had received one hundred votes. Decisions were dependent on a majority vote: the option with the most votes was selected for the melody.

Figure 4 – ‘Crowdsound’ stave, colour coded pitches.

Figure 5 – ‘Crowdsound’ poll, selecting a pitch option.

Figure 6 – ‘Crowdsound’ poll, showcasing pitch options in the melody.
By imitating the creative process that a sole agent traditionally undertakes when composing, *Crowdsound* ostensibly provided enormous collective control. However, one notable factor diminished crowd agency: the implementation of several influential predeterminations into the system. Firstly, the work was set in the key of C major. Secondly, available voting options were limited to a narrow register of pitches from the C major scale. Finally, the structure of the melody, chord progression and accompaniment material were pre-established.

Taken together, these significantly restrained the scope of the system’s potential output, which ultimately led to a decidedly uninteresting musical result. Nevertheless, it could be argued that these restrictions were necessary in making the work accessible. For instance, providing a chromatic, wider range of pitch options might have been overwhelming, and thus, discourage participation. Overall, despite predeterminations significantly restricting the musical result, I consider *Crowdsound* to exhibit a high-level of crowd agency due to the potential in its system.

4.2.3 Crowdsourced visual art

These collaborative models are not limited to music, and related mediums provide an insight into alternative practices for facilitating crowd-composition. This section examines two works that utilise crowd creation and crowdvoting within visual art.

4.2.3.1 Place

Reddit is a social news aggregation website on which Web users post and rate content. This content is organised by subject, otherwise known as subreddits, covering a large variety of topics. In 2017, one such subreddit was created, www.reddit.com/r/place. This was an art experiment that featured a blank 1000 x 1000 tile canvas on which Web users could place a coloured tile every five minutes. In discussing the impetus of *Place*, the authors wrote:

(We wanted) to create a project that explores the way that humans interact at large scales. This year we came up with Place, a collaborative canvas on which a single user could only place a single tile every five minutes. This
limitation de-emphasized the importance of the individual and necessitated the collaboration of many users in order to achieve complex creations. 62

Due to the size of the canvas, and the five minute restriction, large-scale collaboration was necessary for producing any significant designs. Over one million people participated in Place 63, and their contributions were generally directed by the objectives of various subreddits. This is exemplified in the complete Place canvas, Figure 7, which shows a collage of images made by hundreds of online communities. Included here are logos, cartoon characters, album covers, and particularly impressive, a portrayal of Mona Lisa (Fig. 8).

Figure 7 – ‘Place’ completed canvas

Exhibiting a high-level of crowd agency, *Place* utilised a similar system to *WIKI-PIANO*. However, as with *WIKI-PIANO*, its canvas was a dynamic artwork as participants fought for space. One community in particular – dubbed The Void – attempted to overtake many images with black tiles. Fortunately, through a five minute restriction between contributions, a device was used to assert balance across the collective.

### 4.2.3.2 SwarmSketch

A final example of crowdsourced art is *SwarmSketch*, developed by Peter Edmunds in 2005. *SwarmSketch* randomly selects a term each week, and invites Web users to collectively draw a picture based on that term. As part of each contribution, participants can draw 1 line, and can then vote on the opacity of up to 50 other lines. The opacity of each line is determined by the mean percentage of all votes received. Figure 9 depicts one such collective illustration, titled Cavemen. Cavemen contains 349 lines, and received 3,344 opacity votes.\(^{64}\)

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Essential to *SwarmSketch* is the combination of both crowd creation and crowdvoting. The implementation of creative contributions allows for an open framework that is largely unrestrained by the author voice of Edmunds. The subsequent opacity vote enables the crowd to cooperate, empowering them to collectively direct and mould the artwork. This makes *SwarmSketch* distinct from previous crowd creation examples *WIKI-PIANO* and *Place*, where contributions supersede one another. The difference elevates crowd agency in *SwarmSketch*, giving it perhaps the highest crowd agency in this review.

### 4.3 Summary

*TweetDreams* and *WIKI-PIANO* demonstrate the diversity that crowd creation can offer as a collaborative model for facilitating crowd-composition. Whilst *TweetDreams* involved casual participation, *WIKI-PIANO* is a platform for more taxing, complex interactions. Although this review has been interested in identifying systems that exhibit the highest crowd agency, making *WIKI-PIANO* the most relevant to my research, both works arguably fulfil different roles. *TweetDreams* took place in a live, concert-environment, whereas *WIKI-PIANO* coordinated the asynchronous interactions of co-located participants. This distinction may suggest that there is a ceiling to the amount of crowd agency that can be afforded in live situations, making this an additional point for my research to consider.

![Figure 9 – ‘SwarmSketch’, Cavemen.](image)
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As with crowd creation, *No Clergy* and *Crowdsound* both show that crowdvoting too can have diverse applications within composition systems, and can also be implemented in both concert and Web-environments. Furthermore, through the disparity of crowd agency between *No Clergy* and *Crowdsound*, there is once again the suggestion that concert and Web-environments are distinct in terms of the amount of agency they can afford.

Despite the similarities, the ability of crowdvoting to produce a collectively determined music is more experimental, as it evokes a hive mind-like cognition that seems especially novel when compared with the collaborative models previously discussed. In addition, this characteristic arguably facilitates a higher level of crowd agency than crowd creation. Whereas with crowd creation a composition emerges from the discrete contributions of many individuals, through crowdvoting, the crowd is able to purposefully determine a series of compositional decisions, leading to a more unified representation of collective input. The value in crowdvoting is perhaps best demonstrated by *SwarmSketch*, through which numerous creative contributions could easily result in an indecipherable mess. However, crowdvoting enables collective input in *SwarmSketch* to become more productive, leading to coherent realisations of its objective terms.

4.4 Case studies

The following case studies provide a deeper look at two works from the review, *TweetDreams* and *Crowdsound*. These works were selected for analysis because they exhibit highly contrasting systems: *TweetDreams* is a low-level crowd agency work that utilises crowd creation in a concert-environment, whereas *Crowdsound* is a high-level crowd agency work that utilises crowdvoting in a Web-environment. The analyses in this section are focused on the following questions:

1. Was the experience enjoyable and satisfying for participants?
2. Was the crowd able to create an interesting or unique composition?

These questions are intended to explore the quality and extent of participant interaction, as well as to appraise the music created through this participation.
It should be noted that these were precursors to the research questions, established in Chapter 1, that are used to evaluate my own composition portfolio:

1. How can crowd-composition facilitate meaningful experiences for participants?
2. How can crowd-composition lead to musical works or perspectives that are distinct from sole agent composition?

The use of enjoyment and satisfaction was prompted by my interest in video games and ludology, in which they are common tools for evaluating user experience. For instance, one study investigated the relationship between ratings of enjoyment and satisfaction, with varied levels of difficulty. Enjoyment is a term that assesses the reception of the experience, whereas satisfaction assesses the quality of participant interaction. Both terms represent subjective assessments by participants, and they remained central for stimulating participant feedback throughout my portfolio. However, I later shifted to meaningful because it meant being able to draw on the body of literature on the subject of meaningful experiences, which includes enjoyment and satisfaction, along with a wider array of experiential measures.

The facilitation of an interesting or unique composition was initially a strong focus, however this was revised as my portfolio research progressed, as ultimately these elements became part of the broader assessment of distinctive attributes to collective creativity.

The questions addressed below are, therefore, not as sophisticated as those eventually implemented. However, they are included here because their insights represent an essential step in developing my portfolio.

### 4.4.1 TweetDreams

#### 4.4.1.1 Was the experience enjoyable and satisfying for participants?

The authors note negative participant feedback on several elements of the work. Firstly:

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65 Christoph Klimmt, Christopher Blake, Dorothée Hefner, Peter Vorderer, and Christian Roth, “Player Performance, Satisfaction, and Video Game Enjoyment,” in *Proceedings of Entertainment Computing – ICEC 2009* (Paris, France: ICEC, 2009), 2, [https://doi.org/10.1007/978-3-642-04052-8_1](https://doi.org/10.1007/978-3-642-04052-8_1).
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About half the respondents reported that they were unable to interact with the piece due to not having either an internet connected device or a Twitter account.\(^{66}\)

This is obviously a major setback, as so many were not able to participate in the work as intended.

Further to this, for those who were able to make use of Twitter, a second issue emerged. Some participants expressed a concern with annoying their Twitter followers by broadcasting tweets that made no sense outside the context of the performance. Therefore, for those that could participate, some were unwilling to fully engage with the activity.

Thirdly, the authors noted that:

> Those who did tweet were engaged in the process of looking for and tracking their own tweets. Some reported that this required so much attention that they could not appreciate what was happening on a larger scale.\(^{67}\)

As some participants were oblivious to the spectacle of collective creativity, this feedback indicates that the activity compelled them to disregard an arguably essential part of the experience.

Finally, some participants commented that motifs were too similar, and that a system where words or letters matched to pitches would create more variety. This suggests that the creative pursuit undertaken in TweetDreams was not satisfying. The authors argue that they did not implement such a system as they felt the audience would inevitably “compose messages that ‘play’ this mapping, leading to tweets that are no longer idiomatic to natural language”\(^{68}\). However, this reasoning is possibly groundless because their system does not ensure the use of idiomatic language, as Twitter hashtags have no such restriction.

Overall, feedback to TweetDreams reveals several factors that degraded the quality of the experience. However, there are positives to be recognised. Firstly, one can clearly hear laughter from the audience at times in the source video\(^{69}\). A simple reaction, it nonetheless

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\(^{67}\) Ibid.

\(^{68}\) Ibid., 272.

indicates that TweetDreams was entertaining to some extent. Secondly, the authors acknowledge that many enjoyed the performance passively, noting that participants were able to "sit back and voyeuristically watch the conversations of the world become music". Therefore, perhaps for those unable to participate, the interactions of others was enough to enrich the experience. The third point relates to previously discussed feedback, that the search for personal contributions occluded an awareness of the overall experience. Whilst this was regarded as an undesirable trait, it is also indicative that the activity was immersive. All of these points can largely be credited to the visualisation element of the work, which was reportedly very clear in illustrating when tweets had been retrieved and when input led to variation.

In summary, although there was enjoyment to be had in TweetDreams, my impression is that it was fleeting. Dan Maynes-Aminzade et al. advise to “focus on the activity, not the technology”, or else, if the activity is not inherently entertaining, the audience will quickly lose interest. It is possible that this is what transpired in TweetDreams. On the whole, it seems that participants were unsatisfied, craving a higher level of crowd agency – both because some wanted more creative control, and because some were simply unable to participate.

4.4.1.2 Was the crowd able to create an interesting or unique composition?

There were several issues that negatively impacted on TweetDreams’ music, relating to its central component – the melodic motifs. Despite there being some interest provided by algorithmically-generated variations, parent motifs appeared very much alike. This was observed by participants. Each motif was made up of a six note sequence, and all were similar in timbre, dynamic, and rhythmic material. This issue was compounded by the fact that, as melodic elements, the work’s multitude of motifs occupied the same listening space. Without additional textural elements, such as distinctive instruments or layers, the soundscape was monotonous. Further to this was a structural issue, in that following an

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71 Ibid., 274-275.
initial build-up, the texture remained largely unchanged. Uniformly cacophonic, the result of these issues left the music one-dimensional and undeveloped.

Thus, the musical features of the work’s framework limited the crowd’s ability to create an interesting or unique composition. However, the crowd were also greatly limited by low-level crowd agency, which was attributable to one fundamental detail – that a TweetDreams performance was shaped by performers, who controlled the following central parameters:

- Dequeueing rate: modifies the rates at which the tweets are dequeued and dispatched;
- Search terms: adds or removes search terms;
- Distance threshold: changes the minimum distance required to associate tweets and thus the rate at which new trees are created\(^\text{74}\).

Although this did leave participants with some agency, as they were still charged with producing the foundational hashtags that the music grew from, it is clear that the performers were dominant agents in TweetDreams. Furthermore, as a result of this limitation, participants had no awareness of motivic options, nor what motif would be associated with their contribution. As a final point, it should be mentioned that part of the resultant music was governed by globally-retrieved tweets, and therefore, some participants were unaware that they were contributing. I consider this to diminish crowd agency because parts of the collective were not critically engaging with the creative process they were involved in.

The authors write that “the development of TweetDreams began with the desire to include the audience as participants in the music-making process”\(^\text{75}\). However, analysis shows that their system did not match this ambition, as the crowd’s creative role in TweetDreams was minimal.

\(^{75}\) Ibid., 272.
4.4.2 Crowdsound

4.4.2.1 Was the experience enjoyable and satisfying for participants?

Crowdsound attracted over 67,000 people, and, Reddit’s Place aside, it is therefore the largest crowd-composition work in this review. In fact, Crowdsound was so unexpectedly popular that its server crashed occasionally due to excessive traffic. Additionally, Brendon Ferris, author of the work, increased the poll voting threshold from fifty to one hundred votes, following an unexpected spike in traffic, as he feared the composition would be completed too quickly. An immediate assumption is that a positive assessment of participation could be construed from Crowdsound’s popularity. However, a deeper look at the work’s data reveals a more complex outcome. The 67,000 participants contributed just 77,000 votes, making it likely that a relative minority of 10,000 participants, or fewer, contributed more than once. It is therefore indicated that the retention of participants in Crowdsound was low, suggesting that any enjoyment to be had was largely short-lived.

Having said that, for those that remained, there may have been greater value in the experience, and I attribute this reasoning to several factors. Firstly, despite utilising music notation, which may have been unintelligible to many in its heterogenous group of participants, Crowdsound was in fact very accessible. This can be credited to its user-friendly interface. As shown previously in Figure 4-6, the pitches presented in each poll were colour coded – corresponding with coloured notes on the stave – helping make options more distinguishable. Furthermore, a playback function allowed participants to hear each option alongside its preceding sequence of notes, meaning that participants did not have to rely solely on musical literacy. This factor applies particularly to those without musical training, but is also relevant to more experienced participants, as this may have improved the intuitiveness and efficiency of the system.

A second factor that relates to accessibility was the simplicity of the system. Participation was heavily restricted by predeterminations implemented by Ferris. The key, and by extension, available voting options (scalar C major pitches), structure and chord progression, were all pre-established. In addition, the number of options was increased from eight to eleven later in the work, echoing guidance to gradually “ramp up the difficulty of the...”

activity”\textsuperscript{78}. The effect of these restrictions was that participants could not be overwhelmed by a surplus of choice.

Thirdly, again in relation to accessibility, \textit{Crowdsound} facilitated a risk-free environment. Because of the system’s simplicity, it was practically impossible for participants to make any significantly inappropriate decisions. However, more than this, I suspect that for those with limited compositional experience, contributing to \textit{Crowdsound} was more inviting than undertaking an equivalent creative pursuit independently, as being part of the collective may minimise a fear of failure, self-doubt, or other such deterrents. This idea stems from the documented characteristic of crowd dynamics, that the anonymity of a crowd mediates inhibiting behaviours of the individuals within it\textsuperscript{79}.

Finally, there was sufficient enthusiasm amongst \textit{Crowdsound} participants that the work was able to sustain vibrant social communities on online forums, Reddit, and SoundCloud. Within these communities, people published arrangements, debated the latest updates, and discussed future applications of their crowd-composed work.

Bringing these factors together, my judgement is that the accessibility of an unfamiliar and ostensibly sophisticated compositional approach allowed some participants to engage with a practice they otherwise would not have been able to. In turn, this produced a satisfying experience, which is indicated by the communities that emerged from the work, for whom the crowd-composed music held great significance.

\subsection*{4.4.2.2 Was the crowd able to create an interesting or unique composition?}

Despite utilising an innovative system, \textit{Crowdsound}’s result was, in my opinion, largely uninteresting. Its musical premise was a major factor here. Whilst the pre-established key, chord progression, accompaniment and structure may have made the system more accessible, they were also characterised by some fairly elementary decisions by the author. A I-V-vi-IV chord progression, popular in all forms of music, repeated throughout the song’s standard verse-chorus-verse-chorus-outro structure. Additionally, this accompaniment,

\textsuperscript{78} Maynes-Aminzade, Pausch and Seitz, “Techniques for Interactive Audience Participation”, 19.
produced with an unpleasant electric piano sound, consisted of simple triadic, semibreve chords. These played once at the beginning of each bar, and were unchanging throughout the work. An example of this is shown in Figure 10. Together, these created a platform that almost certainly shaped the resulting music.

This issue was compounded by the voting framework of Crowdsound. Firstly, polling was confined to even, quaver intervals, ensuring that the melody exhibits a tirelessly plodding metre throughout. Secondly, the pitch options – C to B of a C major scale – omitted a high-C option until late into the work. As the resultant melody excessively favours descending patterns down to C, it appears that the crowd were determined to resolve to the tonic, but had only one option to do so.

In a similar vein, the crowd made several further decisions relevant to this discussion, though these were not necessarily engendered by the work’s infrastructure:

1. They relied heavily on the C major triad, particularly the tonic, selecting these for over half the notes in the melody.
2. The melody is very repetitive. In fact, the end of the work features a motif that unfailingly repeats for 24 bars.
3. An excessive use of stepwise movement led to a meandering melody with an aimless quality.
4. They rarely selected the rest option, so that, along with its resolving and repetitive nature, and scalic aimlessness, it also evokes these qualities incessantly.

Figure 10 – ‘Crowdsound’ transcription, opening four bars.
Whilst these decisions may be echoing the rudimentary accompaniment and other predeterminations, the crowd also share responsibility for these outcomes.

In conclusion, the crowd were not able to create an interesting or unique music. Freeman previously warned that aggregating collective input using a model like that found in *Crowdsound* inevitably leads to a musical result that is “painfully dull” in the “averaging out of all such contributions into the lowest common denominator”\(^80\). Whilst this is perhaps what transpired in *Crowdsound*, my sense was that the outcome was more attributable to the work’s infrastructure. Crowd agency was high because the crowd had extensive, precise control, and yet, dichotomously, their agency was also markedly funneled by Ferris’ predeterminations. I remained drawn to the originality of *Crowdsound* in its scale and its capacity for collective decision-making through crowdvoting, but I also saw potential for interesting results if conditions within the system were explored further. In addition, I was encouraged by the popularity of the work, and by the greater agency that participants craved in *TweetDreams*, which supported my notion that there was a demand for crowd-composition beyond my personal enthusiasm. The *Crowdsound* model therefore became the catalyst for my composition portfolio.

\(^{80}\) Freeman, “Web-based collaboration, live musical performance and open-form scores”, 153.
Chapter 5    Portfolio commentary

5.1    Introduction

This portfolio consists of four original crowd-composition works that feature the gradual construction of a new musical work through the collective decision-making of a group of participants. One is a Web-environment work; existing on the Web, over an extended period of time. Three are concert-environment works; taking place in concert settings, over a focused period of time. The principal crowdsourcing technique used was crowdvoting – a method of leveraging community opinion through polling – in order to determine a number of elements, such as compositional criteria and writing with notation. Though at times the portfolio features creative contributions from individuals, crowdvoting is central throughout.

This chapter will describe and evaluate works in the portfolio (Tab. 2), presenting them as a sequence of steps in a narrative of discovery. The findings will lead to a deeper discussion of my research questions in the following chapter.

5.1.1    Structure

The constructional basis for each work will be examined, accompanied by an exploration of modifications undertaken. Evaluation of the composition data and musical result then follows, with a focus on comparing prior expectations with final outcomes.

5.1.1.1    Methodology

To evaluate each work, four terms were selected that aimed to categorise the technical and experiential features of my works. These were: the collective decision-making mechanism, crowd agency, user interface, and engagement.

In assessing each of these features, there were three categories of composition data to draw upon:

1. Voting data – tallied votes for each poll;
2. Survey data – responses to questionnaires distributed following each work; and,
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3. Impressions – anecdotal evidence from myself and the participants.

The musical result of each work was also analysed, with a focus on identifying specific qualities of the crowd’s decision-making and resultant materials.

Table 2 – List of studies in the portfolio.

<table>
<thead>
<tr>
<th>Name of work</th>
<th>Iteration</th>
<th>Abbreviation in text</th>
<th>Abbreviation in tables</th>
<th>Crowd</th>
<th>Date</th>
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<td>Pilot</td>
<td>-</td>
<td>-</td>
<td>Oct, 2016</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>Main study</td>
<td>CrowdComp</td>
<td>Half trained musicians, half without musical training</td>
<td>Mar-May, 2017</td>
</tr>
<tr>
<td>HyperCello</td>
<td>First</td>
<td>Main study</td>
<td>HyperCello</td>
<td>UoS Music Department staff and students</td>
<td>Jul, 2017</td>
</tr>
<tr>
<td>It Wasn’t All Yellow</td>
<td>First</td>
<td>First study</td>
<td>It Wasn’t All Yellow 1</td>
<td>UoS Music Department staff and students</td>
<td>Jul, 2018</td>
</tr>
<tr>
<td></td>
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<td>General public</td>
<td>Feb, 2019</td>
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<tr>
<td>ElectroQuiz</td>
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<td>ElectroQuiz 3</td>
<td>Children</td>
<td>Mar, 2019</td>
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</table>

5.1.1.1.1 The collective decision-making mechanism

Referring to the method of interaction between participants and the compositional process, this section predominantly assessed voting mechanisms and the forms that contribution took. A central concern here was that the crowd found their contribution to the process obvious. This is illustrated by an outcome of a collaborative project by Maynes-Aminzade et al. in which participants steered a car by leaning left and right, where, in order to prove to
themselves that they were in control, participants attempted to veer the car off the road\(^81\). Also relevant is *Graph Theory* by Jason Freeman (2006), which was comprised of 61 short musical fragments, displayed on a grid. Web users traversed this grid, creating their own version of the piece. Each decision users made was logged on a database, which amalgamated contributions to create a score revealing the most popular route through the grid. Unfortunately, Freeman indicates that the audience felt disconnected in *Graph Theory* because the process that led from their contribution to a collectively determined result was not transparent, diminishing the success of the work\(^82\).

### 5.1.1.1.2 Crowd agency

This section considered aspects that related to the crowd’s agency in the work, primarily reflecting on the construction of polls and the degree of freedom granted to participants.

In a low-level crowd-composition system, materials may be slowly built, choice by choice; in a high-level system, it may completely transform through just a few decisions. The difference, however, does not necessarily equate to crowd agency, as each approach provides opportunities for a spectrum of restrictions on decision-making. Nevertheless, neither approach should provide the crowd with truly free agency, as this would leave participants feeling overwhelmed by a plethora of possible actions, and likely have the opposite effect of diminishing crowd agency. Conversely, too much limitation would be suppressive, and would devalue the crowd’s role. Therefore, crowd-composition works must continually balance constraint and freedom so as to take full advantage of the medium’s interactional capacity.

Take, for instance, *SwarmSketch* by Peter Edmunds, where users collaborate towards sketching a specific subject, and can draw anywhere on an open canvas to complete the task. The open canvas represents a huge amount of freedom, running the risk of discouraging user activity, but simple limitations temper this freedom, making the task more manageable. Provision of a subject, e.g. Cavemen, reduces potential chaos. Additionally, visitors may draw just one short line per visit, and, as their contribution takes up so little room, a user is unlikely to feel preoccupied with submitting perfection. Finally, after drawing, users have the


\(^{82}\) Freeman, “Web-based collaboration, live musical performance and open-form scores”, 162.
opportunity of voting on the transparency of contributions from other users. This is less challenging than the sketching task, and so further interaction and collaboration is achieved. These tools ensure that crowd agency is not diminished by excessive freedom in *SwarmSketch*.

In order to assess this concern, my evaluations consider the following data:

1. **Majority strength**: the percentage of votes that each majority vote received.

   Majority strength data can be tallied and divided, categorised by the number of options each poll presented, to produce arithmetic means across the work. These insights are then used to produce a *mean overall majority*, which is the mean majority strength for all completed polls.

   I inferred from my review in Chapter 4 that low majority strength would have a significant negative effect on the success of a work. Therefore, throughout my portfolio I aimed to achieve a mean overall majority of 50% or more. My sense was that this was a good benchmark, as collective decisions, on average, would then have been made by over half the crowd.

   It is important to highlight *theoretical probability* with regards to majority strength – the percentage that each option would receive if all votes were distributed evenly within a poll. Theoretical probability reveals a bias in my evaluation towards polls with fewer options, as these have a higher theoretical probability. For instance, the theoretical probability for options in a 2-option poll is 50%, whereas in a 5-option poll votes are more diffused, and its theoretical probability is 20%. Therefore, it is inevitable that polls with fewer options will have stronger majorities. Taken further, let us imagine that the 2-option poll led to a 60% majority strength, and 55% for the 5-option poll. An initial review of these outcomes indicates that the 2-option poll had the strongest majority. However, by subtracting the theoretical probability from majority strength, the *differential majority* reveals this treatment to be limited. In this example, the differential majority of the 2-option poll is 10%, whereas for the 5-option poll it is 35%. Therefore, from this perspective, the 5-option poll had a stronger majority.

   It is also of note that comparing data between option quantity categories is problematic because mean data considers various sums of polls. For example, 2-option polls may have
been used twice, whereas 5-option polls may have been used twenty times. This is referred to as *relative frequency* in the commentary.

Differential majority and relative frequency data are presented in tables alongside majority strength for each work. However, they were taken into account only once the portfolio had been completed, consequently undermining some evaluative outcomes with regards to majority strength. Where relevant, this will be acknowledged in the commentary.

2. The crowd’s perception of influence: survey data that reveals how critical to collective decision-making individual participants felt.

Whilst the voting data reveals the objective strength of the crowd’s influence, survey data is able to interpret their subjective view of this concern. This is perhaps the more important outcome, as this concern is one that is largely experiential. I have been interested, however, in whether there can be disparity between the two factors.

The combination of majority strength and the crowd’s perception of influence is referred to in this commentary as *crowd cohesion*. My principle aim here was to explore whether it was possible for both high crowd agency and strong crowd cohesion to be facilitated, and to assess what effect these factors had on the work.

5.1.1.1.3 *User interface*

The user interface is the means by which participants interact with a system. This could be a website design or staging in a live concert. It includes how participatory information is communicated, and assesses whether participants were equipped to engage with their task. Crowd-composition involves sharing a host of information to participants, from educational materials to indicating where to click with a cursor. It is important that this information is displayed coherently, and be sufficient for all participants.

Users must possess the knowledge required to meaningfully participate. This is particularly relevant with participants that have no musical training; systems must cater for their needs and not overestimate the level of difficulty that they can manage. Additionally, the balance of participation is important. Simula conveys how issues arise when a minority asserts
Chapter 5

influence over a system\textsuperscript{83}, which can happen if a select group of participants are more capable than others. The effect of this would demotivate participants that feel less competent, and generate a one-sided result. A user interface must enable all participants to contribute equally.

Crowdsound provides an excellent example of an effective user interface. As discussed in Chapter 4, pitches were colour coded, making a user-friendly distinction between options, and this was reinforced by the polling overlay. The poll appeared above the score when it was time for participants to vote, instead of, for example, opening a secondary window. This overlay was an efficient tool for presenting multiple pages of information, easing the task for participants. In addition, it encouraged participants to rely on listening, rather than imposing a need to understand music notation. These features made Crowdsound both informative and inclusive.

5.1.1.1.4 Engagement

Engagement refers to the overall quality of the experience. It is seen as essential to motivating participation, taking “precedence over the generation of music itself”\textsuperscript{84}. Maynes-Aminzade et al. warn that if an experience is not engaging, then within 30 seconds the crowd’s interest will be lost\textsuperscript{85}.

Initially introduced in the preceding chapter, enjoyment in the experience and satisfaction with the musical result were the two measures of engagement I chose to employ when I began the portfolio. Chapter 4 stated that enjoyment referred to the reception of the experience; whereas satisfaction was a subjective assessment, by participants, of the quality of their interaction. These terms represent what I recognised as core properties of a two-way view of engagement in crowd-composition:

- What is received by participants – entertainment; and,


\textsuperscript{85} Maynes-Aminzade, Pausch and Seitz, “Techniques for Interactive Audience Participation”, 19.
• What is given by participation – a capacity for the experience to be augmented by its collaborative nature.

My evaluations drew on enjoyment and satisfaction ratings in the survey data, and suggested explanations for these outcomes. A positive assessment might have meant that participants found the work to be enjoyable and satisfying, and they may even have learned something from the experience. However, if engagement was poor, then neither the participants’ attention, nor their attendance, could be retained. They may have felt that the experience had no value to them, the system was likely to have had either too much or too little challenge, or the mechanism for collective decision-making may have failed.

5.1.1.2 Surveys

Each work in the portfolio provided an opportunity to survey participants. Survey design was informed by the literature, notably: Question and Questionnaire Design (2010) by Jon A. Krosnick and Stanley Presser, and Conducting Research on the Internet: Online Survey Design, Development and Implementation Guidelines (2003) by Dorine Andrews, Blair Nonnecke and Jennifer Preece. In addition, I also turned to an educational resource from Iowa State University by Sorrel Brown, titled Likert Scale Examples for Surveys (2017). Following this guidance, Likert scales were predominantly used to generate survey data, although open-ended questions were also employed.

Questions related to the evaluative features introduced in this methodology. They assessed the quality and value of various components, comprehension, and engagement. Each questionnaire was built on the findings from preceding works, and reflected changing concerns over the course of the project. Therefore, as this element varied, the details of each are documented independently under the relevant headings.

5.1.1.3 Discussion in relation to research questions

Following analysis, each work was reviewed in terms of the two research questions:
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- How can crowd-composition facilitate meaningful experiences for participants?
- How can crowd-composition lead to musical works or perspectives that are distinct from sole agent composition?

Primarily consulting assessments of engagement, the first question helped develop an understanding of how the crowd-composition experience may have been meaningful, as well as highlight elements that were detrimental to those attributes. This project considers a meaningful experience to be one that is a worthy investment of a participant’s time.86 The second reflects on the creative decision-making of the crowd, and the resultant music, exploring aspects of crowd-composition that were distinct from conventional practice.

5.1.1.4 Ethics

It was necessary to seek approval from the University Ethics Committee, via the Ethics and Research Governance Online (ERGO) system, for performances where surveys were issued that required feedback from individual participants. The ERGO numbers for these applications are below:

- CrowdComp [main study] – 26631
- It Wasn’t All Yellow [second study] – 47212
- ElectroQuiz [second study] – 47211

The central concern was ensuring that feedback remained anonymous, and the live performances came with the added issue of providing enough time for participants to read, understand and sign ethics forms. In addition, care was taken to ensure safeguarding of the younger participants in the ElectroQuiz [pilot] and ElectroQuiz [second study] workshops. Permission was also sought to publish footage of the audience from the It Wasn’t All Yellow

[second study] workshop. The *ElectroQuiz* [first study] workshop footage was recorded by SÓN, who hosted the event and received their own permissions to publish, and so images of this audience may also be used in the commentary.
5.2 CrowdComp

CrowdComp was a Web-based work in which a melody was crafted through crowdvoting. Note by note, a closed group of 50 participants voted in daily polls, the results of which led to the completion of a 16-bar melody. The stimulus of the work was my case study analysis of Crowdsound by Brendon Ferris, and my aim was to build on that system in an attempt to increase the likelihood of more interesting musical results. The work took place over 47 days, between March 23rd and May 10th, 2017.

5.2.1 Construction

As with Crowdsound, CrowdComp’s melody was written note by note. For each note, participants voted on a selection of pitch options, the winning option receiving the most votes. Likewise, this work included a pre-written accompanying music that played alongside the forming melody, and the system materials were written in C major, a key suitable for working with non-musicians.

To steer the crowd towards a more interesting musical result, several updates were made to the Crowdsound system. Firstly was the addition of a high C pitch option, so that the available range was a full scale, rather than stopping on the leading tone. Crowdsound participants had an appetite for resolving to the tonic and I hoped that with the inclusion of an upper tonic, they would utilise this ascending resolution, adding variety to the shape of the melody. Secondly was the inclusion of a note value poll. In Crowdsound, participants were polled in divisions of quavers, which resulted in an overly metronomic rhythmic structure. In CrowdComp, note value was instead determined by the crowd. Here, five options were available:

- Semibreve;
- Minim;
- Crotchet;
- Dotted crotchet;
- Quaver.
I also held that Crowdsound’s rudimentary accompaniment had led to its musical simplicity. Therefore, finally, I incorporated more developed materials and instrumentation to see what effect this would have. The accompaniment in CrowdComp featured a continually developing chord progression, and several textural layers within an established electro-ambient soundworld.

5.2.2 System

Fifty participants were recruited from the University of Southampton: half were musically trained (having received a GCSE in Music, or higher), and half were not. This decision was made in order to study how each demographic engaged with the work. They were informed that CrowdComp would last approximately 4 weeks, that contributing daily was expected but not compulsory, and, finally, that two random participants would each receive a £20 gift voucher as a reward for taking part.

Participants were emailed daily with the result of the previous vote, and a link to an iSurvey\(^87\) questionnaire presenting two polls (Fig. 11). The first determined the pitch of the next note in the melody. Participants choose from the eight pitches of a C major scale, as well as a ninth rest option. The second poll determined note value.

Audio and picture resources were provided with the questionnaires, found through hyperlinks to a separate webpage. There were audio examples for each pitch option, as well as pictures of the options as both traditional notation and within a piano roll (Fig. 12). These resources hoped to be enough for the non-musician group to participate meaningfully. Comparable resources for note value options would have been too time-consuming for participants. Instead, musical terminology was accompanied by simple definitions: very long, long, medium, short, and very short. A hyperlink was also available that allowed participants to listen to an up-to-date melody.

\(^87\) The University of Southampton’s survey generation and research tool for distributing online questionnaires.
Visit the CrowdComp website to hear the up-to-date melody.

Question 1.

Listen to the pitch options in the links below.

Option:
- C
- D
- E
- F
- G
- A
- B
- C [hsp]

Select your preferred pitch option.

Question 2.

Select your preferred length option.

Option:
- Semibreve (very long)
- Minim (long)
- Dotted crotchet (medium)
- Crotchet (short)
- Quaver (very short)

Figure 12 – ‘CrowdComp’ [main study] daily questionnaire.

Figure 11 – ‘CrowdComp’ [main study] resource, ‘C’
5.2.3 Revisions

A pilot took place in October, 2016. Rather than using iSurvey, this ran on a private Facebook group. Facebook was used partly because it was straightforward to recruit friends and family to help test the concept, and also because I had hoped to continue using Facebook for future works, assuming dissemination and accessibility would be easier through that platform.

The pilot led to several revisions. Firstly, it was immediately clear that including a semiquaver option in the note value poll would extend the work beyond realistic timescales. The second revision was to find a more suitable platform for the questionnaires. The Facebook polls automatically folded options to show only those with the most votes, meaning many options were overlooked. A third issue was that Facebook displayed on-going votes within polls. Several members of the group commented that this feature influenced their decision-making. Due to this, I elected to remove all visibility of the voting data.

Finally, Facebook members were able to comment beneath each poll, and there was one contingent who were attempting to “rickroll” the system by composing the melody from *Never Gonna Give You Up* by Rick Astley. Whilst this was certainly good-natured, it led me to ensure that participants could not communicate this way in future, falling in line with Surowiecki’s guidance for anonymity amongst the crowd.

5.2.4 Survey

Following the completion of CrowdComp, participants were asked to answer the questionnaire presented in Figure 13.

The details of this survey design are as follows:

- Question 1 – relating to crowd agency, this assessed the participants’ subjective experience of involvement, which could then be compared against objective outcomes by looking at majority strength in the voting data.

---

88 ‘Rickrolling’ is a prank involving an unexpected appearance of Rick Astley’s 1987 song, ‘Never Gonna Give You Up’.


90 Note: where ‘Pitch | Note length’ is written, the question was asked once for each. Similarly, where ‘audio | picture’ is written, the question was also asked once for each.
1. **How often did it seem that the options you selected influenced the CrowdComp melody?**

<table>
<thead>
<tr>
<th>Pitch</th>
<th>Note length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>Rarely</td>
</tr>
<tr>
<td>Occasionally</td>
<td>Frequently</td>
</tr>
</tbody>
</table>

2. **How much did you rely on the audio | picture resources in making your choice?**

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Very little</th>
<th>Somewhat</th>
<th>To a great extent</th>
</tr>
</thead>
</table>

3. **Were the audio | picture resources provided enough to help you make an informed decision?**

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Very little</th>
<th>Somewhat</th>
<th>To a great extent</th>
</tr>
</thead>
</table>

4. **How do you feel about the duration of the work?**

<table>
<thead>
<tr>
<th>Far too short</th>
<th>Too short</th>
<th>About right</th>
<th>Too long</th>
<th>Far too long</th>
</tr>
</thead>
</table>

5. **Did the way you engaged with the work change over time?**

*Space left for written feedback*

6. **Did you enjoy taking part in CrowdComp?**

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
</table>

7. **Are you satisfied with the finished CrowdComp melody?**

<table>
<thead>
<tr>
<th>Very dissatisfied</th>
<th>Dissatisfied</th>
<th>Undecided</th>
<th>Satisfied</th>
<th>Very satisfied</th>
</tr>
</thead>
</table>

8. **Any additional comments?**

*Space left for written feedback*

---

**Figure 13** – ‘CrowdComp’ [main study] participant survey.

- Question 2 – relating to user interface, this assessed the value of the two resource components.
- Question 3 – relating to user interface, and building on Question 2, this assessed the relevance of the resources in completing the two polls respectively.
- Question 4 – relating to engagement, this queried opinion on the duration of the work.
- Question 5 – an open-ended question, this queried whether the participants’ relationship with the work deviated over time from their initial involvement.
- Question 6 – relating to engagement, this assessed reception of the experience.
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- Question 7 – relating to engagement, this assessed the participants’ opinion on the quality of their interaction.

The questionnaire was trialled as part of the pilot, leading to two amendments. Firstly, note value was changed to note length in Questions 1-3, as well as throughout the CrowdComp system. This was seen as more intelligible for those without musical training. Secondly, Question 5 was initially forced choice, in that I provided specific outcomes as options. However, participants felt that these did not fully represent their experience, and that the question would benefit from changing to an open-ended format.

Seventeen of CrowdComp’s fifty participants responded to the survey. Twelve were musicians, five were non-musicians.

5.2.5 Evaluation

The evaluation examines composition data from CrowdComp, divided into the four evaluative features covered in the methodology. Following this, the resultant music is analysed.

5.2.5.1 Composition data

5.2.5.1.1 The collective decision-making mechanism

This section discusses three elements that pertain to the collective decision-making mechanism in CrowdComp:

- The twofold poll of the online questionnaires;
- The transparency of the voting data;
- The resolution of multiple majorities.

To have offered the same amount of choice with a combined pitch and note length poll would have resulted in more options than I could feasibly have asked participants to consider. Therefore, the twofold mechanism was used, though some took issue with it. One participant commented:
I felt that voting for the pitch and length as separate categories was odd since I was choosing for the length of the pitch I was selecting but not necessarily the length if another note was selected. This was an astute observation, and it was something that I had not seen as an issue before the work began.

When participants were informed of the winning pitch and note length options each day, they were given no indication of the voting data for those polls. Several participants responded negatively to this, remarking that it led them to feel disconnected from the process. Maynes-Aminzade et al. note the importance of ensuring that an interactive process is transparent91, and this response made it clear how transparency can apply to crowd-composition.

Finally, of the 94 separate polls the crowd completed, there were 24 occasions in which two or more options held an equal majority – a multiple majority. In these instances, a die was rolled to randomly select the winning option, which I saw as a fair resolution. However, as roughly 24% of polls were determined this way, it meant that a large amount of decision-making was random. The crowd were not aware of this as the voting data was not visible. However, conceptually I saw it as a weakness of the work because randomness detracts from the purposeful nature of collective decision-making, therefore undermining my crowd-composition vision.

5.2.5.1.2 Crowd agency

This section discusses crowd cohesion, as it pertains to crowd agency in CrowdComp.

Table 3 shows the mean overall voting majority, which is the mean for all majority votes from the work. The table also shows means for the 5 and 9-option polls, which are the mean majorities for polls with those specific option quantities. The data reveals that mean majorities were weak in CrowdComp:

5-option polls are shown to be stronger here. However, theoretical probability makes this a likely outcome, and the differential majority is in fact 17% for both – a comparison that can confidently be made as the two categories have an equal relative frequency (Tab. 4).

Table 4 – ‘CrowdComp’ [main study], voting data, additional information.

<table>
<thead>
<tr>
<th></th>
<th>5 options</th>
<th>9 options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential majority</td>
<td>17%</td>
<td>17%</td>
</tr>
<tr>
<td>Relative frequency</td>
<td>47</td>
<td>47</td>
</tr>
</tbody>
</table>

In terms of the crowd’s perception of influence, the table below shows similarly negative feedback:

Table 5 – ‘CrowdComp’ [main study] survey data, ‘How often did it seem that the options you selected influenced the CrowdComp melody?’

<table>
<thead>
<tr>
<th>How often did it seem that the options you selected influenced the CrowdComp melody?</th>
<th>Musicians</th>
<th>%</th>
<th>Non-musicians</th>
<th>%</th>
<th>Totals</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pitch</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>1</td>
<td>8%</td>
<td>1</td>
<td>20%</td>
<td>2</td>
<td>12%</td>
</tr>
<tr>
<td>Rarely</td>
<td>4</td>
<td>33%</td>
<td>1</td>
<td>20%</td>
<td>5</td>
<td>29%</td>
</tr>
<tr>
<td>Occasionally</td>
<td>5</td>
<td>42%</td>
<td>2</td>
<td>40%</td>
<td>7</td>
<td>41%</td>
</tr>
<tr>
<td>Frequently</td>
<td>2</td>
<td>17%</td>
<td>1</td>
<td>20%</td>
<td>2</td>
<td>18%</td>
</tr>
<tr>
<td>Always</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Note length</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Rarely</td>
<td>5</td>
<td>42%</td>
<td>1</td>
<td>20%</td>
<td>6</td>
<td>35%</td>
</tr>
<tr>
<td>Occasionally</td>
<td>4</td>
<td>33%</td>
<td>4</td>
<td>80%</td>
<td>8</td>
<td>47%</td>
</tr>
<tr>
<td>Frequently</td>
<td>2</td>
<td>17%</td>
<td>0</td>
<td>0%</td>
<td>3</td>
<td>12%</td>
</tr>
<tr>
<td>Always</td>
<td>1</td>
<td>8%</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>6%</td>
</tr>
</tbody>
</table>
Crowd cohesion was clearly unsuccessful, and many participants reported that it was “frustrating” to be left out. However, feedback in Table 5, when compared with the difference between 5 and 9-option mean majorities, suggests better results if votes are spread less thinly. Additionally, feedback showed how 9 options does not necessarily equate to high agency. One participant wrote, “all the options sound the same”, indicating an issue with option selection. The eight pitch options from the C major scale may not have been easily distinguishable for some participants and more contrasting options could be considered in future.

5.2.5.1.3 User interface

This section discusses two elements that pertain to the user interface in CrowdComp:

- Whether the user interface was effective in assisting participation;
- Whether the information provided was sufficient for meaningful participation.

CrowdComp’s user interface resided in several locations: an email, the iSurvey questionnaire, and the resources website. Resources were available through nine different hyperlinks on the questionnaire, and as the work developed, these expanded in order to accommodate the growing melody.

Feedback to the survey question ‘Did the way you engage with the work change over time?’, relates to user interface:

- “(I) spent less time voting as it went on”
- “I tended to only listen to the last few seconds after a while and listening to the entire melody for each pitch was boring”
- “I began to vote less often the longer it got”

Some comments from the end of the survey are also relevant:

- “The different pages confused me”
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- “Sometimes I guessed because clicking all the links was boring”
- “Felt like I needed three screens to complete this”

It seems that the user interface was too complicated, impairing the crowd’s ability to participate. The laborious nature of the hyperlinks were noted as a particular issue, with the increasing size of those resources compounding the problem.

Feedback in Table 6 shows that participants relied on the audio resources far more than the picture resources, though the picture resources may have been more useful for the non-musicians. However, as twelve musicians responded compared to five non-musicians, it is difficult to compare the two groups.

Table 6 – ‘CrowdComp’ [main study] survey data, ‘How often did you rely on the audio and picture resources in making your choice?’

<table>
<thead>
<tr>
<th>How much did you rely on the audio</th>
<th>picture resources in making your choice?</th>
<th>Musicians</th>
<th>%</th>
<th>Non-musicians</th>
<th>%</th>
<th>Totals</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Audio</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>1</td>
<td>8.3%</td>
<td>0</td>
<td>0%</td>
<td>1</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>Very little</td>
<td>1</td>
<td>8.3%</td>
<td>0</td>
<td>0%</td>
<td>1</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>Somewhat</td>
<td>3</td>
<td>25%</td>
<td>1</td>
<td>20%</td>
<td>4</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>To a great extent</td>
<td>7</td>
<td>58.3%</td>
<td>4</td>
<td>80%</td>
<td>11</td>
<td>65%</td>
<td></td>
</tr>
<tr>
<td><strong>Picture</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>1</td>
<td>8.3%</td>
<td>1</td>
<td>20%</td>
<td>2</td>
<td>12%</td>
<td></td>
</tr>
<tr>
<td>Very little</td>
<td>7</td>
<td>58.3%</td>
<td>1</td>
<td>20%</td>
<td>8</td>
<td>47%</td>
<td></td>
</tr>
<tr>
<td>Somewhat</td>
<td>3</td>
<td>25%</td>
<td>2</td>
<td>40%</td>
<td>5</td>
<td>29%</td>
<td></td>
</tr>
<tr>
<td>To a great extent</td>
<td>1</td>
<td>8.3%</td>
<td>1</td>
<td>20%</td>
<td>2</td>
<td>12%</td>
<td></td>
</tr>
</tbody>
</table>

Feedback in Table 7 and 8 indicates that the musician group were able to utilise the audio and picture resources for both pitch and note length. However, feedback to ‘Did the way you engaged with the work change over time?’ suggests that the resources were unnecessary for this group. One participant commented, “I started using musical intuition later rather than relying on audio examples”. Another said, “I used my piano to explore the options”. Conversely, the non-musician group responded more negatively, only finding the audio resources useful for determining pitch. In light of this information, a more streamlined user interface that did not accommodate the picture resources could have been used, alongside new resources to assist non-musicians in determining note length.
5.2.5.1.4 Engagement

This section discusses three elements that pertain to engagement in CrowdComp:

- Participant turnout;
- Enjoyment ratings;
- Satisfaction ratings.

Table 7 – ‘CrowdComp’ [main study] survey data, ‘Were the resources provided enough to help you make an informed decision about pitch?’

<table>
<thead>
<tr>
<th>Were the resources provided enough to help you make an informed decision about pitch?</th>
<th>Musicians</th>
<th>%</th>
<th>Non-musicians</th>
<th>%</th>
<th>Totals</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Audio</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Very little</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Somewhat</td>
<td>5</td>
<td>42%</td>
<td>0</td>
<td>0%</td>
<td>5</td>
<td>29%</td>
</tr>
<tr>
<td>To a great extent</td>
<td>7</td>
<td>58%</td>
<td>5</td>
<td>100%</td>
<td>12</td>
<td>71%</td>
</tr>
<tr>
<td><strong>Picture</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>0</td>
<td>0%</td>
<td>1</td>
<td>20%</td>
<td>1</td>
<td>6%</td>
</tr>
<tr>
<td>Very little</td>
<td>1</td>
<td>8%</td>
<td>2</td>
<td>40%</td>
<td>3</td>
<td>18%</td>
</tr>
<tr>
<td>Somewhat</td>
<td>8</td>
<td>67%</td>
<td>1</td>
<td>20%</td>
<td>9</td>
<td>53%</td>
</tr>
<tr>
<td>To a great extent</td>
<td>3</td>
<td>25%</td>
<td>1</td>
<td>20%</td>
<td>4</td>
<td>23%</td>
</tr>
</tbody>
</table>

Table 8 - ‘CrowdComp’ [main study] survey data, ‘Were the resources provided enough to help you make an informed decision about note length?’

<table>
<thead>
<tr>
<th>Were the resources provided enough to help you make an informed decision about note length?</th>
<th>Musicians</th>
<th>%</th>
<th>Non-musicians</th>
<th>%</th>
<th>Totals</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Audio</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>1</td>
<td>8%</td>
<td>0</td>
<td>0%</td>
<td>1</td>
<td>6%</td>
</tr>
<tr>
<td>Very little</td>
<td>0</td>
<td>0%</td>
<td>3</td>
<td>60%</td>
<td>3</td>
<td>18%</td>
</tr>
<tr>
<td>Somewhat</td>
<td>6</td>
<td>50%</td>
<td>1</td>
<td>20%</td>
<td>7</td>
<td>41%</td>
</tr>
<tr>
<td>To a great extent</td>
<td>5</td>
<td>42%</td>
<td>1</td>
<td>20%</td>
<td>6</td>
<td>35%</td>
</tr>
<tr>
<td><strong>Picture</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>1</td>
<td>8%</td>
<td>1</td>
<td>20%</td>
<td>2</td>
<td>12%</td>
</tr>
<tr>
<td>Very little</td>
<td>0</td>
<td>0%</td>
<td>2</td>
<td>40%</td>
<td>2</td>
<td>12%</td>
</tr>
<tr>
<td>Somewhat</td>
<td>6</td>
<td>50%</td>
<td>2</td>
<td>40%</td>
<td>8</td>
<td>47%</td>
</tr>
<tr>
<td>To a great extent</td>
<td>5</td>
<td>42%</td>
<td>0</td>
<td>0%</td>
<td>5</td>
<td>29%</td>
</tr>
</tbody>
</table>
Chapter 5

*Figure 14* shows participant turnout for each day *CrowdComp* took place, indicating four points:

- Never did all fifty participants contribute in one poll;
- The total turnout quickly declined;
- The non-musicians contributed less often than the musicians; and,
- The non-musician turnout declined quicker than the musicians.

Thus it is clear that *CrowdComp* failed to engage participants over a prolonged period of time. In addition, 53% of participants reported that the work was either ‘too long’ or ‘far too long’. This feedback is no surprise as the work lasted 3 weeks longer than advertised. As warned by the literature, whilst the technology may have initially caught the interest of participants, it could not maintain their attention for long. Furthermore, retention was worse for the non-musician group, the cause of which may be that resources were insufficient for non-musicians to make an informed decision.

*Table 9* shows feedback for enjoyment in the work, revealing a somewhat positive experience, though this response would likely have been diminished by the 33 participants who did not respond.
Table 9 – ‘CrowdComp’ [main study] survey data, ‘Did you enjoy taking part in ‘CrowdComp’?’

<table>
<thead>
<tr>
<th></th>
<th>Musicians</th>
<th>%</th>
<th>Non-musicians</th>
<th>%</th>
<th>Totals</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>Disagree</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>Undecided</td>
<td>1</td>
<td>8%</td>
<td>0</td>
<td>0%</td>
<td></td>
<td>6%</td>
</tr>
<tr>
<td>Agree</td>
<td>9</td>
<td>75%</td>
<td>4</td>
<td>80%</td>
<td>13</td>
<td>76%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>2</td>
<td>17%</td>
<td>1</td>
<td>20%</td>
<td>3</td>
<td>18%</td>
</tr>
</tbody>
</table>

There are two factors that may have negatively affected enjoyment. Firstly, the convoluted and time-consuming user interface was detrimental. I also suspect that a solitary, computer-based Web-environment is inherently unsuitable for a collaborative musical venture, and that the user interface did not do enough to offset this. Secondly, CrowdComp’s system was too repetitive. One participant wrote:

The tasks required of participants were repetitive. Perhaps it would be more engaging if participants were asked to contribute in different ways each day, not asking for pitch and length every day.

The need to “vary the pacing of the activity”\(^\text{92}\) is clear. However, variety was not present in CrowdComp.

Responses to satisfaction with the finished melody were mixed (Tab. 10), and key issues here were weak crowd cohesion and invisible voting data. However, the feedback also indicates that non-musicians were more satisfied, even if resources were insufficient for them to make an informed decision. My suspicion is that, in contrast to those with musical training, non-musicians likely produced something they otherwise would not have been able to. This is in line with expectations based on analysis of Crowdsound, where I felt that a similar outcome emerged.

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Table 10 – ‘CrowdComp’ [main study] survey data, ‘Are you satisfied with the finished CrowdComp melody?’

<table>
<thead>
<tr>
<th>Are you satisfied with the finished CrowdComp melody?</th>
<th>Musicians</th>
<th>Non-musicians</th>
<th>Totals</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very dissatisfied</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>13%</td>
</tr>
<tr>
<td>Undecided</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>25%</td>
</tr>
<tr>
<td>Satisfied</td>
<td>5</td>
<td>4</td>
<td>9</td>
<td>56%</td>
</tr>
<tr>
<td>Very satisfied</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>6%</td>
</tr>
</tbody>
</table>

5.2.5.2  Musical result

The resultant music (Fig. 15, Track 1) is bright and energetic, contrasting with its wispy accompaniment. It is broken into two phrases, framed by the drum kit material. There is a bouncing, syncopated quality to the melody. The second phrase reaches higher notes with greater frequency, forming a climactic trajectory to the melody’s shape.

I considered Crowdsound to be too reliant on notes from the C major triad, and in particular the tonic C, as well as overly favouring stepwise movement. My immediate impression with CrowdComp was that this was no longer the case and that the crowd had become more inventive. However, the data tells a different story. Table 11 compares pitch data between the opening section (12 bars) of Crowdsound, and CrowdComp’s 16-bar melody, representing the proportions of each component as a percentage. It shows that the use of triad pitches and stepwise movement are both roughly similar between the two compositions.

Table 11 – ‘CrowdComp’ [main study] pitch analysis.

<table>
<thead>
<tr>
<th></th>
<th>Crowdsound</th>
<th>CrowdComp</th>
</tr>
</thead>
<tbody>
<tr>
<td>C triad</td>
<td>54%</td>
<td>59%</td>
</tr>
<tr>
<td>C tonic</td>
<td>20%</td>
<td>23%</td>
</tr>
<tr>
<td>Stepwise movement</td>
<td>47%</td>
<td>46%</td>
</tr>
</tbody>
</table>
Figure 15 – ‘CrowdComp’ [main study] completed melody (blue notation).
Therefore, the significance of the note length poll became clear. Decision-making in the two works may have been similar, but through a variety of note values, a melody with more interest emerged. Sustained moments of tension were achieved by drawing out non-harmonic pitches (see examples 1 & 2), as well as creating rhythmic flavour through syncopation (examples 3-5). The inclusion of a high C pitch option also had an effect. Even though the amount of tonic notes in the melody was the same as in Crowdsound, 4 of the 11 tonics were the high option, creating a more open shape than the persistent descending to the low C exhibited in the Crowdsound melody.

It is of interest to me that the melody does not reflect the electro-ambient soundworld of the accompaniment. If I had independently composed a melody for CrowdComp, I would have favoured longer note values and made more use of silence. Additionally, because engagement was so low, I thought shorter note values would be avoided as these would prolong the work. In fact, the opposite took place, with the shortest options filling the greatest proportion of notes. On top of this, of the 47 crowd-determined notes, only 4 were rests. This suggests a preference in crowd-composition for a more energetic music.

5.2.6 Discussion in relation to research questions

5.2.6.1 How can crowd-composition facilitate meaningful experiences for participants?

CrowdComp did not appear to be a worthwhile, meaningful experience for most participants. This was indicated by a number of factors, particularly the poor participant turnout, though all evaluative features share responsibility:

- The collective decision-making mechanism failed through a lack of transparency, as well as the unsuitability of the twofold poll;
- Crowd cohesion was weak due to a surplus of choice; and,
- The user interface was both too convoluted, and insufficient for non-musicians.

Ultimately, CrowdComp was, in general terms, repetitive, tedious, and unrewarding. However, there were positives to take away from the work. Most notably, whilst satisfaction
feedback was mixed overall, non-musicians were significantly more satisfied than the musician group. This is encouraging because it suggests there may be potential for a meaningful experience in assisting those without musical training to create something they would not have been able to individually.

5.2.6.2 How can crowd-composition lead to musical works or perspectives that are distinct from sole agent composition?

Although collective decision-making was essential to CrowdComp’s system, weak crowd cohesion and a general dissatisfaction amongst participants meant that, in a sense, the resultant music was not reflective of the desires of its contributors. The involuntary nature of this outcome is interesting because it is so unlike the far more deliberate practice that I have experienced as a composer. However, whilst this may be distinct, the negative affect this had on engagement makes it undesirable.

A second distinction is seen in how drawn-out and detached the process was, with a single note in contention every 24 hours, which one musically trained participant described as “grotesque”. Several participants noted in informal conversation that this significantly impacted their decision-making. Their view of the compositional task was narrow as their attention focused solely on how the previous note should move to the next, with little awareness of the overall music. This is distinct from a sole agent experience of composing, which affords a far more open and flexible perspective.

A final observation lies with the resultant music. Throughout the work’s timeline, I constantly felt at odds with collective decisions. Within individual polls, my preferences were rarely chosen, and the completed melody did not match what I envisaged as a good fit for the accompaniment. Reflecting on this reaction, and on the largely poor engagement of CrowdComp, I came to realise that I had erred by putting too much of my own voice into the work. Its highly-stylised accompaniment was the biggest factor here, which was implemented in an effort to produce a more interesting result than in Crowdsound. This agenda got in the way of a potentially distinct musical outcome, as the system was so heavily steered by predeterminations. In addition, it also diverted my attention away from engagement, which ultimately led to losing the majority of participants by the end of the work, an outcome that emphasises the importance of engagement.
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However, it is of note that this reflects a similar outcome to that of Crowdsound, suggesting that the foundational system has significant intrinsic problems.

5.2.7 Moving forward

CrowdComp did not meet expectations, but its failures highlighted a number of aspects to revise in my approach. In particular, there were two fundamental changes implemented for the following work. Firstly, I endeavoured to devolve further agency to the crowd by allowing them to create a multi-layered texture, removing the need for pre-written accompanying materials. Secondly was a shift from the Web to the concert hall. The review in Chapter 4 suggested that a concert-environment was better suited to supporting engagement, which was one reason for this change, as engagement was so unsuccessful in CrowdComp. I also felt that, in contrast to my limited abilities in Web design, my extensive performative experience would be more effective in this new environment. For these reasons, I hoped that the shift would have a major role in alleviating the issues discussed in this evaluation.
5.3 HyperCello

HyperCello is an interactive workshop for cellist, crowd, and two auxiliary performers – moderator and operator. It was performed with cellist Oliver Coates in July 2017, to an audience of 20 Music Department staff and students. In HyperCello, the crowd votes on multiple-choice questions using electronic remotes, which produces materials for the cellist to play in stages. The operator materialises the crowd’s decisions into a live score for all to read. My role was as moderator, acting as a conduit between the cellist, crowd and operator. Note by note, the crowd creates short materials for the cellist to perform, record and loop. Following this, the cellist improvises a melody alongside the looping materials, governed by rules determined by the crowd. The title is a play on hypertext fiction, a Web-based form of interactive literature where the reader controls elements of the narrative, which I saw as a somewhat literary equivalent to crowd-composition.

5.3.1 Construction

Moving to a concert-environment required my technique of capturing crowdvoting data to be adapted. Advice came from University staff who used polling in their lectures to facilitate interactivity. Due to its range of design and graphic feedback options, I used the Audience Response System (ARS) TurningPoint, which integrated within Microsoft PowerPoint (PPT) to ask attendees questions. Physical remotes (Fig. 16) were used, rather than a smartphone app, for two reasons:

1. A Wi-Fi connection is necessary for ARS smartphone apps, but not always available. Remotes required only a local network, which can be generated from a computer.
2. I hoped that the novelty and physicality of the voting devices would produce an increased sense of connectedness to the task and situation.
Having identified that CrowdComp’s limitations were unproductive, in HyperCello I wanted to create a more open-ended system and relinquish a greater degree of control. Therefore, I devised a system in which a multi-layered texture could be created, where the crowd was able to compose short materials to loop and build throughout the workshop.

Techniques for Interactive Audience Participation by Maynes-Aminzade et al. was also an influence. One of its guidelines is to “vary the pacing of the activity”, which shone a light on CrowdComp’s repetitive system. Therefore, HyperCello is broken up into different sections, with each section offering a different task. The focus of the first section is percussive sounds, pitches in the second, and terminology in the last section. In addition, different polls present various quantities of options.

Another guideline encourages projects to “ramp up the difficulty of the activity”. Accordingly, I began the workshop with practice PPT slides so that attendees were eased into the process. These were followed by 4-option polls, and then progressed to 9-option polls. 5 and 3-option polls were also used. My hope was that this revision would improve engagement, and, in light of the poor crowd cohesion in CrowdComp, I also expected the reduced option quantities implemented here to increase mean majority strength.

In CrowdComp, due to findings from the pilot, I opted to conceal voting data. However, this appeared to disconnect participants from the process. The importance of making “the control mechanism obvious” has been emphasised, and this finding made it clear how that

94 Ibid.
95 Ibid.
guidance could apply to crowd-composition. In HyperCello, I ensured that voting data would be transparent – once each poll was completed, the voting data was presented to the crowd.

The final guideline considered in the design of HyperCello was to “play to the emotional sensibilities of the crowd”96. As CrowdComp participants reported finding the process robotic and tedious, I hoped that the introduction of a live cellist would serve to resolve this issue by facilitating a more dramatic and stimulating atmosphere. In the final stage of HyperCello, I also included an opportunity for creative submissions through inviting attendees to contribute terms that would govern an improvisation by the cellist. I expected this would inject some energy, competition and humour into the situation. Additionally, a 10 second timer was applied to polls to create a sense of urgency.

Another factor that shaped the construction of HyperCello was knowing that it would be presented within a university context where the majority of attendees would be trained musicians. For this reason, I decided to retain the 9-option pitch poll, as my assumption was that this group would prefer that degree of choice. Though the 9-option poll was problematic in CrowdComp, analysis showed that the feature was more successful with the musician group, and so I felt that its inclusion here would be less troublesome.

Further features were incorporated in order to engage this specialist crowd:

1. The depth of governance rules for the improvisation, where terms to inform its character, style, and narrative were requested.
2. An irregular time signature was used – $7/8$ – to introduce complexity to both the decision-making and the resultant materials.
3. Inspired by the opacity vote in SwarmSketch, the crowd could also revise the pre-set rhythmic values of the time signature ($\uparrow + \uparrow + \downarrow$).

Providing such moments was another way to enhance crowd agency, which I felt was undeveloped in CrowdComp.

5.3.2 System

In HyperCello, the crowd answered multiple-choice questions, using electronic remotes, to crowdvote new musical materials. Their decisions were materialised by the operator in a live score, which was shown on a screen to the cellist and crowd. The cellist performed, recorded and looped the materials, which were set in a 7/8 time signature and at 120 bpm. These materials played continuously throughout the workshop’s creative process. The culminating moment of the work featured an improvisation played over the loops. As moderator, I facilitated the performance. PPT, which was displayed on a second screen, showed the multiple-choice questions that the crowd answered, received voting data and displayed results. An illustration of this staging can be seen on the next page (Fig. 18).

Following practice slides, the first section began with the crowd creating a 2-bar rhythmic pattern by choosing between four options in a succession of polls divided into quavers: rest, palm slap, finger slap, and finger scrape (Fig. 17). These mimic the bass drum, snare drum and hi-hat of a drum kit. The cellist showcased the options before the section commenced, but not within the section.

<table>
<thead>
<tr>
<th>Section 1</th>
<th>Rhythmic pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rest</td>
<td><img src="Image" alt="Rest" /></td>
</tr>
<tr>
<td>2. Palm slap</td>
<td><img src="Image" alt="Palm slap" /></td>
</tr>
<tr>
<td>3. Finger slap</td>
<td><img src="Image" alt="Finger slap" /></td>
</tr>
<tr>
<td>4. Finger scrape</td>
<td><img src="Image" alt="Finger scrape" /></td>
</tr>
</tbody>
</table>

Figure 17 – ‘HyperCello’ [main study] rhythmic pattern poll.

In an effort to create variety, a ‘majority dominance rule’ was included that informed the dynamic of each determined note, which was dependent on the strength of the majority vote. The difference between the first and second strongest option was measured:
Figure 18 – ‘HyperCello’ [main study] staging.
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- Majority dominance less than 10% - ghost note (*piano*)
- Majority dominance gap between 10-19% - default (*mezzo-forte*)
- Majority dominance gap 20% or more - accented note (*forte*)

*Figure 19* shows the key for this section. A greyed notehead for a ghost note and an accent articulation event were used instead of dynamics, as I was concerned that too many dynamic markings would clutter the score. No rule applied if a rest was selected.

The cellist was instructed to continually play the loop as it gradually filled in. Therefore, if the first note chosen was a palm slap, and it had a majority dominance greater than 20%, then the following two bars would be looped by the cellist:

*Figure 20* – ‘HyperCello’ [main study] rhythmic pattern example [1].

If the next note was a finger slap that had a majority dominance of less than 10%, then the cellist would seamlessly shift to the following two bars:

*Figure 21* – ‘HyperCello’ [main study] rhythmic pattern example [2].
In this way, the crowd continually heard the developing material (*HyperCello [main study] – Clip 4 02:39*). Once the rhythmic pattern was completed, the cellist recorded the material into Ableton Live, which continued to loop through the PA.

The crowd had 10 seconds to make each decision and then voting would close, followed by the data appearing on the presentation. As with CrowdComp, if a multiple majority occurred, a die roll resolved the tie.

Section 2 worked similarly. 9-option pitch polls were presented, built on a C major pentatonic scale, gradually creating a 2-bar bassline (*Fig. 22*). A pentatonic scale was used, instead of a diatonic scale, so as to provide more contrasting options, which was identified as an issue in CrowdComp. The same majority dominance rule applied, but with the ghost note omitted as I felt a 9-option vote spread would be generally too slim to cater for three rules. The two bars were divided into six polls: two lots of ♩ + ♩ + ♩. Once again, the cellist showcased the options before the section commenced, but not during. Following the determination of all six polls, the crowd could then revise their positions by moving each note by a quaver either side, or leave them in place (*Fig. 23*). Participants were provided only with verbal explanations for these options.

![Figure 22 – ‘HyperCello’ [main study] bassline pitch poll.](image)
Section 2
Part 2: Bassline
Nudge the note

1. 50%←↓
2. ↓
3. ↓→50%

Figure 23 – ‘HyperCello’ [main study] bassline revision poll.

Therefore, the following bassline could emerge:

Figure 24 – ‘HyperCello’ [main study] bassline revision example [1].

Then, through revisions, it may become:

Figure 25 – ‘HyperCello’ [main study] bassline revision example [2].

As previously, the cellist continuously played the developing bassline, before recording and looping it.

In Section 3, the crowd voted on three rules to govern an improvisation performed over the looping materials, informing its character, style and narrative (Fig. 26). No time constraints were set for this section. Each poll presented five options – three pre-determined, and two contributed by the crowd. With that completed, the workshop ended with the cellist improvising in a manner shaped by the crowd’s decisions.
Section 3
Improvised material

Character

1. Jolting
2. Graceful
3. Bold
4. ?
5. ?

Improvised material
Style

1. Melodious
2. Irregular
3. Noisy
4. ?
5. ?

Improvised material
Narrative

1. Quiet opening, climactic middle section, fade to nothing
2. Quiet until a fiery end
3. Oscillates between passive and aggressive three times
4. ?
5. ?

Figure 26 – ‘HyperCello’ [main study] improvised material polls.

5.3.3 Survey

Following the workshop, attendees completed a survey via PPT with their electronic remotes. This questionnaire is presented below:
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| 1. Did you appreciate the quick-fire nature of the multiple choice questions? |
|---------------------------------|-----------------|-----------------|---------------------|
| Not at all                      | Very little     | Somewhat        | To a great extent   |

| 2. Would you have preferred longer to consider your choice? |
|--------------------------------------------------------|-----------------|-----------------|---------------------|
| Not at all                                              | Very little     | Somewhat        | To a great extent   |

| 3. Did you become less interested in participating over time? |
|-------------------------------------------------------------|-----------------|-----------------|---------------------|
| Not at all                                                  | Very little     | Somewhat        | To a great extent   |

| 4. How often did it seem that the options you selected influenced the collective decision? |
|-----------------------------------------------------------------------------------------------|-----------------|-----------------|---------------------|
| Never                                                       | Rarely           | Occasionally    | Frequently          | Always             |

| 5. Did you find the cellist’s role worthwhile? |
|------------------------------------------------|-----------------|-----------------|---------------------|
| Strongly disagree                                     | Disagree        | Undecided       | Agree               | Strongly agree     |

| 6. Did you enjoy taking part in HyperCello? |
|---------------------------------------------|-----------------|-----------------|---------------------|
| Strongly disagree                           | Disagree        | Undecided       | Agree               | Strongly agree     |

| 7. Are you satisfied with HyperCello’s crowdvoted materials? |
|-------------------------------------------------------------|-----------------|-----------------|---------------------|
| Very dissatisfied                                          | Dissatisfied    | Undecided       | Satisfied           | Very satisfied     |

Figure 27 – ‘HyperCello’ [main study] participant survey.

Survey design was informed by CrowdComp, with the following revisions made:

1. Questions 1 and 2 were added because of the negative response to the twofold poll in CrowdComp, which indicated that questions relating to reception of the collective decision-making mechanism should be included in the survey.

2. Question 3 queried changes in engagement over time, and was adapted from ‘Did the way you engaged with the work change over time?’ in CrowdComp’s survey, in order to directly address feedback from the previous work.

3. Relating to user interface, Question 5 was added to assess the instrumentalist component, which was specific to HyperCello.

As the survey was completed with electronic remotes, open-ended questions were removed from the questionnaire. This is also why Question 3 was adapted as it was. The workshop
was followed by a discussion session for attendees to ask questions and share their thoughts, which was an opportunity to gather informal feedback.

5.3.4 Evaluation

The evaluation examines composition data from the HyperCello workshop, divided into the four evaluative features covered in the methodology. Following this, the resultant music is analysed.

5.3.4.1 Composition data

5.3.4.1.1 The collective decision-making mechanism

This section discusses three elements that pertain to the collective decision-making mechanism in HyperCello:

- The electronic remotes;
- The transparency of the voting data;
- The resolution of multiple majorities.

As the mechanism for making collective decisions, the TurningPoint remotes were mostly successful. At the start, the crowd had little sense of what to expect and the remotes served to heighten an air of mystery and so facilitate engagement.

Several attendees mentioned appreciating being able to cast their votes privately, without judgement from others, and one attendee remarked liking that the remotes allowed them to change their mind. Some reviews were less positive. Attendees noted that submission feedback – the flashing of a small light – was insufficient. This may have adversely effected engagement.

Relating to transparency, voting data was displayed as a bar graph at the end of each vote. This had a far greater impact than I had anticipated, with the crowd frequently responding with cheering, booing, and laughter. As the timer counted down to 0, eyes were fixed on the presentation, waiting for the data to appear.
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The concern with transparency also applied to multiple majorities. These were resolved by rolling a die, as they were in CrowdComp, but now this was performed in front of participants. Not only did this serve to reinforce transparency, it also facilitated engagement, creating tension as the crowd waited. As described in the following section, my efforts to increase majority strength were realised to a point, and only 14% of decisions were determined in this way (compared with CrowdComp's 25%) – making multiple majorities feel more like an exciting feature than a hindrance to crowd agency.

5.3.4.1.2 Crowd agency

This section discusses two elements that pertain to crowd agency in HyperCello:

- Crowd cohesion;
- Polling structure.

Table 12 displays mean majority data in HyperCello, showing improved results:

Table 12 – ‘HyperCello’ [main study] voting data, mean majorities.

<table>
<thead>
<tr>
<th></th>
<th>Mean overall majority</th>
<th>Mean 2 options</th>
<th>Mean 3 options</th>
<th>Mean 4 options</th>
<th>Mean 5 options</th>
<th>Mean 9 options</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrowdComp</td>
<td>32%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>37%</td>
<td>28%</td>
</tr>
<tr>
<td>HyperCello</td>
<td>41%</td>
<td>-</td>
<td>54%</td>
<td>39%</td>
<td>40%</td>
<td>32%</td>
</tr>
</tbody>
</table>

Though the 4-option differential majority is slightly lower, likely due to a far greater relative frequency, differential majorities were all broadly similar in HyperCello (Tab. 13). Despite this, the relevance of utilising polls with fewer options, and therefore a higher theoretical probability, is perhaps illustrated by the improvement to the data shown in Table 14. This indicates that stronger mean majorities appear to have impacted on the crowd’s perception of influence. Alongside this, the improvement may also be credited to the live setting – discussion indicated that the live setting, cellist, and verbal contributions enhanced the
crowd’s sense of inclusion. That being said, crowd cohesion in *HyperCello* remained a mixed success.

Table 13 – ‘*HyperCello*’ [main study] voting data, additional information.

<table>
<thead>
<tr>
<th>Differential majority Relative frequency</th>
<th>2 options</th>
<th>3 options</th>
<th>4 options</th>
<th>5 options</th>
<th>9 options</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrowdComp</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>17%</td>
<td>17%</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>47%</td>
<td>47%</td>
</tr>
<tr>
<td>HyperCello</td>
<td>-</td>
<td>21%</td>
<td>14%</td>
<td>20%</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>5</td>
<td>14</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 14 – ‘*HyperCello*’ [main study] survey data, ‘How often did it seem that the options you selected influenced the collective decision?’

<table>
<thead>
<tr>
<th>How often did it seem that the options you selected influenced the collective decision?</th>
<th>CrowdComp</th>
<th>HyperCello</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean overall majority</td>
<td>32%</td>
<td>41%</td>
</tr>
<tr>
<td><strong>Pitch</strong></td>
<td>12%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Note length</strong></td>
<td>29%</td>
<td>35%</td>
</tr>
<tr>
<td><strong>Occasionally</strong></td>
<td>41%</td>
<td>47%</td>
</tr>
<tr>
<td><strong>Frequently</strong></td>
<td>18%</td>
<td>12%</td>
</tr>
<tr>
<td><strong>Always</strong></td>
<td>0%</td>
<td>6%</td>
</tr>
</tbody>
</table>

*Table 15* shows survey feedback relating to the system’s polls, and responses here told an interesting story. My expectation was that a similar proportion of attendees would respond to both the ‘to a great extent’ option of the first question, and the ‘not at all’ option of the second. However, what seemed to be the case is that whilst most attendees thought they had ample time to make their decision, some within that bracket did not appreciate the quick-fire nature of the multiple-choice questions. As moderator, I was aware that some polls were completed well before the countdown ended, and others may have needed a little extra time. Furthermore, some attendees might have felt there was ample time, but that the resources available were not enough to make an informed decision — the rhythmic and bassline options were showcased before their sections began, but not during. Perhaps confirming this, it was discussed afterwards that pausing the looping cellist would enable them to more accurately select their preferred option. This point, however, was contested
by other attendees who felt that the looping cello added a lot to the workshop. It seems that this issue is complex, and it may be that ultimately it is not possible to please everyone.

Table 15 – ‘HyperCello’ [main study] survey data; ‘Did you appreciate the quick-fire nature of the multiple-choice questions?’, ‘Would you have preferred longer to consider your choice?’

<table>
<thead>
<tr>
<th>Did you appreciate the quick-fire nature of the multiple-choice questions?</th>
<th>Would you have preferred longer to consider your choice?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>Not at all</td>
</tr>
<tr>
<td>Very little</td>
<td>Very little</td>
</tr>
<tr>
<td>Somewhat</td>
<td>Somewhat</td>
</tr>
<tr>
<td>To a great extent</td>
<td>To a great extent</td>
</tr>
</tbody>
</table>

5.3.4.1.3  User interface

This section considers the staging of the workshop, as well as some of its components.

Staging was made up of seven components: cellist, moderator, operator, PPT presentation, live score, PA, and electronic remotes. The workshop required attendees to process information from each of these in order to make their decisions. It was complicated, and some elements could have been concealed. However, similar to the visibility of voting data, I saw it as important to make this ‘assembly line’ transparent – whilst this risked overwhelming the crowd, I feared that concealing components could also lead to issues with engagement.

Fortunately, the staging did not appear to overwhelm the crowd, with the components seemingly forming a cohesive whole, further bound together by the moderator. My sense was that moderation was more significant than I had envisioned. When designing the work, I planned for moderation to lay the groundwork, and then have the workshop autonomously flow by itself. In practice, I enacted this role in an animated and sometimes humorous fashion, becoming more active than expected, and it was clear that this enhanced engagement. However, whilst I was relatively pleased, I identified issues with my sense of timing and delivery, which I felt would improve with experience.
The cellist also had an important role. To the survey question, ‘Did you find the cellist’s role worthwhile?’; 33% agreed, and 60% strongly agreed. The interaction between the cellist and crowd enlivened the work. For example, they cheered when something was chosen that would be difficult to play, or when Oliver’s performance was particularly impressive. My sense was that the cellist built a stronger connection between the process and crowd. Additionally, it was discussed afterwards how Oliver’s creativity was integral to the workshop. For instance, Oliver inputted on how best to produce the percussive sounds (Fig. 28, HyperCello [main study] – Clip 2 01:22). He also stated that he was “a vessel for you guys (the crowd)”, which was met with appreciation – it was clear that the crowd valued his interpretation of their decisions.

![Image of cellist and workshop participants]

Figure 28 – ‘HyperCello’ [main study] cellist Oliver Coates conveys his approach for producing the rhythmic pattern’s percussive sounds.

Although there were no technical difficulties in the workshop, I saw that there was scope to improve the design and legibility of the presentation. A lack of clarity can be seen in Figure 29. The first slide shows a scene awash with indecipherable text, particularly that found below the bar chart. The second contains a rather ambiguous representation of the revision technique: ‘50% ⇐ †’. Each issue demanded additional verbal explanation, interrupting the flow of the workshop. This may not seem significant, but it does not take much for a crowd to lose concentration.
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5.3.4.1.4 Engagement

This section assesses the aggregate impact of HyperCello’s features, drawing on enjoyment and satisfaction ratings in the survey feedback.

Firstly, it must be noted that HyperCello exhibited maximum participant turnout throughout its performance. This contrasts with CrowdComp, where participant turnout declined significantly over the course of the work. Maximum turnout was ensured by the live setting – as all participants were unavoidably present for each poll – as well as by the use of TurningPoint, which indicated how many participants had voted so that polls could close once all votes had been received. By extension, the same outcome occurred for all subsequent portfolio works, as these too utilised a live setting and TurningPoint. Therefore, from this point onwards, engagement data naturally becomes more positive as a result.

Compared with CrowdComp, Table 16 shows a marked improvement for enjoyment:

Figure 29 – ‘HyperCello’ [main study] a lack of clarity in the PPT design.
Table 16 – ‘HyperCello’ [main study] survey data, ‘Did you enjoy participating in (this work)?’

<table>
<thead>
<tr>
<th></th>
<th>CrowdComp</th>
<th>HyperCello</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Disagree</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Undecided</td>
<td>6%</td>
<td>0%</td>
</tr>
<tr>
<td>Agree</td>
<td>76%</td>
<td>40%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>18%</td>
<td>60%</td>
</tr>
</tbody>
</table>

In addition, Table 17 presents positive feedback to ‘Did you become less interested in participating over time?’, which was identified as a significant issue in CrowdComp. The shift from a Web-environment to a concert-environment, and the inclusion of a moderator and live cellist, seem to have been a source of this change. Another explanation lies with the positive response to the varied structure of the work, indicated in discussion following the workshop. In particular, attendees highlighted the final section, which invited contributions from the crowd for voting options. This participatory technique turned out to be especially successful, with attendees eager to have their voices heard within a context of some hilarity. I sensed a welcome shift from the previous mode was created here.

Table 17 – ‘HyperCello’ [main study] survey data, ‘Did you become less interested in participating over time?’

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>44%</td>
</tr>
<tr>
<td>Very little</td>
<td>25%</td>
</tr>
<tr>
<td>Somewhat</td>
<td>31%</td>
</tr>
<tr>
<td>To a great extent</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 18 shows a marginal improvement to satisfaction:
Alongside a similar degree of improvement to crowd cohesion, the staging components and transparency of the system were also important developments, collectively creating a synergistic atmosphere in which it was clear that attendees felt invested in what was being produced. However, though these may have served to connect the crowd to the process, their impact was not as great as expected. The explanation lies perhaps in the fact that I was catering for a group of trained musicians. Although HyperCello included esoteric features that aimed to meet this group’s creative expectations, I suspected that the system could not satisfy and marshal the diverse tastes of a group of musicians with developed views about music composition.

5.3.4.2 Musical result

The resultant music (Fig. 30, Track 2) is made up of three layers: a rhythmic pattern, bassline and an improvisation. The improvisation lasted roughly 3 minutes.

There is pleasant variety in the rhythmic pattern, and it stands out to me that the greatest proportion of notes lies with the hi-hat–like finger scrape – remarkably evoking the traditional structure of a drum kit pattern, in which repetitive hi-hat hits are the continuity underpinning the less frequent bass and snare drum.

Choosing a rest for the first quaver of this material was a surprise in that this is a highly unusual choice for a rhythmic pattern. A significant proportion chose it too, and cries of elation went up when the voting data appeared. In combination with the irregular time signature, it made the material awkward for the cellist. Before the workshop began, some
attendees had stated that they were looking forward to making life difficult for Oliver. It seems that their goal of inconveniencing him was quickly realised.

The bassline also yielded an intriguing result. Figure 31 shows the modifications that took place in the revision section, using arrows to indicate movement. Interestingly, their decisions produced one of the most impactful transformations of all potential outcomes. Not only were the D and A brought together, but this pair became an isolated island in a sea of silence as the G was pushed forward. These changes made the material even more irregular than the original set-up through the 7/8 time signature.

Figure 31 – ‘HyperCello’ [main study] bassline revisions.

Table 19 lists options for the improvisation polls:
Chapter 5

Table 19 – ‘HyperCello’ [main study] improvised material voting options, bold text indicates volunteered contributions.

<table>
<thead>
<tr>
<th>Character</th>
<th>Style</th>
<th>Narrative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jolting</td>
<td>Melodious</td>
<td>Quiet opening, climactic middle section, fade to nothing</td>
</tr>
<tr>
<td>Graceful</td>
<td>Irregular</td>
<td>Quiet until a fiery end</td>
</tr>
<tr>
<td>Bold</td>
<td>Noisy</td>
<td>Oscillates between passive &amp; aggressive three times</td>
</tr>
<tr>
<td>Impish</td>
<td>Reggae</td>
<td>Sonata</td>
</tr>
<tr>
<td>Erotic</td>
<td>Grime</td>
<td>Crescendo study</td>
</tr>
</tbody>
</table>

This section was driven by humour: the contributions were considered amusing by the crowd. Erotic and reggae were chosen for character and style, and the pre-written option ‘oscillates between passive and aggressive three times’ was chosen for the narrative. Erotic was selected by 56% of the crowd (a significantly greater majority strength than the mean overall majority). Grime was close behind reggae (38% v. 31%), but both would have been an absurd combination alongside erotic, as well as within the context of the workshop. Despite these efforts to inconvenience and perhaps embarrass Oliver, the improvisation was superb. I spoke to Oliver afterwards about how he tried to incorporate these bizarre terms. For erotic, he used long bowings and glissando to create a languid, sultry atmosphere. For reggae, he implemented an offbeat and shuffled rhythmic feel, faintly mimicking the musical characteristics of reggae. Finally, he emphasised the narrative oscillations by using pizzicato in the passive periods, and arco in the aggressive periods. What was particularly pleasing for the crowd was that although so much creativity was deferred to the cellist, the governing rules were palpable in the improvisation.
5.3.5 Discussion in relation to research questions

5.3.5.1 How can crowd-composition facilitate meaningful experiences for participants?

An important outcome from *HyperCello*, compared to *CrowdComp*, was an improved response to the question of enjoyment. This resulted from a more enhanced connection between process and crowd, principally through the shift to a concert-environment. The moderator and cellist were crucial to this outcome. Furthermore, the work’s varied structure seemed to also have played a part.

However, though enjoyment was a key contributor to making *HyperCello* a meaningful experience, satisfaction was less successful in this regard. The most significant factor here appeared to be a tension caused by the idiosyncrasies of the specific demographic that *HyperCello* catered for (trained musicians).

5.3.5.2 How can crowd-composition lead to musical works or perspectives that are distinct from sole agent composition?

Similarly to *CrowdComp*, this work too resulted in an energetic music. In addition, another distinctive quality of the crowd’s creative process in *HyperCello* was that they were driven by humour and disruption. Reflecting on this, I perceived what may be an inherent quality of crowd-composing: the desire to make impactful decisions, whether that is to be contentious, or to simply chose the most lively options. I thought this interesting for my project as it suggests that crowds may have distinct behavioural mechanisms in crowd-composition environments, which is an outcome highly relevant to this research question.

5.3.6 Moving forward

In the following work, I decided to diverge from the note-by-note system underpinning both *CrowdComp* and *HyperCello*, and explore new techniques for facilitating crowd-composition. Although *HyperCello* did make some progress, I concluded that *Crowdsound*’s foundational system was not as effective as hoped. Crowd cohesion was a continuous issue throughout these early works, resulting largely from the need to present numerous pitch options. In addition, the slow rate at which music was composed was undesirable in both the Web and
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conzert-environment, the issue further compounded by the limited timeframe of a live setting.

As with CrowdComp, HyperCello inspired a number of revisions for future work. However, most fundamental of these grew from the success of the final section of the work, during which the crowd determined rules to govern an improvisation, which was found to be a particularly engaging feature. I strove to emphasise this in the following work, and incorporate more similarly high-level decision-making, where options would have a greater impact on the music.
5.4 It Wasn’t All Yellow

*It Wasn’t All Yellow* is an interactive workshop that continued the exploration of an interplay between crowd, moderator, operator and instrumentalists. The work takes an 18-bar extract of *Yellow* by Coldplay and invites a crowd to transform it through crowdvoting. It uses a mix of high and low-level alterations, ranging from the melodic construction seen in previous works, to comprehensive overhauls of the score, gradually creating a new musical work. The title is a play on lyrics from the source material, “and it was all yellow”, evoking the transformation that occurs in the workshop.

*It Wasn’t All Yellow* took inspiration from *WIKI-PIANO* by Alexander Schubert (2018-), a work introduced in Chapter 2, and covered in greater detail in Chapter 4. *WIKI-PIANO* is a Web-based application through which users are able to visit and edit an online score. The work uses 49 interactive modules that collectively offer enormous participatory variety. Some modules involve notation and so require experienced musical ability, whereas others ask for YouTube videos, audio samples and drawings to be submitted – tasks that allow for wider participation. I was keen to experiment with this level of versatility in my portfolio.

There were two iterations of *It Wasn’t All Yellow*, with significant revisions between the first and second. They were as follows:

1. First study – July 2018, performed by clarinettist Filipa Botelho and guitarist Tom Pauwels, to an audience of 20 from the Music Department.

2. Second study – February 2019, performed by OUT-TAKE ensemble, for which it was rescored for trumpet (Adam Stockbridge) and guitar (Ben Jameson), to a public audience of 30.

Staging and components were unchanged following *HyperCello*, other than the increase to two instrumentalists and the removal of a PA. An evaluation of the first study is provided in the Revisions section, with the main evaluation focusing on the second.

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97 I use the term ‘instrumentalists’, rather than ‘musicians’, to make clear the distinction between the various performers in *It Wasn’t All Yellow*, all of whom can be considered musicians.
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5.4.1 Construction

Rather than building materials from scratch, for *It Wasn’t All Yellow* a pre-existent score was transformed through various techniques. As the result of a series of decisions, such as, reharmonising the guitar part, adapting *Yellow* into a waltz, or breaking the score into fragments and reassembling them, a new composition was produced. Inspired by developments in *HyperCello*, the hope was that by transferring the focus from construction to overhauling, the same amount of decision-making could lead to a longer and more developed work, potentially producing a more rewarding experience.

In total, the first iteration of this work offered 18 different techniques. They are, in alphabetical order, as follows:

Table 20 – ‘It Wasn’t All Yellow’ [first study] technique list.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additions</td>
<td>4 new bars are inserted into the score. A time signature is chosen for each, and then fragments of the source material or overhauling scores are added.</td>
</tr>
<tr>
<td>Articulation</td>
<td>Volunteers are invited to add a selection of articulation events to the score.</td>
</tr>
<tr>
<td>Build Your Own Melody (BYOM): bits</td>
<td>Notes are placed in the gaps left by the ‘delete sections’ node.</td>
</tr>
<tr>
<td>BYOM: chunks</td>
<td>A new section is created, and fragments from the source material or overhauling scores are chosen to fill the space.</td>
</tr>
<tr>
<td>Character</td>
<td>Terms are decided that inform the character of the performance. Options are suggested by the crowd. One term is selected for the first half of the score, another term (or the same) for the second half.</td>
</tr>
<tr>
<td>Delete sections</td>
<td>The crowd votes to delete a beat of material from each bar of the score.</td>
</tr>
<tr>
<td>Dynamics</td>
<td>Volunteers are invited to add a selection of dynamics to the score.</td>
</tr>
<tr>
<td>Instrumentalist control</td>
<td>The instrumentalists edit the score as they see fit.</td>
</tr>
<tr>
<td>Manipulation</td>
<td>The melody may be transformed through an array of devices.</td>
</tr>
</tbody>
</table>
Chapter 5

<table>
<thead>
<tr>
<th>Operator control</th>
<th>The operator edits the score as they see fit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstruction</td>
<td>The score is broken into many parts and the crowd votes to reassemble them.</td>
</tr>
<tr>
<td>Reharmonisation</td>
<td>Harmonic content of the guitar part is replaced.</td>
</tr>
<tr>
<td>Rhythmic</td>
<td>Rhythmic content of the guitar part is replaced.</td>
</tr>
<tr>
<td></td>
<td>alternatives</td>
</tr>
<tr>
<td>Style</td>
<td>The score is overhauled into either a waltz, tango or polka.</td>
</tr>
<tr>
<td>Techniques and</td>
<td>The crowd selects which pre-prepared performance techniques or effects the instrumentalists will use.</td>
</tr>
<tr>
<td>effects</td>
<td></td>
</tr>
<tr>
<td>Tempo</td>
<td>The tempo is determined.</td>
</tr>
<tr>
<td>Transposition</td>
<td>Portions of the melody are transposed.</td>
</tr>
<tr>
<td>Unison melody</td>
<td>The guitar accompaniment is deleted and replaced with the melody.</td>
</tr>
</tbody>
</table>

Many of these techniques drew directly from past works, for example, ‘Build Your Own Melody (BYOM) bits’ recycled the previously used constructional methods, and ‘BYOM: chunks’ and ‘additions’ experimented with replacing single note options with larger fragments. ‘Character’ retained the verbal submissions from HyperCello, and because of the success of that approach, I introduced more opportunities for volunteered contributions in ‘articulation’ and ‘dynamics’. Finally, the appreciation of instrumentalist influence in HyperCello led to ‘instrumentalist control’, ‘operator control’ and ‘techniques and effects’. However, key to the It Wasn’t All Yellow system were the overhauling techniques: ‘manipulation’, ‘reconstruction’, ‘reharmonisation’, ‘rhythmic alternatives’, ‘style’, ‘tempo’ and ‘unison melody’. These techniques transformed the score in more drastic ways.

Another source of inspiration was interactive literature such as hypertext fiction, Choose Your Own Adventure novels, and text-based adventure computer games, in which readers take their own path through a narrative. For example, in The Mystery of Chimney Rock by Edward Packard (1979), a plot may be altered by decisions the reader makes (Fig. 32). Previous works were traversed linearly, and so in It Wasn’t All Yellow I wanted to experiment with a more flexible narrative. The intention was to provide an additional element to crowd
agency, widening the spectrum of potential results, and hopefully improving satisfaction feedback.

The work was built on a branching decision tree, an example of which is shown in Figure 3.

Here there are eight distinct narratives that may be taken. The crowd votes to navigate the decision tree’s crossroads, demonstrated by the highlighted nodes, as well as voting on options within those nodes. As shown in Figure 34, the decision tree occasionally features compulsory nodes: nodes that the crowd must complete before moving to their chosen node. This element imitated the random encounters that can appear in interactive fiction, through which encounters with non-player characters or events occur outside the control of the player. The array of nodes, interactive techniques, and navigational choices, continued HyperCello’s endeavour to deliver a varied experience.

Figure 32 – ‘The Mystery of Chimney Rock’ decision tree.
It Wasn’t All Yellow’s decision tree featured the 18 listed techniques mapped onto 18 possible narratives (Fig. 35). This web of decision-making alone offered great variety in potential results, and other elements also enhanced this aspect. For example, many nodes are unique to each workshop, such as ‘character’ and ‘instrumentalist control’, as these are dependent on the unpredictability of volunteered contributions. Additionally, some nodes offered a randomised selection from a range of options, and these could be recast again. The position of compulsory nodes could also be re-arranged.
Figure 35 – ‘It Wasn’t All Yellow’ [first study] decision tree.
Along with its musical framework, analysis of HyperCello also fed into the logistical features of It Wasn’t All Yellow. The performative roles and visible voting data were retained, as these proved to be so engaging. I upgraded the PPT design (Fig. 36), aiming to facilitate a more professional experience. The practice PPT slide was kept, ensuring that the opening “gradually (ramped) up the difficulty”\(^98\). The timer device and 9-option poll were removed, as both were shown to be undesirable. A 2-option poll was added to further explore the benefits of lower option quantities.

Figure 36 – PPT design: ‘HyperCello’ (above), ‘It Wasn’t All Yellow’ (below).

Yellow by Coldplay is a monumentally famous, platinum certified song. Yellow was chosen as the source material in part because I believed that its fame would generate interest in the workshop, more than an unfamiliar score at least, and so increase engagement. I also saw Yellow as a catalyst for decision-making. Many attendees were likely to hold strong notions

about both the song and the artist: my experience has been that some ardently believe in the beauty of Yellow, whereas others maintain that it is crude and overplayed. Through the creative scope that the decision tree offered, along with taste judgements of the source material, my hope was that the crowd’s decision-making would reflect their intentions as a collective composer. For example, intention could materialise through the opportunities they had to:

- be mean-spirited, or kind-hearted to the instrumentalists, for example, in the difficulty of the materials chosen in ‘additions’;
- devolve or retain agency with ‘instrumentalist control’ and ‘operator control’; and,
- make or avoid impactful changes.

5.4.2 Revisions

A noteworthy success of the first study was a significant improvement to mean majority strength, shown in the table below that compares results across the portfolio:

<table>
<thead>
<tr>
<th></th>
<th>Mean overall majority</th>
<th>Mean 2 options</th>
<th>Mean 3 options</th>
<th>Mean 4 options</th>
<th>Mean 5 options</th>
<th>Mean 9 options</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrowdComp</td>
<td>32%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>37%</td>
<td>28%</td>
</tr>
<tr>
<td>HyperCello</td>
<td>41%</td>
<td>-</td>
<td>54%</td>
<td>39%</td>
<td>40%</td>
<td>32%</td>
</tr>
<tr>
<td>It Wasn’t All Yellow</td>
<td>63%</td>
<td>75%</td>
<td>69%</td>
<td>56%</td>
<td>51%</td>
<td>-</td>
</tr>
</tbody>
</table>

Due to theoretical probability, this can partly be attributed to the removal of a 9-option poll and the addition of a 2-option poll, which meant that the spread of votes was more compact. However, as differential majorities have continued to rise along with majority strength (Tab. 22), the improvement can also be linked to poll content, which I will come to shortly.
Table 22 – ‘It Wasn’t All Yellow’ [first study] voting data, additional information.

<table>
<thead>
<tr>
<th>Differential majority</th>
<th>2 options</th>
<th>3 options</th>
<th>4 options</th>
<th>5 options</th>
<th>9 options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CrowdComp</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>17%</td>
<td>17%</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>HyperCello</td>
<td>-</td>
<td>21%</td>
<td>14%</td>
<td>20%</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>5</td>
<td>14</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>It Wasn’t All Yellow</td>
<td>25%</td>
<td>36%</td>
<td>31%</td>
<td>31%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6</td>
<td>18</td>
<td>4</td>
<td>-</td>
</tr>
</tbody>
</table>

The crowd began by choosing a fast tempo in the opening node, and then navigated the following:

Figure 37 – ‘It Wasn’t All Yellow’ [first study] workshop narrative.

The source material is recognisably present in their composition (Fig. 38, Track 3), but it now exhibits a stunted metre and random moments of mania. The music is a hilarious, stuttering mess, and the crowd was certain of its collective decision-making in many of the choices that led to it, this cohesion secured through their desire to make impactful decisions. For
Figure 38 – ‘It Wasn’t All Yellow’ [first study] completed score.
instance, of the three tempo options available, 92% chose the fastest option (Fig. 39, It Wasn’t All Yellow [first study] – Clip 2 07:26). When offered either ‘dynamics’ or ‘operator control’, where it was obvious which would have the greatest impact, 100% chose to devolve their agency to the operator. In ‘BYOM: bits’, the least tonal option was frequently selected. Similarly, in ‘additions’, the most irregular or complex options were selected. Humour was involved in much of this decision-making, and it emerged in the ‘character’ node as it did in HyperCello. When contributions were asked for, rambunctious and seductive were given. In the first poll, both options received 38% of the vote. After a die had determined that seductive would be used in the first half, the second poll resulted in a 60% majority strength for rambunctious – extraordinarily high for a 5-option poll.

Figure 39 – ‘It Wasn’t All Yellow’ [first study] ‘fast tempo’ is selected by 92% of the crowd.

In addition, cohesion may have been achieved because available options suited this crowd’s particular expertise. Remembering that the crowd were largely trained musicians, it is perhaps no surprise that they chose to delete and rebuild with ‘delete sections’ (64%) and ‘BYOM: bits’ (60%), or that they devolved agency to a composer in ‘operator control’ (100%).

Despite improvements to majority strength, as well as the production of an intriguing musical result, other aspects were less successful. The major issue was the excessive scale of the decision tree, which was difficult to grasp in practice. The operator relied on my guidance and the instrumentalists had several moments of confusion leafing through the option scores. In addition, I, as moderator, encountered problems, for example, by mistakenly introducing wrong nodes (It Wasn’t All Yellow [first study] – Clip 3 07:53).
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The compulsory nodes were another awkward aspect of the work’s structure, an untimely interruption in the workshop that delayed progression. This outcome can be observed in *It Wasn’t All Yellow [first study] – Clip 4 08:36*. Here, one participant declares eagerly, “I knew you’d pick that!”, in response to a navigational choice that was immediately interrupted by the ‘additions’ compulsory node. This highlights the excitement that had been generated and then diminished by the inclusion of compulsory nodes. A second structural concern lay with the ending sequence. The crowd enjoyed watching the operator make their modifications in the final node, and because those changes were so substantial, the workshop ended with a bit of fanfare. However, this highlighted that the final nodes of other potential narratives were potentially less engaging. For instance, if ‘dynamics’ had been chosen, its relatively minor alterations may have left the final interaction undesirably lacklustre. Reflecting upon previous works, although the improvisation in *HyperCello* generated drama, *CrowdComp*’s conclusion was unsuccessful for this reason.

Alongside these overarching issues, there were problems with some specific nodes as well, such as with ‘tempo’. The different tempo options had to be restrained by playability, particularly in terms of future transformations that could occur. As a result of this tension, the change to fast was ambiguous. There were also issues with the constructional nodes, such as ‘additions’ and ‘BYOM: bits’, which were too repetitive. Alongside more interesting moments, it was evident that engagement suffered as these nodes progressed.

Following this evaluation, it became clear that a future *It Wasn’t All Yellow* workshop would be more successful if these elements were revised.

Finally, an addition was made that related to the selection of a crowd-composing objective. Karim Lakhani notes that:

...whereas contests separate contributions and maximise diverse experiments, communities are organised to marshal the outputs of multiple contributors and aggregate them into a coherent and value-creating whole ...communities must first assess what should be included in the final aggregating and then accomplish that through a combination of technology and process.99

---

99 Lakhani and Boudreau, “Using the Crowd as an Innovation Partner”, 66.
Lakhani here recognises the importance of a crowd-determined objective for the activity. Anecdotal feedback following the workshop supported this, indicating that engagement suffered because attendees did not feel motivated to collaborate. My sense was that an objective would also have benefited HyperCello, where it seemed that attendees were unable to cooperate due to disparate visions for the work. In this first performance of *It Wasn’t All Yellow*, though the crowd were united by a desire to make impactful decisions, they did not experience this as a cooperative goal. Therefore, an initial poll was introduced in which the crowd selects a composition objective by voting for a title. All taken from Yellow lyrics, this poll offered three distinct, evocative options, as titles which would express the theme of the composition:

- *Your Skin and Bones* referred to a visceral, disruptive or discordant music;
- *Turn Into Something Beautiful* referred to a graceful, pretty music;
- *Ooo-oo-ooo* referred to a silly and humorous music.

As a result of the revisions explored above, the new, reduced technique list can be seen in Table 23.

*Figure 40* shows the revised and simplified decision tree that governed the second study. This model was more manageable in the live setting as it was now linear, although navigational choice was preserved to some extent (see Stages 2, 4 and 7). Whilst some nodes were removed, I endeavoured to retain a varied pacing, with different forms of interaction evenly spaced across the sequence. This is exhibited by the figure’s colour-coding:

- *Grey* is the title slide;
- *Red* represents overhauling techniques;
- *Yellow* represents nodes involving volunteered contributions;
- *Orange* represents the concluding nodes – techniques which offered unexpected ways of closing the compositional process.
The final category listed above, the concluding nodes, was the last revision to the work. I noted previously my concerns with the ending sequence. Finding a solution was difficult, and as I saw it, the challenge left two options:

1. Make a final, minor decision that is sensitive to the creative process, but risks being a tepid ending;
2. Have an impactful, engaging ending, that potentially undoes some of what has been previously constructed.

My solution was to let the crowd decide. In this final stage, they could defer responsibility by selecting ‘instrumentalist control’ or ‘operator control’, or retain their agency by selecting ‘audience additions’. With this last technique, the crowd voted to add a sample to play alongside the instrumentalists’ performance, with a wide variety of options available – options that ranged from merging seamlessly with the score, through to more destabilising options.
Table 23 – ‘It Wasn’t All Yellow’ [second study] technique list.

<table>
<thead>
<tr>
<th>Audience additions</th>
<th>The crowd votes to add a sample – drum beat loop, musical collage, or ambient sound – that plays alongside the instrumentalists.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Character</td>
<td>Terms are decided that inform the character of the performance. Options are suggested by the crowd. One term is selected for the first half of the score, another term (or the same) for the second half.</td>
</tr>
<tr>
<td>Dynamics / articulation</td>
<td>Volunteers are invited to add a selection of dynamics and articulation events to the score.</td>
</tr>
<tr>
<td>Instrumentalist control</td>
<td>The instrumentalists edit the score as they see fit.</td>
</tr>
<tr>
<td>Manipulation</td>
<td>The melody may be transformed through an array of devices.</td>
</tr>
<tr>
<td>Operator control</td>
<td>The operator edits the score as they see fit.</td>
</tr>
<tr>
<td>Reharmonisation</td>
<td>Harmonic content of the guitar part is replaced.</td>
</tr>
<tr>
<td>Rhythmic alternatives</td>
<td>Rhythmic content of the guitar part is replaced.</td>
</tr>
<tr>
<td>Style</td>
<td>The score is overhauled into either a waltz, tango or polka.</td>
</tr>
<tr>
<td>Title</td>
<td>The crowd votes to determine the title and theme of their composition.</td>
</tr>
<tr>
<td>Unison melody</td>
<td>The guitar accompaniment is deleted and replaced with the melody.</td>
</tr>
</tbody>
</table>

5.4.3 System

The second study was split into seven stages, beginning with the first and moving sequentially through. Polls and results were presented on PPT, and options were showcased by the instrumentalists where applicable. The instrumentalists also performed the score following each stage. In Stage 1, the crowd voted to select their composition objective. Following this, they were presented with a navigational choice – ‘rhythmic alternatives’ or ‘style’. In ‘rhythmic alternatives’, the available options were:

- No change – avoid transformations;
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- Spacious – the rhythmic material is severely reduced;
- Irregular – the rhythmic material is replaced with erratic patterns.

The options for ‘style’ were:

- No change;
- Waltz – the score is transformed into 3/4, reworked as an interpretation of a waltz;
- Polka – similarly, the score is transformed into a polka, the time signature changed to 2/4.

The instrumentalists showcased these options before the crowd voted.

With their navigational choice made, and Stage 2 completed, the workshop moved onto Stage 3’s ‘character’ node. The crowd were invited to call out suggestions, and they then voted to choose a term for both the first and second half of the score.

Following this, the crowd faced another navigational choice in Stage 4: ‘unison melody’ or ‘reharmonise accompaniment’. In ‘unison melody’, the guitar accompaniment was deleted and replaced with the melody. In ‘reharmonise accompaniment’, the available options were:

- No change;
- Reharmonisation [1] – a small deviation. The original chord progression is still somewhat intact, but there are some harmonic surprises;
- Reharmonisation [2] – a large deviation. The chords are far more exotic and change frequently.

Both reharmonisations could be applied to any of the ‘rhythmic alternative’ or ‘style’ overhauls. Again, options for these nodes were showcased by the instrumentalists.

After this navigational choice, and the completion of Stage 4, came Stage 5’s ‘manipulation’ node. The crowd voted to manipulate the melody, and they first decided whether to do this as a whole, or to split the melody into two halves. They were informed that the difference
was between producing a very dissimilar result, or minimising impact by retaining the verse-
chorus structure of the source material. They then voted on the options below:

- No change;
- One randomly selected technique;
- Three randomly selected techniques.

Again, the difference between options here was the scale of impact. Using the Figure 41 key, a die was rolled to determine which manipulation would transform the melody.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invert</td>
<td>Shuffle pitches</td>
<td>Retrograde pitch</td>
<td>Retrograde rhythm</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Retrograde rhythm &amp; pitch</td>
<td>Rotate pitches</td>
<td>Rotate rhythms</td>
<td>Rotate rhythms &amp; pitches</td>
</tr>
</tbody>
</table>

Figure 41 – ‘It Wasn’t All Yellow’ [second study] key: ‘manipulation’ die roll.

Following this came ‘dynamics & articulation’ in Stage 6. Here, five volunteers, chosen at random, were each assigned a set of options, and then invited to add up to three events to the score from their set. An explanation of these options was verbally provided as each volunteer approached the stage. The available sets were:

- pp, p & mp
- mf, f & ff
- *diminuendo* & *crescendo*
- *Staccato* & *slur*
- *Accent* & *fermata*
Finally was Stage 7, in which the crowd had a choice of three navigational options: ‘instrumentalist control’, ‘operator control’ or ‘audience additions’. ‘Instrumentalist control’ and ‘operator control’ deferred agency over the final transformations of the workshop. In ‘audience additions’, the crowd voted to add a sample to play alongside the instrumentalists (Fig. 42). They first chose a category: drum beat loops, musical collage, or ambience. They then voted on three options from their chosen category, each containing a range of samples. These samples could be showcased by the moderator via a computer before voting.

<table>
<thead>
<tr>
<th>Audience additions</th>
<th>Druml beat loops</th>
<th>Musical collage</th>
<th>Ambience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock</td>
<td>Coldplay – Yellow</td>
<td>Beach waves</td>
<td></td>
</tr>
<tr>
<td>Bossa</td>
<td>Bach – Prelude in C</td>
<td>Animals in the savannah</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>Ben Jameson – Tapping Music</td>
<td>Child screaming</td>
<td></td>
</tr>
</tbody>
</table>

Figure 42 – ‘It Wasn’t All Yellow’ [second study] ‘audience additions’ options.

With this completed, the instrumentalists performed the score one final time, and the workshop came to a close.

5.4.4 Survey

The survey completed by attendees following the workshop is presented below:
1. **How often did it seem that the options you selected influenced the collective decision?**

<table>
<thead>
<tr>
<th>Option</th>
<th>Never</th>
<th>Rarely</th>
<th>Occasionally</th>
<th>Frequently</th>
<th>Always</th>
</tr>
</thead>
</table>

2. **How do you feel about the duration of the work?**

<table>
<thead>
<tr>
<th>Duration</th>
<th>Far too short</th>
<th>Too short</th>
<th>About right</th>
<th>Too long</th>
<th>Far too long</th>
</tr>
</thead>
</table>

3. **Was the presentation easy to understand?**

<table>
<thead>
<tr>
<th>Agreement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
</table>

4. **Did the quality of the presentation add to your enjoyment?**

<table>
<thead>
<tr>
<th>Agreement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
</table>

5. **Did the technology and equipment used add to your enjoyment?**

<table>
<thead>
<tr>
<th>Agreement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
</table>

6. **Did the use of musicians add to your enjoyment?**

<table>
<thead>
<tr>
<th>Agreement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
</table>

7. **Did you enjoy taking part in It Wasn’t All Yellow?**

<table>
<thead>
<tr>
<th>Agreement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
</table>

8. **Are you satisfied with It Wasn’t All Yellow’s crowdvoted materials?**

<table>
<thead>
<tr>
<th>Satisfaction</th>
<th>Very dissatisfied</th>
<th>Dissatisfied</th>
<th>Undecided</th>
<th>Satisfied</th>
<th>Very satisfied</th>
</tr>
</thead>
</table>

9. **Do you feel the music created is yours?**

<table>
<thead>
<tr>
<th>Agreement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
</table>

10. **Do you feel you have a greater or new understanding of music composition than you did before you came to the workshop today?**

    *Space left for written feedback*

11. **Is there anything else that you feel you have learned as a result of this workshop?**

    *Space left for written feedback*

12. **Would you like to make any additional comments?**

    *Space left for written feedback*

Figure 43 – ‘It Wasn’t All Yellow’ [second study] participant survey.
In relation to the survey used in the preceding work, the following revisions were made for *It Wasn’t All Yellow*:

1. Question 2 was reintroduced, as it was omitted previously only through error.
2. Relating to user interface, Questions 3 and 4 were added to assess moderation, which followed the realisation in *HyperCello* that this component was a key aspect of the workshop.
3. Similarly to the above, Questions 5 and 6 were added to assess the workshop’s components in greater detail than the preceding work.
4. Relating to engagement, Question 9 was added to examine whether the crowd-composition process could lead to participants having a sense of authorship over the resultant music, as I came to realise that exploring this potential would benefit discussion through my research questions.
5. Relating to engagement again, Questions 10 and 11 assessed the pedagogical value of the workshop. A review of the relevant literature brought to my attention that accurately determining teaching effectiveness is a highly complex task, with studies typically drawing on multiple sources over a period of years. However, I remained committed to investigating this aspect of crowd-composition, if only to a limited degree, as I felt that feedback may still enrich evaluation of *It Wasn’t All Yellow*, and perhaps prompt future research.

Those that volunteered in ‘dynamics & articulation’ were asked to complete an additional survey, which presented three extra questions relating to volunteering in the workshop:

<table>
<thead>
<tr>
<th>1. Did you enjoy contributing your creative ideas?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>2. Did you feel any discomfort in volunteering?</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>3. Would you like to make any comments to do with volunteering in <em>It Wasn’t All Yellow</em>?</td>
</tr>
</tbody>
</table>

*Space left for written feedback*

Figure 44 – ‘It Wasn’t All Yellow’ [second study] participant survey for volunteers.
This addition was prompted by a concern that discomfort in volunteering would diminish both engagement and the quality of the resultant music, and therefore, feedback to the volunteer survey was intended to provide a deeper understanding of *It Wasn’t All Yellow*’s outcomes.

Lastly, whereas the survey for *HyperCello* was delivered via PPT and the electronic remotes, the survey for *It Wasn’t All Yellow* was distributed as printed copies, as *HyperCello* attendees intimated that they would have preferred the flexibility of this approach.

### 5.4.5 Evaluation

The evaluation examines composition data from the second study of *It Wasn’t All Yellow*, divided into the four evaluative features covered in the methodology. Following this, the resulting music is analysed.

#### 5.4.5.1 Composition data

##### 5.4.5.1.1 The collective decision-making mechanism

This section discusses three elements that pertain to the collective decision-making mechanism in *It Wasn’t All Yellow*:

- The electronic remotes;
- Die rolling;
- Creative submissions.

Logistics, and their effects on the workshop, were similar to *HyperCello*. Electronic remotes were tethered to *TurningPoint/PPT*, allowing attendees to submit votes anonymously. The remotes were useful in generating an initial air of excitement. The data was displayed once votes were collected, and this captured the attention of attendees (*Fig. 45*), again creating moments of tension and approval that were important to engagement. However, issues remained around the responsiveness of the remotes, in that acknowledgement of vote submission was inadequate for some.
Along with resolving multiple majorities (of which there was only 1), a die roll was also used in the ‘manipulation’ node to select the techniques that would transform the melody. Unfortunately, some attendees took issue with this feature, with one writing in feedback: “We have to take your word for it when you roll dice!”. Another wrote, “All this technology and you used dice! Funny. The roll should be shown on the PowerPoint”. Future iterations of this work could potentially incorporate electronic die rolling, to make this function more suitable and avoid this reaction.

Due to concerns that the performative pressures of volunteering in ‘dynamics & articulation’ may have an adverse effect on the work, an additional survey was issued to volunteers, assessing how they responded to the task. As can be seen in Table 24, this received a positive response:

Table 24 – ‘It Wasn’t All Yellow’ [second study] survey data; ‘Did you enjoy contributing your creative ideas?’, Did you feel any discomfort in volunteering?.

<table>
<thead>
<tr>
<th>Did you enjoy contributing your creative ideas?</th>
<th>Did you feel any discomfort in volunteering?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree 0%</td>
<td>None 40%</td>
</tr>
<tr>
<td>Disagree 0%</td>
<td>Little 60%</td>
</tr>
<tr>
<td>Undecided 0%</td>
<td>Some 0%</td>
</tr>
<tr>
<td>Agree 60%</td>
<td>Much 0%</td>
</tr>
<tr>
<td>Strongly agree 40%</td>
<td>A great deal 0%</td>
</tr>
</tbody>
</table>
Space was given for comments, and these were positive too. One wrote, “safe environment, felt welcomed being a music novice”. The data shows room for improvement, but ultimately some anxiety is to be expected considering that they were required to operate in front of a crowd. Finally, it is important to note that those who volunteered were likely to provide positive feedback, as it can be assumed that these participants were more willing than others to engage with this aspect of the work. This data does not capture the feelings of participants that may have been more inclined to finding the experience uncomfortable.

5.4.5.1.2 Crowd agency

This section discusses two elements that pertain to crowd agency in *It Wasn’t All Yellow*:

- Crowd cohesion;
- A sense of authorship.

Although the mean overall majority shows a successful outcome, the data weakened slightly from the first study (*Tab. 25*). The cause of this may have been a more diverse demographic. In comparison with previous workshops, rather than being wholly music literate, this crowd was a public audience – a collection of people many of whom who were not necessarily musically trained. Cohesion may have come less easily because this diversity disrupted the decision-making. This relates particularly to the ‘title’ node, where the three options each received an almost equal share of the vote, but the ‘graceful, pretty’ objective was ultimately selected. I gathered afterwards that the musically trained were drawn towards options counter to this objective, wanting to disrupt and distort the extract, whereas those outside this group did not have this mentality, either because of an innate appreciation for the song or because they were comparatively more content with fulfilling the objective. As expected, the source material led to an interesting revelation on how taste judgements can affect crowd intention.
Table 25 – ‘It Wasn’t All Yellow’ [second study] voting data, mean majorities.

<table>
<thead>
<tr>
<th></th>
<th>Mean overall majority</th>
<th>Mean 2 options</th>
<th>Mean 3 options</th>
<th>Mean 4 options</th>
<th>Mean 5 options</th>
<th>Mean 9 options</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrowdComp</td>
<td>32%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>37%</td>
<td>28%</td>
</tr>
<tr>
<td>HyperCello</td>
<td>41%</td>
<td>-</td>
<td>54%</td>
<td>39%</td>
<td>40%</td>
<td>32%</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 1</td>
<td>63%</td>
<td>75%</td>
<td>69%</td>
<td>56%</td>
<td>51%</td>
<td>-</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 2</td>
<td>60%</td>
<td>67%</td>
<td>53%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

A regression in cohesion is also shown by the differential majorities, which reveal a result only marginally better than CrowdComp (Tab. 26). This is emphasised by the fact that option quantities with a higher theoretical probability were used. However, as the relative frequency data shows a sizeable discrepancy in the amount of polls for each category, a comparison between the two works is largely unhelpful.

Table 26 – ‘It Wasn’t All Yellow’ [second study] voting data, additional information.

<table>
<thead>
<tr>
<th>Differential majority</th>
<th>Relative frequency</th>
<th>2 options</th>
<th>3 options</th>
<th>4 options</th>
<th>5 options</th>
<th>9 options</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrowdComp</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>17%</td>
<td>17%</td>
</tr>
<tr>
<td>HyperCello</td>
<td>-</td>
<td>-</td>
<td>21%</td>
<td>14%</td>
<td>20%</td>
<td>21%</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 1</td>
<td>25%</td>
<td>36%</td>
<td>31%</td>
<td>31%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>It Wasn’t All Yellow 2</td>
<td>17%</td>
<td>20%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 2</td>
<td>17%</td>
<td>20%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The crowd’s perception of influence rose dramatically in It Wasn’t All Yellow (Tab. 27). This question was included in surveys from the beginning as I have been interested in whether there can be a disparity between objective and subjective influence. However, as improvements to majority strength consistently paired with ratings for perception of influence, evidence is provided that these two outcomes are intertwined. This is in spite of the less conclusive differential majority data, indicating that majority strength is a useful measure, regardless of theoretical probability bias. In addition, I sensed that the inclusive
elements developed through the portfolio, such as the intimacy of the live setting and performative roles, as well as improvements to system transparency, also had a part to play.

Table 27 – ‘It Wasn’t All Yellow’ [second study] survey data, ‘How often did it seem that the options you selected influenced the collective decision?’.

<table>
<thead>
<tr>
<th>How often did it seem that the options you selected influenced the collective decision?</th>
<th>CrowdComp</th>
<th>HyperCello</th>
<th>It Wasn’t All Yellow 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean overall majority</td>
<td>32%</td>
<td>41%</td>
<td>60%</td>
</tr>
<tr>
<td>Pitch</td>
<td>12%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Never</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Rarely</td>
<td>29%</td>
<td>13%</td>
<td>36%</td>
</tr>
<tr>
<td>Occasionally</td>
<td>41%</td>
<td>47%</td>
<td>25%</td>
</tr>
<tr>
<td>Frequently</td>
<td>18%</td>
<td>12%</td>
<td>60%</td>
</tr>
<tr>
<td>Always</td>
<td>0%</td>
<td>6%</td>
<td>4%</td>
</tr>
</tbody>
</table>

A new element I wanted to explore here was whether crowd-composition could lead to attendees having a sense of authorship over the resultant music. My theory was that if attendees felt authorship over their crowd-composed material, they would then value the experience and the result more, thereby improving engagement. Table 28 shows that authorship was experienced by the majority of attendees:

Table 28 – ‘It Wasn’t All Yellow’ [second study] survey data, ‘Do you feel the music created is yours?’.

<table>
<thead>
<tr>
<th>Do you feel the music created is yours?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>0%</td>
</tr>
<tr>
<td>Disagree</td>
<td>0%</td>
</tr>
<tr>
<td>Undecided</td>
<td>16%</td>
</tr>
<tr>
<td>Agree</td>
<td>60%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>24%</td>
</tr>
</tbody>
</table>

Relevant comments from the surveys include:
Chapter 5

- “I didn’t know how creative I was!”
- “Tonight I became a composer.”
- “We made so many decisions, even choosing which direction to go in, and all these decisions added up to a lot of control. I also felt freedom in that you designed the system, so I knew I couldn’t get it wrong to the point that it would break things.”

One attendee, Stuart Ffoulkes, even referenced authorship in a blog post published following the workshop:

I have been too lazy to work out precisely how many pieces we could have composed but, even if we ignore the entirely free choice of styles, it must have been orders of magnitude beyond the millions.100

These comments allude to attendees experiencing considerable influence and creative freedom within the It Wasn’t All Yellow system. Influence can be attributed to stronger crowd cohesion. Regarding creative freedom, the focus on overhauling appeared significant. This allowed for an array of digestible creative options, relative to the note-by-note system of previous works, which were perceived as constituting unrestricted agency. My sense was that both of these feelings underpinned their sense of authorship over the resultant music, making the experience more worthwhile for attendees, and so supporting engagement.

5.4.5.1.3 User interface

This section considers the staging of the workshop, as well as some of its components.

Table 29 shows a favourable assessment of the workshop’s user interface, with almost all attendees responding positively. Comments relating to this assessment include:

- “Great job Joe, you really made me feel involved”

“Difficult to follow at times but the presenter brought it all together”

Table 29 – ‘It Wasn’t All Yellow [second study] survey data, user interface questions.

<table>
<thead>
<tr>
<th>Did the use of musicians add to your enjoyment?</th>
<th>Did the technology and equipment used add to your enjoyment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree 0%</td>
<td>Strongly disagree 0%</td>
</tr>
<tr>
<td>Disagree 0%</td>
<td>Disagree 0%</td>
</tr>
<tr>
<td>Undecided 0%</td>
<td>Undecided 0%</td>
</tr>
<tr>
<td>Agree 4%</td>
<td>Agree 32%</td>
</tr>
<tr>
<td>Strongly agree 96%</td>
<td>Strongly agree 68%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Was the presentation easy to understand?</th>
<th>Did the quality of the presentation add to your enjoyment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree 0%</td>
<td>Strongly disagree 0%</td>
</tr>
<tr>
<td>Disagree 4%</td>
<td>Disagree 0%</td>
</tr>
<tr>
<td>Undecided 0%</td>
<td>Undecided 4%</td>
</tr>
<tr>
<td>Agree 32%</td>
<td>Agree 40%</td>
</tr>
<tr>
<td>Strongly agree 64%</td>
<td>Strongly agree 56%</td>
</tr>
</tbody>
</table>

Similarly to HyperCello, these indicated the importance of moderation in linking components, as well as in defusing issues that may have negatively impacted engagement. However, there were some comments suggesting that the resources provided were not sufficient for all:

- “It would be helpful to have a cheat sheet e.g. it was difficult to process when three options were given verbally”
- “Would benefit from additional explanations... perhaps a glossary of terms”
- “A karaoke ball on the music would make it easier for the music plebs to follow”

I had not considered distributing additional information resources and this would be useful to consider for enhancing engagement in future.
The most positive feedback in Table 29 came in response to the instrumentalists. It is clear that the crowd had great affinity for the instrumentalists, as they did in HyperCello, and this will have been an important aspect of engagement in the work.

5.4.5.1.4 Engagement

This section assesses the aggregate impact of It Wasn’t All Yellow’s features, drawing on enjoyment and satisfaction ratings in the survey feedback.

Table 30 shows a marked improvement to feedback for enjoyment:

Table 30 – ‘It Wasn’t All Yellow’ [second study] survey data, ‘Did you enjoy participating in (this work?)’.

<table>
<thead>
<tr>
<th>Did you enjoy participating in (this work)?</th>
<th>CrowdComp</th>
<th>HyperCello</th>
<th>It Wasn’t All Yellow 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Disagree</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Undecided</td>
<td>6%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Agree</td>
<td>76%</td>
<td>40%</td>
<td>16%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>18%</td>
<td>60%</td>
<td>84%</td>
</tr>
</tbody>
</table>

This is indebted to several workshop elements:

1. The instrumentalists had a major impact on enjoyment;
2. Aspects of the successful user interface, namely the quality of presentation, were also key contributors;
3. It is likely that the structure of the work and focus on overhauling was impactful, creating a more varied and rewarding experience;
4. Feedback on the duration of the work also improved (Tab. 31).
Table 31 – ‘It Wasn’t All Yellow’ [second study] survey data, ‘How do you feel about the duration of the work?’.

<table>
<thead>
<tr>
<th>How do you feel about the duration of the work?</th>
<th>CrowdComp</th>
<th>It Wasn’t All Yellow 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Far too short</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Too short</td>
<td>0%</td>
<td>8%</td>
</tr>
<tr>
<td>About right</td>
<td>47%</td>
<td>92%</td>
</tr>
<tr>
<td>Too long</td>
<td>47%</td>
<td>0%</td>
</tr>
<tr>
<td>Far too long</td>
<td>6%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Satisfaction ratings also show considerable improvement (Tab. 32). Strong crowd cohesion, and a sense of authorship amongst the crowd, appear to have been crucial here – attendees felt involved in the decision-making and central to the creative process. Another contributor may be that the workshop was experienced as a collaborative venture. One attendee wrote, “Great to work together and great fun”, with another writing, “collaboration was really effective!”. This highlights the composition objective, which facilitated cooperation and provided satisfaction through fulfilment of the objective. An additional benefit of this collaborative mentality, remarked on by some attendees in conversation, was that it led to an informal atmosphere that was both unexpected and appealing. Therefore, this was likely another factor to improved enjoyment ratings.

Table 32 – ‘It Wasn’t All Yellow’ [second study] survey data, ‘Are you satisfied with (the work’s) crowdvoted materials?’.

<table>
<thead>
<tr>
<th>Are you satisfied with (the work’s) crowdvoted materials?</th>
<th>CrowdComp</th>
<th>HyperCello</th>
<th>It Wasn’t All Yellow 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very dissatisfied</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>13%</td>
<td>6%</td>
<td>0%</td>
</tr>
<tr>
<td>Undecided</td>
<td>25%</td>
<td>27%</td>
<td>0%</td>
</tr>
<tr>
<td>Satisfied</td>
<td>56%</td>
<td>47%</td>
<td>44%</td>
</tr>
<tr>
<td>Very satisfied</td>
<td>6%</td>
<td>20%</td>
<td>56%</td>
</tr>
</tbody>
</table>

Pedagogy also appears to have played a part. To the question, ‘Do you feel you have a greater or new understanding of music composition than you did before you came to the workshop
today?, many responded positively. Comments refer to learned terminologies and a greater understanding of music notation:

- “Seeing how the score was created was very educational”
- “I feel I learned about reading music by following the changes in the score”
- “Yes – terms that go on the score”
- “The articulation node showed me loads about how a music can be performed”
- “A greater understanding of musical vocabulary which meant nothing to me at school”

Another passage from Ffoulkes’ blog post also applies here:

It was a fabulously enjoyable and educational evening and gave me a tiny insight into the possibilities that composition lends to even fairly simple basic materials.\(^{101}\)

Whilst the true extent of pedagogy in It Wasn’t All Yellow is difficult to define, is clear that it had some part to play in making the workshop a rewarding experience.

5.4.5.2  Musical result

Decision-making within previous works can be summarised by a desire to make impact, and in the interactive workshops, this has largely been seen in the selection of options that veer the most from conventionality. With this in mind, the result from the second study was entirely unexpected. The composition is spacious, jovial, and considerate, fulfilling the Turn Into Something Beautiful objective (Fig. 46, Track 4).

In their first navigational choice, the crowd opted for the ‘style’ node’s more orthodox options, and here they chose waltz. Second came ‘character’, in which the crowd provided

\(^{101}\) Ffoulkes, “The Sure Thing”.

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Figure 46 – ‘It Wasn’t All Yellow’ [second study] completed score.
the options, with passionate selected first and jaunty second. Given the contributions from previous iterations of this node, I was surprised that no erotically-themed terms had emerged. In their second navigational choice, ‘reharmonise accompaniment’ was selected, and the option involving just a small deviation from the original harmonies was selected thereafter. The fourth node was ‘manipulation’, where they retained the verse-chorus structure of the extract. Next they opted to manipulate the first half with three random manipulations, and just one for the second half. The fifth node was ‘dynamics & articulation’, with volunteers each contributing a thoughtful, balanced assortment from their option set, adding greatly to the sophistication of the subsequent performance of the score. ‘Instrumentalist control’ was selected in the final navigational choice. The crowd were seemingly keen to devolve agency, but avoided the more volatile ‘operator control’. This was also driven by the appreciation the crowd had for the instrumentalists. The musicians made a few changes that enhanced the score in a manner suitable to the objective.

In summary, the crowd’s decision-making was effective in fulfilling the objective. They repeatedly made choices that found a middle ground between stasis and extremity, retaining some of Yellow’s natural charm. In light of previous workshops, I had not expected this to be the case, and the result can be seen as a testament to the power of a composition objective in guiding creativity in crowd-composition.

5.4.6   Discussion in relation to research questions

5.4.6.1   How can crowd-composition facilitate meaningful experiences for participants?

Enjoyment ratings remained high for this work, and rose as journeyed elements were improved through experience.

Reported levels of satisfaction had a breakthrough in the second study, in comparison with previous works, with positive feedback linked to strong crowd cohesion, which also led to a sense of authorship over the resultant material. This outcome is significant because it indicates the experience was perceived as genuine and fulfilling, and so, for participants, their creation had personal value. It reveals the depth of meaningful experiences that can be generated in crowd-composition.
Pedagogy was a new evaluative measure explored in the work, and it was shown to have had some impact on the experience. It seems that both terminology and musical language were notable areas of learning. However, judging by survey comments, it is likely that learning was encountered more by non-musicians, than by the musically trained.

5.4.6.2 How can crowd-composition lead to musical works or perspectives that are distinct from sole agent composition?

One of the most interesting outcomes of the second study was the sense of authorship over the resultant music that the crowd experienced, which appeared to have a major role in a significant improvement to engagement. My sense was that, though the crowd-composed music may have been worthless to anyone else, authorship enhanced the composition’s value for the crowd. This implies that, through crowd-composition, there can exist a unique relationship between audience and music, perhaps filling a niche that a sole agent model cannot, which generally forces audiences to have a more peripheral role. Whilst this is somewhat similar to stem remix culture, where artists release stems of their compositions for amateurs to freely remix and reuse themselves, this approach lacks the collaborative depth and accessibility of crowd-composition. The consequences of this sense of authorship are, to my knowledge, yet to be explored.

5.4.7 Moving forward

Despite the successes of It Wasn’t All Yellow, I changed tack once again in the following work. This decision partly came from a feeling that my portfolio, and subsequent discussion, would benefit from a greater range of works. In addition, I felt compelled to experiment with a system that avoided music notation, as, given that notation had been a central element of preceding works, I was interested in what effect this fundamental change would have. Therefore, the following work explored crowd-composition in an entirely new context, relative to this doctoral project, of electronic controllers and probabilistic music.

\[102\] Stems are isolated threads of a composition, used in audio production to either mix and master before release, or to remix the composition into a new state. Stems usually group related elements, for instance, backing vocals or percussion stems may be formed of multiple audio sources.
5.5 ElectroQuiz

The fourth work in this portfolio, and third interactive workshop, ElectroQuiz invites a crowd to vote to create electronic music. Utilising both crowdvoting and creative submissions, its engine is built on a string of probabilistic music generators which produce a continuous, generative music, able to be edited in real-time. With these generators, volunteers create bassline, kit, keyboard accompaniment and melody materials. The crowd votes for which to include, in addition to determining tempo, key, instrumentation, and the order that these four textural layers are composed. Overall, the engine allows for a much wider array of potential musical results than previous works (Track 5), and I aimed to pair this with an intuitive and user-friendly system, accessible to all ability levels. The hope was that these elements would lead to an enhanced crowd-composition experience.

ElectroQuiz was performed on three occasions, and I continued my role as moderator in each. They were as follows:

1. First study – a public concert with professional chamber orchestra SÓN, in July 2018, to a diverse audience of 60.

The following performances explored workshopping with children.

2. Pilot – revisions to ElectroQuiz were tested with the 8 members, aged 10-16, of the Southampton Youth Percussion ensemble from the Southampton Music Service (SMS) in December 2018.

3. Second study – a formal performance with 30 members of the SMS Acorn (aged 7-9) and Elgar (aged 10-14) string ensembles in March 2019.

Because ElectroQuiz was performed more than previous works, and because the demographics met across those performances were so different, this commentary is divided between the first and second study. The first is described and evaluated, before the pilot is discussed under Revisions, and then the second evaluated in the final section.
5.5.1 Construction [first study]

The work was commissioned by SÓN, a professional chamber orchestra based in Southampton. I was invited to compose a work as part of their SÓNic Interventions: a series of concerts responding to a Gerhard Richter exhibition at the John Hansard Gallery (JHG) in Southampton. I chose to respond specifically to the featured piece of the exhibition: 4,900 Colours by Richter (2007, Fig. 47). This work consists of 4,900 tiles, each displaying a distinct colour, all algorithmically selected by a computer program, and distributed onto panels randomly. Therefore, the work privileges “chance and abstraction at the expense of... painterly touch”\textsuperscript{103}.

![Figure 47 – ‘4,900 Colours’ by Gerhard Richter.](image)

Galleries have agency over the arrangement of panels, and in this way, 4,900 Colours is both one work and many. In addition, spectators have commented that they search for organisation within the aleatoric display, allowing their minds to find constellations, patterns or rules where none may exist\textsuperscript{104}. In this sense, the work continues to evolve through the eyes of the viewer. It was the openness of these qualities that drew me to 4,900 Colours, as I saw similarities in this devolution of agency with my portfolio.


\textsuperscript{104} Ibid.

The People’s Choice Music consists of two compositions: The Most Wanted Song and The Most Unwanted Song. Participants completed surveys that explored preferences and aversions to areas such as instrumentation, duration, and theme\(^\text{105}\). Feedback formed the catalyst of these works – the artists composed freely, but ensured that the feedback was integral to the resulting music. I was drawn to this questionnaire-model because it was a technique that I had yet to consider, and was potentially flexible enough to be accessible at any ability level.

I also drew upon No Clergy by Kevin Baird. Baird too utilised questionnaires, alongside algorithmic probability, with participants responding to queries about pitch, duration, rests, articulation and dynamics using Likert Scales. The responses were channelled through a Markovian matrix and, in turn, transformed an existing composition. The People’s Choice Music was largely informed by high-level decisions, whereas No Clergy made use of low-level ones. I aimed to integrate both, in a fusion that hoped to avoid the tediousness of low-level decision-making shown by previous works, whilst including its potential for high crowd agency. This led to the utilisation of generative music, which was intended to offset the low-level issue by allowing for a more reactive platform. Through this capacity, a considerable degree of control could be afforded, in a form that might have been more inclusive, as it required a lower level of musical expertise than previous systems to operate. In addition, generative music is able to demonstrate changes in real-time, potentially enhancing the user experience. This applied to the low-level decision-making through the parameters described below, as well as with the more high-level decisions.

A further advantage was that relying on algorithmic rendering would relegate my own creative voice in favour of that of the crowd, contrasting with The People’s Choice Music, in which composer voice dominated the work. I saw this as more suitable to my crowd-composition aesthetic.

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*ElectroQuiz* utilised electronic controllers to produce materials, rather than a score and instrumentalists. This model was adopted for several reasons. Firstly, notation and live performance were an inextricable part of previous works, and I was interested in exploring the affect a different paradigm might have in evaluation. In particular, I was keen to explore whether the avoidance of notation would be more accessible, and therefore more engaging. Secondly, I was also interested in whether unfamiliar technology would enhance engagement. Finally, pairing with the reactiveness of the generative engine, the controllers might have improved the efficiency of the crowd-composition process, as additional performers were no longer needed as intermediaries. This could have led to more complex compositions, potentially improving satisfaction, and in turn, a higher level of engagement.

In *ElectroQuiz*, the crowd votes to make high-level decisions, such as tempo and instrumentation, reflecting the *The People’s Choice Music* model. Musical materials are then created by manipulating parameters, such as pulse and rests, within probabilistic music generators that were inspired by *No Clergy’s* algorithmic devices, gradually chiselling a crowd-composed music from the generative engine. Probability is integral to these parameters. To explain probability in the *ElectroQuiz* engine, I use the example of a single electronically-generated percussive note that is set to continually repeat itself, and is attached to a probabilistic device. If that device is set at 100%, then the note will sound on each repeat. If it is set at 0%, the note still exists as it repeats, but it will not sound. If the device is set at 50%, then there is a 50/50 chance that the note will sound on each repeat. This example is representative of how the parameters in the *ElectroQuiz* engine work.

The bassline and keyboard accompaniment had identical sets of 6 parameters (*Fig. 48*). Both layers began with a repeating, tonic note. The first parameter, pulse, adjusted the frequency that this note repeated. It could be set to any degree between a semiquaver and minim pace. The second was rests, and this worked just as in the probability example described previously, creating varying degrees of space in the material. The following two were paired: pitch options determined how many pitches from a two octave scale the generator could utilise, pitch chance determined the likelihood that the generator would move away from the tonic note. Duration was fifth, controlling the length a note was held. The generators constantly adjusted durations, fluctuating between long and short notes, giving the material
some semblance of musicality. Duration adjusted the average duration – the pivot on which durations shifted back and forth. The final parameter, dynamic, worked the same way.

Along with these parameters, the keyboard accompaniment had an added function: the crowd voted for a device to turn the initially monophonic texture into polyphony. Their choice was to apply chords, arpeggios, or to create a wall of sound by severely elongating the notes. Each came with an extra parameter. The thickness of chords could be adjusted, as could the speed of the arpeggiator, and the density of the drone.

Third was the kit part, for which the crowd first voted to select one of five bass drum patterns. This choice affected just the rhythmic material, not the timbre or articulation of the bass drum. These options reflected standard patterns from various genres of electronic music, such as house and drum & bass. Volunteers then adjusted six parameters to construct the rest of the kit part (Fig. 49). The hi-hat began as a static repeating crotchet pulse and the first four parameters adjusted the frequency of this element. The likelihood of the crotchets turning into quavers, semiquavers, demisemiquavers, and hemidemisemiquavers were all changeable. The final two adjusted the probability of snare and clap elements.

Figure 48 – ‘ElectroQuiz’ [first study] bassline and keyboard accompaniment parameters.

Figure 49 – ‘ElectroQuiz’ [first study] kit part parameters.
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Fourth was the melody (Fig. 50). This generator autonomously meandered around a scale, and the first four parameters controlled the number of minims, crotchets, quavers, and semiquavers that were produced. These paired with rests, duration and dynamic, which worked as before.

ElectroQuiz combined crowdvoting with crowd creation by having the crowd vote on volunteered contributions. My original concept had the crowd voting to manipulate parameters. However, following the first study of It Wasn’t All Yellow, which had issues with repetitive questioning, I removed this voting element. This decision also followed Jason Freeman’s reflection on Graph Theory: “users clearly wanted more opportunities for individual creation”\(^\text{106}\). Instead, along with voting on high-level decisions, the crowd voted on the inclusion of volunteered contributions. Volunteers interacted with the generators, and, when finished, crowdvoting was used to determine which would be included. For each contribution, the crowd could refuse it, inviting someone else to try, or implement the material in question and continue to the next stage of the workshop.

Along with a computer running Ableton Live, where the ElectroQuiz engine was housed, the work utilised the following controllers (Fig. 51):

- Ableton Push – used as an interface for Ableton Live, and for its dial components;
- Novation Launchpad – used to administer the ElectroQuiz engine;
- Novation Launch Control – auxiliary controls.

---

\(^{106}\) Freeman, “Web-based collaboration, live musical performance and open-form scores”, 162.
Video 5 from the accompanying materials demonstrates the use of controllers in ElectroQuiz, and how their functions bring all of these elements together\textsuperscript{107}.

\textbf{5.5.2 System}

Staging differed from previous workshops (Fig. 52). Though the crowd were still equipped with electronic remotes, but the instrumentalist and operator components were replaced with a table of controllers. Contributions were inputted via these, and the resultant music was automatically generated. A camera feed of the controllers was displayed so that all could have a clear view. Polls and results were presented on PPT, and options were showcased with the controllers where applicable.

The workshop began with an introduction explaining the probabilistic premise of the work, detailed the tasks involved, and demonstrated parameters. Following a practice PPT slide, the workshop's first task had the crowd select a tempo. The three available options, along with a corresponding electronic genre, were:

---

\textsuperscript{107} Video 5 is part of the ElectroQuiz performance pack, and as such corresponds to the final iteration of the work, rather than the iteration described here. Therefore, its functionality differs slightly, but it remains a useful tool for understanding ElectroQuiz.
Figure 52 – ‘ElectroQuiz’ staging.
• 70 bpm – *dubstep*;
• 120 bpm – *house*;
• 160 bpm – *drum & bass*.

These were demonstrated through the use and manipulation of a metronome.

Next, the crowd voted to select a key (Fig. 53):

• Major scale;
• Minor scale.

This was referred to as scale in the workshop, rather than key, so as not to create confusion with the keys/keyboard accompaniment material constructed later on. These scale options were showcased through the probabilistic generators.

![Figure 53 – 'ElectroQuiz' [first study] scale poll.](image)

The crowd then had the navigational choice of which material to create first (Fig. 54), a choice they made for each generator, though closing with the melody was mandatory.
They then determined instrumentation for that layer, with a choice of three contrasting options showcased via the controllers (Fig. 55):

- Electronic – a bright, synthy collection of sounds;
- Household – instruments built with household items, such as: a book slamming shut, a pot being struck, the rim of a half-full wine glass being rubbed, an old piano, etc;
- Chiptune – donated by Blake Troise, a PhD colleague and another SÓNic Intervention host. This was an instrument pack featuring vintage and 8-bit sounds.

For the keyboard accompaniment, after selecting instrumentation, the crowd were presented with three polyphonic options:

- Chords;
For the kit part, after selecting instrumentation, the crowd voted for a bass drum pattern:

- House/four-to-the-floor;
- Disco;
- Drum & bass;
- Dubstep;
- Ambient.

Both the polyphonic and bass drum options were showcased through the controllers via their respective probabilistic generators.

With these decisions made, a volunteer was invited to the stage and work on the material began. They manipulated parameters until happy with their efforts. As moderator, I was on hand at all times to advise and facilitate. When finished, the following PPT slide (Fig. 57) was presented to the crowd:
If the crowd liked the material, they voted for continue. If they wished for someone else to take a turn, they voted to reload. This took place for each material.

Following these foundational layers, the workshop moved onto the melody. Instrumentation was determined, and then successive volunteers contributed materials until the crowd reached consensus.

The crowd then revisited earlier decisions in the interlude section, where they could modify the tempo and key, as well as revise one of the layers (Fig. 58):

In the final stage of the workshop, I gave a performance of the crowd-composed materials by recording slices of the generative music, and then constructing those clips into an improvised mini-composition.
With that, the workshop came to a close and a discussion session followed.

5.5.3 Evaluation

The evaluation examines composition data from the first study of ElectroQuiz, divided into the four evaluative features covered in the methodology. Following this, the resultant music is analysed. As no surveys were distributed, the evaluation utilises only the voting data and anecdotal feedback from the workshop’s ensuing discussion.

5.5.3.1 Composition data

5.5.3.1.1 The collective decision-making mechanism

This section discusses two elements that pertain to the collective decision-making mechanism in ElectroQuiz:

- Creative submissions;
- Reloading.

Firstly, it is worth noting elements transferred from previous works. Electronic remotes were again used to facilitate voting, carrying the same pros and cons as before. Voting data was revealed after each poll. As ever, this was usually an exciting moment. Finally, a die was not used to resolve multiple majorities. Instead, these instances were repollled. This was to take on the advice of SÓN’s Artistic Director, Robin Browning, who felt that repolling would be more appropriate in the JHG setting.

Volunteering was, at times, thrilling for all, as attendees were captivated by the seemingly infinite creative options. However, these moments also became stifled and tedious because that plethora of choice was too convoluted. Volunteers could not fully explore options within the time constraints of the workshop, and this also led them to feel uncomfortable (a possibility that Freeman warns of108). Both outcomes will have affected the musical result. The issue also had disengaging

108 Freeman and Godfrey, “Creative collaboration between audiences and musicians in ‘Flock’,” 87.
consequences. In discussion it was mentioned that there were too many parameters to follow, leading to stasis as many attendees absently waited for voting to recommence.

The reload/continue mechanism was also found to be inadequate, as reload was selected too frequently for the workshop to accommodate. This became monotonous for everyone, and yet continue rarely received a majority. My sense was that the inclusion of volunteered contributions in this form was unable to satisfy the crowd, to the point that this prevailed over even their disinterest in those moments.

5.5.3.1.2 Crowd agency

This section will discuss crowd cohesion, as it pertains to crowd agency in ElectroQuiz.

Majority strength was significantly weaker than in It Wasn’t All Yellow:

Table 33 – ‘ElectroQuiz’ [first study] voting data, mean majorities.

<table>
<thead>
<tr>
<th></th>
<th>Mean overall majority</th>
<th>Mean 2 options</th>
<th>Mean 3 options</th>
<th>Mean 4 options</th>
<th>Mean 5 options</th>
<th>Mean 9 options</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrowdComp</td>
<td>32%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>37%</td>
<td>28%</td>
</tr>
<tr>
<td>HyperCello</td>
<td>41%</td>
<td>-</td>
<td>54%</td>
<td>39%</td>
<td>40%</td>
<td>32%</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 1</td>
<td>63%</td>
<td>75%</td>
<td>69%</td>
<td>56%</td>
<td>51%</td>
<td>-</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 2</td>
<td>60%</td>
<td>67%</td>
<td>53%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ElectroQuiz 1</td>
<td>43%</td>
<td>54%</td>
<td>43%</td>
<td>-</td>
<td>33%</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 34 emphasises this outcome by showing the lowest differential majorities so far in the portfolio. However, the table also shows that a 5-option poll was utilised only once, and omitting this from the mean overall majority would improve the data somewhat.
Table 34 – ‘ElectroQuiz’ [first study] voting data, additional information.

<table>
<thead>
<tr>
<th>Differential majority</th>
<th>2 options</th>
<th>3 options</th>
<th>4 options</th>
<th>5 options</th>
<th>9 options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative frequency</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CrowdComp</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>17%</td>
<td>17%</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>HyperCello</td>
<td>-</td>
<td>21%</td>
<td>14%</td>
<td>20%</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>5</td>
<td>14</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 1</td>
<td>25%</td>
<td>36%</td>
<td>31%</td>
<td>31%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6</td>
<td>18</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 2</td>
<td>17%</td>
<td>20%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ElectroQuiz 1</td>
<td>4%</td>
<td>10%</td>
<td>-</td>
<td>13%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>8</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

One cause of this poor cohesion may have been that, as with the second study of *It Wasn’t All Yellow*, the workshop was open to the public and so the crowd were a mixed demographic. With so many backgrounds and abilities, it is perhaps no surprise that there was little consensus. In addition, as moderator, I recognised that the workshop had a competitive atmosphere. Individual participants were focused on their personal view of the process, competing with the aspirations of others, and so cooperation was not forthcoming. An outcome of this can be seen in the crowd’s repeated selection of the reload option. There was also an excessive allowance of agency – as one attendee put it in discussion, “I can’t think of anything more that could have possibly been added. It had everything” – which potentially created an imbalance of freedom over limitation that was detrimental to the success of the work. The inclusion of a composition objective (which had yet to be implemented in my portfolio, as there was some overlap between *It Wasn’t All Yellow* and *ElectroQuiz*) may have helped funnel this excess of perspectives and agency.

5.5.3.1.3  User interface

This section considers the staging of the workshop, as well as some of its components.

In *ElectroQuiz*, controllers replaced instrumentalists, operator and a live score. Though the controllers were exciting at first, as moderator, it was apparent to me that as the workshop progressed, the controllers became less engaging. Ultimately, I found them to be less successful than previously used components. Though there was a live camera feed displaying the actions of volunteers, this did not go far enough in building a connection with the crowd, feeding into the stasis discussed previously.
I had also hoped that this simplification would make moderation easier, as I would not need to worry about assisting other performers. However, I quickly realised the opposite to be true, as juggling the many crowd-composition elements made it difficult to run the workshop smoothly, compounding this engagement issue. Although, moderation remained an essential tool and continued to afford opportunities for conversation and humour during the workshop.

5.5.3.1.4 Engagement

This section assesses the aggregate impact of ElectroQuiz’s features, drawing on my experiences as moderator, and on discussion with attendees.

Generally, ElectroQuiz was found to be a fun and intriguing experience. Laughter throughout the workshop, the eagerness of volunteers, as well as a fascination with the controllers shown through discussion, both during and following the workshop, testify to this. However, these outcomes may have waned somewhat over the course of the workshop. In regards to pedagogy, attendees indicated being made aware of particular materials, rules and terminologies that govern specific genres of electronic music. Additionally, there was enthusiasm for how the engine allowed disparate elements to be combined in unusual ways. One attendee said, “we combined drum & bass, house music and chiptune to create a kind of chaotic mess I have never heard before. I loved it”.

However, engagement failed where the work was too complex. The probabilistic concept required a lengthy introduction – a dull and intrusive way of starting proceedings (ElectroQuiz [first study] – Clip 1 12:58). The volunteering task was also too demanding for the confines of the setting.
Volunteers did not feel they had adequate time to fully explore, and the discomfort for some was plain. This complexity led to accessibility issues for the crowd as well.

In addition, the workshop may not have been a satisfying experience, indicated by the weak crowd cohesion and the crowd’s penchant for reloading. This was expressed by one attendee in discussion, who said, “all of these choices we had was very cool, but my ideas for what to do never got picked”.

There was also a problem with the use of generative music. I felt that *ElectroQuiz* ran the risk of producing a subdued ending, because the generative techniques provided little opportunity for concluding fanfare. Therefore, I closed the workshop with a performance of recorded slices from the engine, hoping to create a climactic ending sequence. However, it was clear that this was unsatisfactory as it utilised my creative voice, and so could not be appreciated as their composition.

5.5.3.2 Musical result

The crowd began by selecting 120 bpm and a minor key. Following this, they chose to first create the keyboard accompaniment, for which they selected the electronic instrumentation and chords MIDI effect. Of the several volunteered contributions, the prevailing material had the chords at maximum thickness, a loud average dynamic, large pitch option selection and a high pitch chance – resulting in a broad and roaming material. The kit part was voted for next, for which the household instrumentation and ambient bass drum pattern were selected. The prevailing material, in contrast with its spacious foundation, made use of parameter settings as active and continuous as possible. The bassline, with the electronic instrumentation, followed. The prevailing material featured no
Chapter 5

pitch changes, and sporadic notes with long durations. It had an unpredictable quality, seemingly out of sync with the other layers. Finally was the melody material, with the chiptune instrumentation. The prevailing material utilised mostly short notes, few rests, a short average duration, large pitch option selection, high pitch chance and a low average dynamic. The outcome was a subdued, punctuated pitter-patter winding around the other layers. In the interlude, the crowd changed the tempo to 160 bpm, and the key to major. They also voted to reload the keyboard accompaniment, and this revision is the version described above.

This journey is illustrated in Figure 61, and the completed materials can be heard on Track 6.

The following outcomes all contributed to a chaotic and abrasive resultant music:

1. Instrumentation polls consistently led to the boldest from each set, and the result features one from each of the instrumentation options;
2. The confliction between a spacious bass drum pattern and incessant upper register elements of the kit part;
3. The hyperactive keyboard accompaniment and melody; and,
4. The unpredictable quality of the bassline.

It has an unrefined feel, caused in part by the limited manipulation of parameters that resulted from an overly complex and uninviting system. Another cause could be their desire for impactful decision-making, seen in the hectic materials, instrumentation selection, fastest tempo, and repeated selection of reload.
5.5.4 Construction [second study]

The final two performances of ElectroQuiz were organised through the SMS, and so attended by young musicians – a very different demographic to that of previous workshops. A major revision of the work was piloted in December 2018, then performed in March 2019.

Evaluation of the first study showed that the work needed to be reduced and simplified, and this necessity was compounded by the fact that subsequent performances were planned for young people.

The following revisions were made:

1. Parameter selection: in all generators, duration and dynamic were removed, and pulse was reduced to offer only a quaver or crotchet pulse. Additionally, snare and clap were removed from the kit part.
2. Voting options: the drone MIDI effect was removed, as were three of the bass drum patterns, leaving only house and ambient. The navigational choice poll was also removed.
3. Instrumentation options were reviewed, leaving two, more clearly defined options – acoustic and electronic.
4. The melody material was removed for the pilot, but this was due to time constraints as the workshop took place within a scheduled SMS rehearsal.
These revisions had the added benefit of addressing issues relating to moderation. Simplifying the system meant that much of the workshop’s challenging introduction could be removed. Additionally, whereas the previous workshop was a little unwieldy, the revisions aimed to make moderation more manageable, creating opportunities for a greater focus on audience interaction.

Another revision was the replacement of the reload/continue poll with a new function that invited two volunteers to the stage. Both volunteers created a material, and the crowd voted to select their preferred contribution in a version poll. Along with parameter reductions, making the task more manageable, this aimed to alleviate discomfort as it would be a less isolating experience. It also hoped to enhance engagement, by encouraging the crowd to identify differences in making their decision.

The final revision was the inclusion of a composition objective, where the crowd selected the mood they wanted their composition to express. There were three contrasting options (Fig. 62):

- Sluggish – pesante;
- Graceful – grazioso;
- Furious – furioso.

5.5.4.1 Revisions

The pilot produced positive data and feedback, as well as an interesting musical result. The completed materials can be heard on Track 7.

After first choosing the furious mood, the crowd made a series of decisions that fulfilled this objective. They produced a rapid, but controlled music, with an animated bassline, frantic kit part,
and punchy chords. Most of their decisions fitted the furious objective, in that a fast tempo, house bass drum pattern, and the most energetic of volunteered contributions were selected. Though similar, the music is less manic and disorganised than the previous result. This can perhaps be credited to the importance of the composition objective in guiding decision-making, which is demonstrated by the extraordinarily successful voting data shown in Tables 35 and 36:

Table 35 – ‘ElectroQuiz’ [pilot] voting data, mean majorities.

<table>
<thead>
<tr>
<th>Mean overall majority</th>
<th>Mean 2 options</th>
<th>Mean 3 options</th>
<th>Mean 4 options</th>
<th>Mean 5 options</th>
<th>Mean 9 options</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrowdComp</td>
<td>32%</td>
<td>-</td>
<td>-</td>
<td>37%</td>
<td>28%</td>
</tr>
<tr>
<td>HyperCello</td>
<td>41%</td>
<td>-</td>
<td>54%</td>
<td>39%</td>
<td>40%</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 1</td>
<td>63%</td>
<td>75%</td>
<td>69%</td>
<td>56%</td>
<td>51%</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 2</td>
<td>60%</td>
<td>67%</td>
<td>53%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ElectroQuiz 1</td>
<td>43%</td>
<td>54%</td>
<td>43%</td>
<td>-</td>
<td>33%</td>
</tr>
<tr>
<td>ElectroQuiz 2</td>
<td>74%</td>
<td>79%</td>
<td>69%</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 36 – ‘ElectroQuiz’ [pilot] voting data, additional information.

<table>
<thead>
<tr>
<th>Differential majority</th>
<th>2 options</th>
<th>3 options</th>
<th>4 options</th>
<th>5 options</th>
<th>9 options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CrowdComp</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>17%</td>
<td>17%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>HyperCello</td>
<td>-</td>
<td>-</td>
<td>21%</td>
<td>14%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>14</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 1</td>
<td>25%</td>
<td>36%</td>
<td>31%</td>
<td>31%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6</td>
<td>18</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 2</td>
<td>17%</td>
<td>20%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ElectroQuiz 1</td>
<td>4%</td>
<td>10%</td>
<td>-</td>
<td>13%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>8</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>ElectroQuiz 2</td>
<td>29%</td>
<td>36%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The selection of options that were thematically in line with the composition objective led to some significantly strong majorities:

- The fastest tempo selected by 75%;
- The four-to-the-floor, house bass drum pattern by 100%;
• The keyboard accompaniment contribution with the quickest pulse by 100%.

Alongside these examples is their cohesion in selecting acoustic for each instrumentation vote, which helped create uniformity in the soundworld. This was not necessarily intended to fulfil the objective, rather, my opinion is that this relates to the use of a small group (8 participants) with closely aligned views. Of all my workshops, this had the most narrow demographic. They were a group of children trained in classical music through the same music system, belonging to the same percussion ensemble, an ensemble through which they had gotten to know one another for a number of years. It is quite possible that this classical context led them to the acoustic instrumentation options, as well as supporting cohesion more broadly in the workshop.

It is important to note that this exceptional cohesion can be considered an anomalous result. The pilot has a very small data set, and small groups skew data – Daniel Kahneman remarks that “extreme outcomes (both high and low) are more likely to be found in small than in large samples”109. Both this and crowd demographic are relevant points in understanding the cohesive success of the data.

The survey completed by attendees following the workshop mirrored that of It Wasn’t All Yellow, with two minor changes:

• Reception of instrumentalists no longer needed to be assessed, as the work did not include instrumentalists, and so this was removed.
• Another pedagogically-focused question was added, enquiring into learning about electronic music, which related to the specifics of ElectroQuiz’s design.

Additionally, the question that deals with authorship, ‘Do you feel the music created is yours?’, was only added for the final iteration of this work. I had also not included at this stage a separate survey for volunteers.

As stated, the data set is small, and so it is difficult to compare with that of previous works. However, the feedback is positive.

Beginning with the crowd’s perception of influence, the positive response shown in Table 3 correlates with improved majority strength, further indicating that crowd cohesion was successful:

Table 3 – ‘ElectroQuiz’ [pilot] survey data, ‘How often did it seem that the options you selected influenced the collective decision?’.

<table>
<thead>
<tr>
<th>How often did it seem that the options you selected influenced the collective decision?</th>
<th>ElectroQuiz 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean overall majority</td>
<td>76%</td>
</tr>
<tr>
<td>Never</td>
<td>0%</td>
</tr>
<tr>
<td>Rarely</td>
<td>0%</td>
</tr>
<tr>
<td>Occasionally</td>
<td>25%</td>
</tr>
<tr>
<td>Frequently</td>
<td>50%</td>
</tr>
<tr>
<td>Always</td>
<td>25%</td>
</tr>
</tbody>
</table>

Table 38 shows survey data to questions relating to user interface and engagement with the work, which was also largely positive. The feedback suggests the following:

- Controllers had a positive impact on enjoyment. This was expected as the group size meant most attendees could volunteer.
- Delivery of the workshop was good, but comprehension of the presentation was more mixed. There was room for improvement in how information was conveyed to the crowd.
- Half the crowd found the duration of the work about right, and half found it too short. As both the melody and interlude section were removed, this was no surprise.
- Satisfaction was good, in line with the crowd cohesion data.
- All attendees enjoyed the workshop.
Table 38 – ‘ElectroQuiz’ [pilot] survey data, user interface and engagement questions.

<table>
<thead>
<tr>
<th>How do you feel about the duration of the work?</th>
<th>Was the presentation easy to understand?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Far too short</td>
<td>Strongly disagree 0%</td>
</tr>
<tr>
<td>Too short</td>
<td>Disagree 0%</td>
</tr>
<tr>
<td>About right</td>
<td>Undecided 12.5%</td>
</tr>
<tr>
<td>Too long</td>
<td>Agree 50%</td>
</tr>
<tr>
<td>Far too long</td>
<td>Strongly agree 37.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Did the quality of the presentation add to your enjoyment?</th>
<th>Did the technology and equipment used add to your enjoyment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree 0%</td>
<td>Strongly disagree 0%</td>
</tr>
<tr>
<td>Disagree 0%</td>
<td>Disagree 0%</td>
</tr>
<tr>
<td>Undecided 12.5%</td>
<td>Undecided 0%</td>
</tr>
<tr>
<td>Agree 25%</td>
<td>Agree 62.5%</td>
</tr>
<tr>
<td>Strongly agree 62.5%</td>
<td>Strongly agree 37.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Did you enjoy participating in ElectroQuiz?</th>
<th>Are you satisfied with ElectroQuiz’s crowdvoted materials?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree 0%</td>
<td>Very dissatisfied 0%</td>
</tr>
<tr>
<td>Disagree 0%</td>
<td>Dissatisfied 0%</td>
</tr>
<tr>
<td>Undecided 0%</td>
<td>Undecided 12.5%</td>
</tr>
<tr>
<td>Agree 25%</td>
<td>Satisfied 62.5%</td>
</tr>
<tr>
<td>Strongly agree 75%</td>
<td>Very satisfied 25%</td>
</tr>
</tbody>
</table>

Three further questions explored the role of pedagogy in the work, asking:

- ‘Do you feel you have a greater or new understanding of music composition than you did before you came to the workshop today?’
- ‘Do you feel you have a greater or new understanding of electronic music than you did before you came to the workshop today?’
- ‘Is there anything else that you feel you have learned as a result of this workshop?’

In answer to the first question, 75% of attendees responded positively, and in answer to the second, 62.5% responded positively. Comments reference enjoying their first experiences with electronic music, and learning what contributes to making an electronic track, both in terms of technology and musical material. Most prominent were references to learning compositional and production terminologies. Feedback to the third question was negligible. Overall, the data suggests that pedagogy played a part in making ElectroQuiz a rewarding experience for this group.

In lieu of the final performance, several areas were identified for revision.
A key issue was the need for further reductions. As moderator, it was clear that the scope of the engine was still having a negative impact. This is shown by the mixed response to ‘Was the presentation easy to understand?’, as well as through discussion with attendees. Therefore, pitch options was removed from parameter selection, and the hemidemisemiquaver parameter was removed from the kit part. Additionally, pulse was removed. Instead, for the bassline, one volunteer was invited to compose a material with a quaver pulse, and one with a crotchet pulse. Similar reductions meant that for the keyboard accompaniment, one volunteer created a material with the chords MIDI effect, one with the arpeggiator effect; and for the kit part, one volunteer created a material with the ambient bass drum pattern, one with the house pattern. These revisions impacted on the creative potential of the engine, but I felt that the need to simplify outweighed this concern.

Feedback also indicated that the workshop was too short. Therefore, the melody and interlude were reintroduced, though these had to be in line with the latest simplifications. For the interlude, rather than revisiting several moments in the workshop, the crowd voted to revisit just one. For the melody, I chose to add a new dimension to the creative process by returning to my original concept for the work (having all parameters determined through crowdvoting), though in a way that would be interesting and accessible for all. To create the melody, the crowd voted on a series of pictorial questions that directly sculpted the melody generator parameters. For instance, Figure 63, where the size of speakers in each image indicates a dynamic option:

![Figure 63 – ‘ElectroQuiz’ [second study] melody, pictorial questionnaire.](image)

This was intended to be an enjoyably fresh and collective technique, with the added benefit of reintroducing removed parameters, as their complexity would no longer sacrifice engagement. The pictorial questionnaire also served to provide a more suitably dramatic ending. Rather than hearing
the melody progressively evolve, as with other layers, they completed the questionnaire in silence, after which only then did the melody materialise.

5.5.4.2 System

Proceedings began with a short introduction informing the crowd of the aim and structure of the workshop. As before, polls and results were presented on PPT, and options were showcased with the controllers where applicable. Following a practice PPT slide, the crowd were first tasked with selecting a composition objective. They then voted to select a tempo (Fig. 64) from the following options:

- Slow (60 bpm) – lento;
- Moderate (100 bpm) – moderato;
- Fast (160 bpm) – presto.

These were demonstrated through the use and manipulation of a metronome.

The workshop then moved onto the bassline, for which the crowd had the following instrumentation options:

- Electronic – a synthy collection of sounds, all from the same digital instrument;
- Acoustic – based on a typical jazz ensemble setup – an acoustic drum kit, *pizzicato* double bass, piano and vibraphone.

Figure 64 – ‘ElectroQuiz’ [second study] tempo poll.
These were showcased via the controllers.

They then voted to select a key, with the bassline used to showcase the major and minor scale options. Following this, two volunteers were invited to the stage, and then the crowd voted for their preference (Fig. 65):

![Version 1 and Version 2](image)

**Figure 65 – ‘ElectroQuiz’ [second study] volunteered contribution poll.**

Next came the keyboard accompaniment, then the kit part, which worked similarly as the bassline.

The interlude section followed, where the crowd voted to revise one of three elements (Fig. 66):

- Tempo;
- Scale;
- Keyboard accompaniment MIDI effect.

![Tempo, Scale, Keys](image)

**Figure 66 – ‘ElectroQuiz’ [second study] interlude, revision poll.**
If tempo or scale were selected, their respective options were presented once again. If the MIDI effect was voted to be swapped, the crowd next manipulated either the chord thickness or arpeggiator speed parameters, which were demonstrated with the controllers (Fig. 67):

![Arpeggiator speed](image)

**Figure 67** – ‘ElectroQuiz’ [second study] interlude, arpeggiator speed poll.

Finally came the melody material, for which the crowd completed a six-stage pictorial questionnaire that was presented on the PPT, examples of which can be seen in Figure 63, and Figure 68 below. Once the questionnaire was completed, the crowd heard their finished composition.

![Melody](image)

**Figure 68** – ‘ElectroQuiz’ [second study] melody, pictorial questionnaire (number of crotchets).

With that came a short outro, summarising their compositional journey, and the workshop came to a close.
5.5.4.3 Survey

The survey completed by attendees following the workshop is presented in Figure 69.

This mirrored that of It Wasn’t All Yellow, with the only change being the removal of ‘Did the use of musicians add to your enjoyment?’, as this did not apply to ElectroQuiz.

Following feedback from the pilot, as well as guidance from the SMS, a version of the questionnaire more appropriate for the youngest demographic was devised. This included just seven questions (Fig. 70). Rather than completing surveys individually, the youngest attendees – those from the Acorn string ensemble, roughly a third of the crowd – gathered around a whiteboard, which presented questions and feedback options. Led by SMS staff, the children were encouraged to apply post-it notes over their preferred responses, or in the case of Questions 5-7, to write comments on the post-it notes.
## Participant Survey

1. How often did it seem that the options you selected influenced the collective decision?
   - Never
   - Rarely
   - Occasionally
   - Frequently
   - Always

2. How do you feel about the duration of the work?
   - Far too short
   - Too short
   - About right
   - Too long
   - Far too long

3. Was the presentation easy to understand?
   - Strongly disagree
   - Disagree
   - Undecided
   - Agree
   - Strongly agree

4. Did the quality of the presentation add to your enjoyment?
   - Strongly disagree
   - Disagree
   - Undecided
   - Agree
   - Strongly agree

5. Did the technology and equipment used add to your enjoyment?
   - Strongly disagree
   - Disagree
   - Undecided
   - Agree
   - Strongly agree

6. Did you enjoy taking part in *ElectroQuiz*?
   - Strongly disagree
   - Disagree
   - Undecided
   - Agree
   - Strongly agree

7. Are you satisfied with *ElectroQuiz’s* crowdvoted materials?
   - Very dissatisfied
   - Dissatisfied
   - Undecided
   - Satisfied
   - Very satisfied

8. Do you feel the music created is yours?
   - Strongly disagree
   - Disagree
   - Undecided
   - Agree
   - Strongly agree

9. Do you feel you have a greater or new understanding of music composition than you did before you came to the workshop today?
   
   Space left for written feedback

10. Do you feel you have a greater or new understanding of electronic music than you did before you came to the workshop today?
    
    Space left for written feedback

11. Is there anything else that you feel you have learned as a result of this workshop?
    
    Space left for written feedback

12. Would you like to make any additional comments?
    
    Space left for written feedback

Figure 69 – ‘ElectroQuiz’ [second study] participant survey.
<table>
<thead>
<tr>
<th>1. Did you enjoy participating in <em>ElectroQuiz</em>?</th>
</tr>
</thead>
<tbody>
<tr>
<td>😞</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Was the presentation easy to understand?</th>
</tr>
</thead>
<tbody>
<tr>
<td>😞</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Do you like the music you created today?</th>
</tr>
</thead>
<tbody>
<tr>
<td>😞</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. How do you feel about the duration of the work?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too short</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. What did you enjoy most about the workshop?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space left for written feedback</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6. Did you learn anything from the workshop?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space left for written feedback</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7. Is there anything else you’d like to say about the workshop?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space left for written feedback</td>
</tr>
</tbody>
</table>

Figure 70 – ‘ElectroQuiz’ [second study] participant survey for the youngest attendees.

Finally, as in *It Wasn’t All Yellow*, those that volunteered were asked to complete an additional survey:

<table>
<thead>
<tr>
<th>1. Did you enjoy contributing your creative ideas?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Did you feel any discomfort in volunteering?</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Would you like to make any comments to do with volunteering in <em>It Wasn’t All Yellow</em>?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space left for written feedback</td>
</tr>
</tbody>
</table>

Figure 71 – ‘ElectroQuiz’ [second study] participant survey for volunteers.
5.5.5 Evaluation

The evaluation examines composition data from the final performance of *It Wasn’t All Yellow*, divided into the four evaluative features covered in the methodology. Following this, the resultant music is analysed.

5.5.5.1 Composition data

5.5.5.1.1 The collective decision-making mechanism

This section discusses two elements that pertain to the collective decision-making mechanism in *ElectroQuiz*:

- Anonymity;
- Creative submissions.

HyperCello attendees noted their appreciation for anonymous voting, and this view was also shared by those of *ElectroQuiz*. Whilst preparing the workshop, I was advised that several children were distressed at the thought of “getting it wrong” or “doing badly”. I was able to give reassurances that there were no bad decisions and that no one would know what they had selected. This indicated that not only is anonymity key to producing a genuine crowd-composition, as it supports an even distribution of influence across the crowd, but it is also invaluable in supporting engagement.

Concerns about the volunteering task in previous performances led to revisions, as well as the inclusion of a bespoke survey for volunteers. Feedback to this showed a positive response (*Tab. 39*):

<table>
<thead>
<tr>
<th>Did you enjoy contributing your creative ideas?</th>
<th>Did you feel any discomfort in volunteering?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>None</td>
</tr>
<tr>
<td>Disagree</td>
<td>Little</td>
</tr>
<tr>
<td>Undecided</td>
<td>Some</td>
</tr>
<tr>
<td>Agree</td>
<td>Much</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>A great deal</td>
</tr>
</tbody>
</table>

Table 39 – ‘ElectroQuiz’ [second study] survey data; ‘Did you enjoy contributing your creative ideas?’, Did you feel any discomfort in volunteering?’.
It seems volunteers felt comfortable and were able to enjoy the process. One volunteer noted, “how easy it was to do the hi-hat!”. I expected this response from my experience as moderator, and it provided confirmation that the latest simplifications meant that volunteers felt unhampered in exploring the engine (ElectroQuiz [second study] – Clip 3 19:20). However, similarly as in It Wasn’t All Yellow, this data does not account for participants that may have felt more uncomfortable volunteering.

5.5.5.1.2  Crowd agency

This section will discuss two elements that pertain to crowd agency in ElectroQuiz:

- Crowd cohesion;
- A sense of authorship.

Table 40 compares voting data across my portfolio, showing success with regards to majority strength for this final workshop.

<table>
<thead>
<tr>
<th></th>
<th>Mean overall majority</th>
<th>Mean 2 options</th>
<th>Mean 3 options</th>
<th>Mean 4 options</th>
<th>Mean 5 options</th>
<th>Mean 9 options</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrowdComp</td>
<td>32%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>37%</td>
<td>28%</td>
</tr>
<tr>
<td>HyperCello</td>
<td>41%</td>
<td>-</td>
<td>54%</td>
<td>39%</td>
<td>40%</td>
<td>32%</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 1</td>
<td>63%</td>
<td>75%</td>
<td>69%</td>
<td>56%</td>
<td>51%</td>
<td>-</td>
</tr>
<tr>
<td>It Wasn’t All Yellow 2</td>
<td>60%</td>
<td>67%</td>
<td>53%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ElectroQuiz 1</td>
<td>43%</td>
<td>54%</td>
<td>43%</td>
<td>-</td>
<td>33%</td>
<td>-</td>
</tr>
<tr>
<td>ElectroQuiz 2</td>
<td>74%</td>
<td>79%</td>
<td>69%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ElectroQuiz 3</td>
<td>60%</td>
<td>66%</td>
<td>53%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

My initial assumption was that the composition objective (in that options aligning with their choice led to strong majorities), reductions to the system, and a crowd with a relatively narrow demographic, had all contributed towards this cohesion. However, Table 41 shows that differential majorities were similar to that of CrowdComp, a result deemed to be weak in evaluation. Therefore, it is clear that theoretical probability bias had the strongest effect here.
Despite this, Table 42 shows a positive response to the crowd’s perception of influence, revealing that attendees felt their voices were heard within the creative process (although the youngest group did not answer the question, and their feedback may have affected this outcome). Similarly to It Wasn’t All Yellow, this again suggests that aiming for high majority strength remains a useful tool, even though it has been shown to be a limited approach due to theoretical probability bias.

As an additional note, Table 41 shows that a 2-option poll is not necessarily the most appropriate option quantity. Whilst there may still be value in utilising the higher theoretical probability of a 2-
option poll, 3-option polls have performed consistently better in terms of differential majorities. However, the significance of this requires further study, and this project is only able to indicate the positive impact of high majority strength.

The table below shows a decline in authorship, no longer pairing with crowd cohesion as it did in It Wasn’t All Yellow:

Table 43 – ‘ElectroQuiz’ [second study] survey data, ‘Do you feel the music created is yours?’.

<table>
<thead>
<tr>
<th>Do you feel the music created is yours?</th>
<th>It Wasn’t All Yellow 2</th>
<th>ElectroQuiz 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>0%</td>
<td>18%</td>
</tr>
<tr>
<td>Disagree</td>
<td>0%</td>
<td>6%</td>
</tr>
<tr>
<td>Undecided</td>
<td>16%</td>
<td>41%</td>
</tr>
<tr>
<td>Agree</td>
<td>60%</td>
<td>29%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>24%</td>
<td>6%</td>
</tr>
</tbody>
</table>

A cause could lie with the mechanism that paired creative submissions and crowdvoting, as well as with the balance between those two, in that too much weight was placed on creative submissions. My sense was that many attendees felt that the role of the crowd in ElectroQuiz was insubstantial. This relates to a warning by Simula, who points out issues with letting a minority exert influence over a system\(^\text{110}\). In the following comments, attendees voice discontent with the workshop’s decision-making:

- “I did not like the fast drum beat”
- “Can I have a go at making my own music on that?”
- “The music might have sounded a bit better if the notes were more frequent”
- “I didn’t like some options”

Of course, every outcome cannot appease each attendee. Even so, the suggestion is that ElectroQuiz’s creative process still did not satisfy. In addition, my sense is that this issue was made

\(^{110}\) Simula, “The Rise and Fall of Crowdsourcing?”, 2786-2787.
more pronounced by working with children, which would be something to consider for future work in similar contexts.

5.5.5.1.3 User interface

This section considers the staging and components of the workshop, as well as whether resources were sufficient for meaningful participation.

Both Acorn and Elgar were asked the following question (Tab. 44):

Table 44 – ‘ElectroQuiz’ [second study] survey data, ‘Was the presentation easy to understand?’.  

<table>
<thead>
<tr>
<th>Was the presentation easy to understand?</th>
<th>Acorn ensemble</th>
<th>Elgar ensemble</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>😞 0%</td>
<td>Strongly disagree 6%</td>
</tr>
<tr>
<td></td>
<td>😞 64%</td>
<td>Disagree 6%</td>
</tr>
<tr>
<td></td>
<td>😊 36%</td>
<td>Undecided 6%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agree 53%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strongly agree 29%</td>
</tr>
</tbody>
</table>

Whilst Elgar’s response was positive, Acorn’s was more mixed, suggesting that revisions made the workshop suitable for the older group, but failed in this respect with the youngest. This is confirmed by Acorn comments, which highlight the challenge in engaging young people, as the difference in only a few years clearly requires distinct approaches:

- “I didn’t get it”
- “I want you to explain more”
- “It was fun but I didn’t understand some”

Though Elgar may have understood the presentation, Table 45 shows that it did not add much to their enjoyment. This emphasises what I was aware of when moderating, which is the difference between crowd-composing with children and adults. Moderation was key to previous workshops, but its role was lesser here, becoming a more peripheral feature. It shifted from entertainer to educator, a new skill area which would need enhancing for future works.
Table 45 – ‘ElectroQuiz’ [second study] survey data, ‘Did the quality of the presentation add to your enjoyment?’.

<table>
<thead>
<tr>
<th>Did the quality of the presentation add to your enjoyment?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>0%</td>
</tr>
<tr>
<td>Disagree</td>
<td>18%</td>
</tr>
<tr>
<td>Undecided</td>
<td>41%</td>
</tr>
<tr>
<td>Agree</td>
<td>35%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>6%</td>
</tr>
</tbody>
</table>

There was great focus on the controllers in this final performance (*ElectroQuiz* [second study] – Clip 6 20:18), and feedback in Table 46 reflects this. In fact, I had to temper their excitement because I knew not everyone would have an opportunity to use them. Several comments relate to this:

- “Can I have a go at making my own music on that?”
- “Next time will everyone have a turn”
- “Maybe next time we can have more audience participation”
- “I want to go again!”

Table 46 – ‘ElectroQuiz’ [second study] survey data, ‘Did the technology and equipment used add to your enjoyment?’.

<table>
<thead>
<tr>
<th>Did the technology and equipment used add to your enjoyment?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>0%</td>
</tr>
<tr>
<td>Disagree</td>
<td>6%</td>
</tr>
<tr>
<td>Undecided</td>
<td>18%</td>
</tr>
<tr>
<td>Agree</td>
<td>35%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>41%</td>
</tr>
</tbody>
</table>

Though the controllers fed into enjoyment, this response suggests that their implementation may also have been detrimental, potentially contributing to the dissatisfaction discussed previously.

5.5.5.1.4 Engaged

This section assesses the aggregate impact of *ElectroQuiz* features, drawing on enjoyment and satisfaction ratings in the survey feedback.
Chapter 5

Table 47 displays enjoyment feedback compared across surveyed portfolio works. Elgar gave a somewhat positive response, which can be attributed to several factors. The presence of controllers, a varied structure, enhanced interactivity, and comprehension of the system: all were influential. Though difficult to assess, pedagogy may also have been significant: 65% responded positively to having learned something about music composition, and 76% about electronic music production. Relevant comments include:

- “What a difference major and minor scales can make”
- “I learned what furioso is, and about demisemiquavers”
- “How easily a piece of music can be adapted!”
- “I have learned what kind of music to use if you want to make something furious”
- “Presto”

Table 47 – ‘ElectroQuiz’ [second study] survey data, ‘Did you enjoy participating in (this work)?’.

<table>
<thead>
<tr>
<th>Did you enjoy participating in (this work)?</th>
<th>CrowdComp</th>
<th>HyperCello</th>
<th>It Wasn’t All Yellow 2</th>
<th>ElectroQuiz 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Disagree</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Undecided</td>
<td>6%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Agree</td>
<td>76%</td>
<td>40%</td>
<td>16%</td>
<td>65%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>18%</td>
<td>60%</td>
<td>84%</td>
<td>35%</td>
</tr>
</tbody>
</table>

Acorn, however, enjoyed ElectroQuiz far less, and the central cause will have been their lack of comprehension. Accordingly, in terms of pedagogy, only 27% responded positively. Duration also played a part, Table 48 showing that whereas Elgar predominantly selected ‘about right’, Acorn found the workshop ‘too short’. This is likely the result of both comprehension and the function of controllers leading to an unfulfilling experience.
Table 48 – ‘ElectroQuiz’ [second study] survey data, ‘How do you feel about the duration of the work?’.

<table>
<thead>
<tr>
<th>How do you feel about the duration of the work?</th>
<th>CrowdComp</th>
<th>It Wasn’t All Yellow 2</th>
<th>ElectroQuiz 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Far too short</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Too short</td>
<td>0%</td>
<td>8%</td>
<td>6%</td>
</tr>
<tr>
<td>About right</td>
<td>47%</td>
<td>92%</td>
<td>82%</td>
</tr>
<tr>
<td>Too long</td>
<td>47%</td>
<td>0%</td>
<td>12%</td>
</tr>
<tr>
<td>Far too long</td>
<td>6%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>Too short 46%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>About right 36%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Too long 18%</td>
</tr>
</tbody>
</table>

Table 49 shows that satisfaction was mixed for both groups. One factor will have been that although crowd cohesion was strong, surveys reported that participants had a poor sense of authorship. This may have resulted from the implementation of controllers in ElectroQuiz, which led to a problematic and unbalanced pairing of creative submissions and crowdvoting. It could also be that generative music, which creates a somewhat illusive and partial musical result, was a factor. Additionally, I suspect that working with young people, who I found to be less accommodating than adults, augment these issues.

Table 49 – ‘ElectroQuiz’ [second study] survey data, ‘Are you satisfied with (the work’s) crowdvoted materials?’.

<table>
<thead>
<tr>
<th>Are you satisfied with (the work’s) crowdvoted materials?</th>
<th>CrowdComp</th>
<th>HyperCello</th>
<th>It Wasn’t All Yellow 2</th>
<th>ElectroQuiz 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very dissatisfied</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>12%</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>13%</td>
<td>6%</td>
<td>0%</td>
<td>6%</td>
</tr>
<tr>
<td>Undecided</td>
<td>25%</td>
<td>27%</td>
<td>0%</td>
<td>24%</td>
</tr>
<tr>
<td>Satisfied</td>
<td>56%</td>
<td>47%</td>
<td>44%</td>
<td>29%</td>
</tr>
<tr>
<td>Very satisfied</td>
<td>6%</td>
<td>20%</td>
<td>56%</td>
<td>29%</td>
</tr>
</tbody>
</table>

5.5.5.2 Musical result

The crowd began by selecting furious as their composition objective. Following this, they voted for fast and a major scale. They then chose acoustic, before volunteers created two distinct basslines, and the crowd voted for the liveliest of these contributions. Acoustic was selected again for the

\[111\] The survey data for Acorn used here is that of ‘Did you like the music you created today?’.
keyboard accompaniment, followed by chords. As before, two volunteers created their materials, and the crowd selected their preference. For the drum kit, acoustic was chosen for the third time, was followed by the house pattern, and then the liveliest contribution was voted for once again. In the interlude, chords changed to arpeggiator, and this was set at a fast rate. Finally, they voted for the busiest or most brazen options in the pictorial questionnaire, producing a melody which reflected this.

The result has an intense and condensed soundworld, a mania underpinned by the marching quality of the bass drum and bassline – a furious music was certainly achieved (Track 8). Most satisfying for me was that the volunteered contributions were some of the most creative I have seen over the course of the work. The children spent some time experimenting with parameters, and this is reflected in the quality of the result.

Despite improvements, all performances led to largely similar soundworlds. Whilst this was their prerogative – and, to a certain extent, expected, as these musical results reflect the impactful nature of collective decisions seen in previous works – it may be indicative of something lacking in the system. Perhaps the generative parameters, or the use of controllers generally, are to blame, in some way imposing a limited creative vision in the crowd. Or, perhaps the shift to working with children has made this collection somewhat anomalous. In any case, considering the potential for variety that was a cornerstone of ElectroQuiz’s design, I see the work as a failure in this respect.

5.5.6 Discussion in relation to research questions

5.5.6.1 How can crowd-composition facilitate meaningful experiences for participants?

Although enjoyment feedback was positive in the second study, it was not at the same level as It Wasn’t All Yellow. The decline was likely caused by the use of controllers and generative music, over instrumentalists and a live score, which seemed to be less engaging crowd-composition tools.

Levels of satisfaction showed a more significant decline, and whilst crowd cohesion was high, the work was unsuccessful in facilitating a sense of authorship amongst participants. The central issue here was an imbalance of creative submissions and crowdvoting, as it was clear that ultimately the crowd felt unfulfilled in their role.

Whilst there are inherent problems with ElectroQuiz, both of these issues were amplified by working with children, who required very different kinds of input and assistance to be able to engage with the process. However, the response to pedagogy was richer than that of It Wasn’t All Yellow. This is perhaps obvious within the context of the young demographic, however, judging by
the survey comments, there may be some additional pedagogical value in the participants’ unfamiliarity with ElectroQuiz’s tools.

5.5.6.2 How can crowd-composition lead to musical works or perspectives that are distinct from sole agent composition?

ElectroQuiz cemented my view that the crowd are drawn towards impactful decision-making, with all three performances producing soundworlds fitting that character. However, this outcome may reveal an explanation as to why that drive exists.

It was clear that many of those who did not volunteer were left unfulfilled by the experience, and this response highlights how unnatural crowd-composition can be seen to be. I am reminded of a previously given example, where, in a video game, the crowd steered a car off the road to prove that they were in control\textsuperscript{112}. My suspicion is that the drive to create impact is an impulse to balance the dichotomy between a desire for a more tangible participation, and the passive participation that takes place from the audience seat.

Another discovery was seen in the obstacles faced through catering for children. Though the composition objective remained important to crowd cohesion, it did not support engagement in the second study of ElectroQuiz as it did in It Wasn’t All Yellow. It may be that these concerns are more relevant for working with adults than children, indicating that the two groups require different approaches if high levels of satisfaction are to be achieved. It suggests that crowd-composing with children is an entirely different experience, adding a new dimension to the question of whether crowd-composition can lead to musical works or perspectives that are distinct from sole agent composition.

\textsuperscript{112} Maynes-Aminzade, Pausch and Seitz, “Techniques for Interactive Audience Participation”, 19.
Chapter 6    Discussion

This chapter will reflect on my portfolio through the lens of the two research questions outlined in my introduction:

- How can crowd-composition facilitate meaningful experiences for participants?
- How can crowd-composition lead to musical works or perspectives that are distinct from sole agent composition?

The first of these begins by defining a framework for unpacking meaningful experiences, as proposed by Pine and Gilmore in *The Experience Economy*. With this in place, the section then proceeds to identify and discuss elements of the portfolio that impacted on the quality of the experience for participants.

Whereas the first question assesses the crowd-composition process, the second focuses more on outcomes. This section explores aspects of crowd agency that are distinct from sole author agency, achieved by comparing the portfolio to fields with similar aesthetics, and using the resulting disparities to highlight where crowd-composition diverges from conventional practice.

6.1  How can crowd-composition facilitate meaningful experiences for participants?

A meaningful experience is one that is a worthy investment of a participant’s time\footnote{B. Joseph Pine and James H. Gilmore, *The Experience Economy, Updated Edition* (Boston, US: Harvard Business Review Press, 2011), 50.}, and the facilitation of meaningful experiences is an important evaluative measure of my works. This is because participation is a central component of the crowd-composition process, and therefore, crowd-composition is beholden to the participatory experience. This is perhaps best demonstrated by what results when there is little experiential value – failure is likely because participants are not willing to engage with the work.

In order to assess this concern across the portfolio, I have chosen to draw on the framework for categorising aspects of a meaningful experience that Pine and Gilmore put forth in *The Experience Economy*.
Economy (first published in 1999, with an updated edition published in 2011). Whilst this text has received criticism as a business philosophy\(^{114}\), I have found their framework convenient for reflecting upon the many elements of my works. The authors explore this subject through four experiential realms:

- *Entertainment*;
- *Escapist*;
- *Esthetic*; and,
- *Education*.

In the case of *entertainment*, Pine and Gilmore refer to the reception of the experience: whether the activity was engaging, and whether it compelled anticipated emotive responses (be that enjoyment, laughter, or terror, depending on the circumstances). Jokes, games, and live performance are all familiar examples of *entertainment*\(^{115}\). The authors consider it foundational, in that the other realms will all feature “at least momentary entertainment”\(^{116}\).

An *escapist* experience is one which aims to immerse through active participation, and the focus here is often on making, rather than consuming. However, in order to be rewarding, the activity cannot be confusing\(^{117}\), and this should be balanced with creating a challenge for participants, one that keeps their abilities in mind\(^{118}\). Relevant examples include video and tabletop games, as well as hypertext fiction, where players mould the world and story through their participation.

For Pine and Gilmore, in the *esthetic* experience, there may be little or no interactive role, but value is provided through an enriching, static environment. This is the case, for example, in the passive reception of an artwork at a museum, or through the observation of a natural wonder, such as the aurora.

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114 *The Experience Economy* has been criticised for not acknowledging fields, such as tourism and leisure, that have well-established insights on the topic; for ignoring the value of efficiency in separating experiences and services; and for demonstrating examples and relationships that are based on anecdotal evidence, which fails to build a theoretical foundation.


116 Ibid.


Finally, education refers to pedagogy. Citing numerous examples, the authors show that learning becomes more desirable through an environment with enjoyable participation\textsuperscript{119}. This has been similarly observed elsewhere, alongside the assertion that enjoyment enhances knowledge retention\textsuperscript{120}.

To describe these in simple terms, entertainment is how the experience was received; escapist refers to the quality of active participation; esthetic is the value in the passive environment; and education is the act of learning. Pine and Gilmore claim that “the richest experiences encompass aspects of all four realms”\textsuperscript{121}.

The following discussion will explore how each of my works relate to these experiential realms, both in terms of elements that hindered the facilitation of a meaningful experience, as well as those that enhanced it. Though I am able to draw on the two terminologies surveyed in each of my works, enjoyment and satisfaction, this discussion also intends to reveal additional qualities that may be relevant to the research question.

In the portfolio, the clearest factor leading to an improvement of the entertainment experience was a shift from a Web-environment to a concert-environment. The ability of HyperCello to engage its crowd, and the laughter and tension that emerged through the process, strongly contrasted with CrowdComp’s failings. This aspect continued to improve with adjustments and experience across the portfolio, a development which was clearly indicated by the increasingly positive response to enjoyment shown in surveys. It was evident that the source of this change lay with the human components of the concert-environment, namely the moderator and instrumentalists. My sense was that these were felt to be more relatable than their Web-environment counterparts, and thus, more engaging. Similarly, they appeared to be more successful than the controllers in ElectroQuiz. In addition to these human components, the shared experience of the concert-environment also seemed to enhance entertainment, as reactions were buoyed by the communal atmosphere.

The convoluted and uninviting digital interface of CrowdComp alienated participants from the activity, consequently leading to a neglect of the escapist experience. By contrast, the live qualities of the three concert-environment works were more transparent – both in terms of interactivity and comprehension – and so led to deeper immersion. This also resulted in improvements to the esthetic experience, with participants noting that the informality and collaboration of crowd-composing in the concert hall was a unique experience, a welcome departure from the conventional

\textsuperscript{121} Pine and Gilmore, The Experience Economy, Updated Edition, 56.
concert setting. This novelty is likely to have supported a more meaningful experience. However, in spite of these observations, I do not mean to suggest that a Web-environment is inadvisable. Rather, I believe that these outcomes indicate that my skillset and ideas were more suitable for facilitating meaningful experiences in a concert-environment.

Another factor was the balance of agency, and this was a multifaceted issue. For instance, CrowdComp and HyperCello both offered a surplus of choice that led to participants feeling overwhelmed. At the same time, the note-by-note polls were unintelligible and dominated by predeterminations, conversely leading to a creatively restricted experience. This was received negatively, and the response was likely compounded by the fact that the nature of these systems meant that only a small amount of music was completed within the workshops, meaning that there was little reward for their efforts. Whilst these issues affected transparency and immersion, and therefore the escapist experience, the note-by-note polls were also found to be overly repetitive and tedious. This led to an inability to engage the crowd, and therefore, the entertainment experience also suffered.

The case was similar in ElectroQuiz, where the system relied too heavily on volunteered contributions, and so crowd agency was arguably restricted despite the enormous flexibility of the system. Paired with the use of controllers, which were also problematic in comparison with instrumentalists, this issue led to a sense of alienation as the crowd’s role felt superficial. In contrast, poll content enhanced the escapist experience in It Wasn’t All Yellow. The work offered limited choice, but through its more transparent, explicit options, the experience became more immersive as participants felt a stronger influence over the process. Its system also led to a longer, and more developed resultant music, once again adding to the escapist experience. Additionally, variety in the work’s structure and polls were evidently more engaging, further enhancing the entertainment experience.

Crowd cohesion was a regular evaluative measure in my portfolio, and it was found to decline when participants had too much choice (e.g., CrowdComp’s 9-option pitch poll: mean majority – 28%), or when options were indistinct (e.g., the muddled instrumentation options from the first study of ElectroQuiz: mean majority – 39%). Through survey feedback, weak crowd cohesion was shown to be closely tied with dissatisfaction. Therefore, these factors indicated participatory failure when they occurred, revealing themselves as important contributors to the escapist experience in crowd-composition.

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Along with strong crowd cohesion, satisfaction was also achieved by encouraging participants to work together. This was primarily realised through the introduction of a composition objective, which guided collective decision-making, producing satisfaction through cooperation, as well as through completion of the goal. This also supported other areas of meaningfulness, in that I found a cooperative disposition led to a more relaxed, conversational atmosphere, which amplified emotive responses (particularly laughter), in turn improving responses to enjoyment in surveys, thus improving the *entertainment* experience. In addition, the *esthetic* experience was improved as the environment was enriched through this elevated engagement.

Just as *entertainment* improves the *esthetic* experience, Pine and Gilmore argue that it also improves the *education* experience\(^{123}\).

Responses from workshops where learning was surveyed indicated numerous pedagogical acknowledgements, both in broad terms, as well as by identifying specific musical lessons. Musical notation, terminology, and compositional and technological tools, were all noted. However, my data contains limited evidence on this matter. Whilst *It Wasn’t All Yellow* and *ElectroQuiz* achieved high levels of engagement and received many responses relating to pedagogy, this aspect was not questioned in other works with less successful engagement, and therefore a definitive relationship between *entertainment* and *education* in crowd-composition cannot be demonstrated. Additionally, the suitability of my works as learning environments is also unclear, as a focus on other experiential realms meant that a more rigorous model for evaluating pedagogy was not implemented. As a teacher, my suspicion was that they allowed only for superficial lessons. This was because many responses were quite generalised, and those that were not frequently referenced terminology – a lesson comprising an already familiar language. A simple explanation for this is that my works were not geared towards pedagogy. However, another factor may be that the artificiality of the systems was too inflexible, leaving little room for an explorative capacity that has been shown to be invaluable for musical learning\(^{124}\). This would be a fundamental issue if pedagogy was the primary focus, as a more accommodating system would require a major overhaul to how crowd-composition was approached in my works.

Ultimately, *education* did have some part to play, and bespoke research could lead to this experiential realm having a more significant role in the future.

\(^{123}\) Pine and Gilmore, *The Experience Economy, Updated Edition*, 49.

Chapter 6

To summarise the extent of meaningful experiences in my portfolio, Table 50 provides an itemised comparison between CrowdComp and It Wasn’t All Yellow: two works that exhibited analogous, but highly contrasting, results.

The portfolio methodology centred on terminologies relating to engagement: enjoyment and satisfaction. This discussion has led to a deeper understanding of the role these had as experiential qualities. In addition, it has been indicated that others emerged as important to facilitating meaningful experiences in crowd-composition. Most notably, these were: novelty and immersion.

To summarise, analysis showed that these qualities were realised, making crowd-composition most meaningful, when experiences were cooperative and accessible, and when they paired with consequential, decisive decision-making.

6.2 How can crowd-composition lead to musical works or perspectives that are distinct from sole agent composition?

To come to an understanding of the qualities of collective composition that are distinct from sole authored composition, it is useful to compare my portfolio to fields with similar aesthetics.

One such field is aleatoric music, in which a composer makes key decisions, but many elements of the composition are left to chance, or some other form of indeterminacy. This relates to the portfolio, as I too establish structural conditions within which compositional decisions are then entrusted to mechanisms outside of my control. Aleatoric music has several forms, one of which includes the use of random procedures to produce a fixed score\textsuperscript{125}. This is the case with Music of Changes by John Cage (1951), where random number generation was used to determine various parameters relating to musical language, ultimately producing a fixed piano score\textsuperscript{126}.

Audiences have been known to be “disconcerted... by (Cage’s) unconventional... musical works arrived at by chance operations”\textsuperscript{127}, perhaps opposing their ostensibly impersonal nature, where conventional notions of artistry are superseded by indeterminacy. Comparable reactions translated in an interesting way to the indeterminacy of my own works. As stated in the preceding chapter,


Table 50 – ‘CrowdComp’ and ‘It Wasn’t All Yellow’ comparison, meaningful experiences.

<table>
<thead>
<tr>
<th>CrowdComp</th>
<th>It Wasn’t All Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entertainment</strong></td>
<td></td>
</tr>
<tr>
<td>Web-environment: remote-located,</td>
<td>Concert-environment: shared experience, real-time,</td>
</tr>
<tr>
<td>asynchronous, computer-rendered music</td>
<td>live components (such as instrumentalists and moderator)</td>
</tr>
<tr>
<td>Engagement (particularly participant turnout)</td>
<td>failed, little emotional investment</td>
</tr>
<tr>
<td>Uniform note-by-note poll system</td>
<td>Varied structure</td>
</tr>
<tr>
<td>Repetitive and tedious</td>
<td>Enjoyable</td>
</tr>
<tr>
<td><strong>Escapist</strong></td>
<td></td>
</tr>
<tr>
<td>Convoluted and uninviting user interface</td>
<td>User interface (staging) was simpler, live components</td>
</tr>
<tr>
<td>Participation was laborious and confusing</td>
<td>produced a tangible interactivity</td>
</tr>
<tr>
<td>A notational focus led to a surplus of choice,</td>
<td>Limited, but diverse, option selection. Decisions were</td>
</tr>
<tr>
<td>unintelligible options, contrived agency, and</td>
<td>more significant, and led to a more substantial</td>
</tr>
<tr>
<td>little resultant music</td>
<td>resultant music</td>
</tr>
<tr>
<td>The creative process was both overwhelming</td>
<td>Process was immersive</td>
</tr>
<tr>
<td>and creatively stifling</td>
<td></td>
</tr>
<tr>
<td>A surplus of choice – poor crowd cohesion</td>
<td>A reduction of option quantities, and an objective to</td>
</tr>
<tr>
<td></td>
<td>filter decision-making and facilitate cooperation –</td>
</tr>
<tr>
<td></td>
<td>strong crowd cohesion</td>
</tr>
<tr>
<td>Unsatisfying</td>
<td>Satisfying</td>
</tr>
<tr>
<td><strong>Esthetic</strong></td>
<td></td>
</tr>
<tr>
<td>Inadequate utilisation of a Web-environment</td>
<td>Contrasted with conventional concert-based experiences</td>
</tr>
<tr>
<td></td>
<td>Ineffective</td>
</tr>
<tr>
<td></td>
<td>Novel</td>
</tr>
</tbody>
</table>
throughout my portfolio the crowd were drawn to impactful decision-making, an umbrella term for a host of decisions, including:

- Fast tempo options – which were selected in each ElectroQuiz workshop.
- A preference for shorter notes and animated fragments, at times to the point of unplayability – e.g. It Wasn’t All Yellow, Figure 46, bar 3, guitar material chosen in additions.
- Out-of-key options – e.g. It Wasn’t All Yellow, Figure 46, bar 1, clarinet, Eb chosen in ‘BYOM: bits’.
- Humorous options – e.g. HyperCello, Figure 30, erotic – reggae, selected as rules to govern the cellist’s improvisation.

Evaluation suggested that this was in part fuelled by what was felt as a contradiction between the anticipated experience of a creative pursuit (practical and artistic) and the reality of the participants’ involvement (impersonal and restricted). Participants sought to counter the detached nature of their voting role by making these impactful decisions. This highlights a difference to Cage’s algorithmic mechanism: a human element can be driven by opinion, emotive response, and other influential stimuli. However, aleatoric music comes in other forms, one of which is the mobile form. Here, chance elements are deferred to a musician within a performance. This is the case in Klavierstück XI by Karlheinz Stockhausen (1957), which includes 19 notated fragments to be performed in a sequence determined by a pianist. As with my own project, mobile form also utilises a human element.

However, a distinction can be made here too, one which is relevant to the research question, as I have found there to be a difference between a sole and collective mechanism for indeterminacy. Throughout my portfolio, I have noted several occasions where decision-making was subject to a kind of herd mentality, particularly where ‘naughty’ decisions were frequently chosen by strong majorities. My sense is that this was a product of the crowd’s anonymity, which has been shown to weaken personal controls, and at times lead to anti-social behaviour. This kind of decision-making was risk-free because their choice could not be attached to the data, nor could their name be attached to the musical result. This is certainly one explanation for the crowd humour that Henri Simula has observed – pranks that crowds play on companies that use polls to leverage ideas or opinions. One example of this is seen in the #NameOurShip poll by the Natural Environment

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128 Reicher, “The Psychology of Crowd Dynamics,” 188.
129 Simula, “The Rise and Fall of Crowdsourcing?,” 2787.
Research Council (2016), where a Royal Research Ship was voted to be named Boaty McBoatface. An additional factor of herd mentality that may have applied is the phenomenon through which “prior ratings (create) significant bias in individual rating behaviour, and positive and negative social influences (create) asymmetric herding effects.” Translated to the portfolio, it was clear that one naughty decision increased the likelihood of another. Laughter was seemingly the strongest factor here, forming both an indication of approval ratings, as well as a positive social influence.

An example is seen in the first study of It Wasn’t All Yellow. Of the recorded voting data, I have deemed to be naughty the following options:

- Inappropriate time signatures and unplayable materials in ‘additions’;
- Out-of-key pitches in ‘BYOM: bits’;
- Humorous contributions in ‘character’;
- The navigational choice to select ‘operator control’, which was known to the crowd to be the most anarchistic option.

Firstly, the mean majority strength for naughty decisions was 64.7%, whereas for others it was 53%. This indicates a tendency for cohesion around crowd humour, in line with the herd mentality observed above. Secondly, Figure 7 shows that the frequency of naughty decisions increased over the course of the workshop.

![Figure 7 – ‘It Wasn’t All Yellow’ [first study] “naughty” decisions.](image)

Klavierstück XI also highlights a second distinction between collective and sole authored composition.

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Due to the difficulty of the work, some musicians premeditate their indeterminate agency, creating a fixed score prior to a performance (such as Pierre-Laurent Aimard’s performance at Alte Oper in 2016). Here, the sole agent is able to observe in totality the series of tasks that lead to the resultant material. This means they can consider how decisions relate to one another, approach tasks in any order, and revise previously made decisions.

At the beginning of this portfolio I utilised note-by-note systems, an approach that aimed to mimic the creative process of a sole agent. Therefore, works that made use of this – CrowdComp, HyperCello, and the first iteration of It Wasn’t All Yellow – were built with an assumed expectation of the elevated and open perspective described above. However, my systems did not allow for this, in that they forced the crowd to tackle a predetermined sequence of tasks, with a limited awareness of what follows. This produced a narrow frame of reference that is cognitively distinct to the way in which a sole agent works. The effect of this was shown most clearly in CrowdComp, during which several participants intimated that their perspective was restricted to the present poll and its relation to the result of the previous one, without a thought for what could follow or how the melody in its entirety should be shaped. As a result, my initial systems were underutilised and unable to be interacted with as intended. It is likely that this was a major factor in the dissatisfaction shown by the survey data. Of course, this effect emerged not from the collective, but from the system, and as such the case would be similar if interacted with by a sole agent.

However, these structural conditions that led to narrowly framed decision-making may be an inherent property of crowd-composition, as they were necessary for leveraging collective opinion. Therefore, this may be an important aspect of crowd-composition to consider in future projects, which could be more successful if they adapted to the narrow frame of reference.

For example the second study of It Wasn’t All Yellow utilised tools that may have offset this issue. Firstly, in comparison with previous works, its system required fewer decisions to be made. This may have been more suitable as the overall view of the process was less broad. Secondly, there was a clarity between its contrasting transformations, making it easier to visualise options and changes across the creative process. Finally, the introduction of a composition objective restricted decision-making to an adjudication of whether options suited that goal, thus providing a framework within which narrowly framed decisions led to some measure of compositional coherence. These features were likely a strong factor in producing a highly successful satisfaction rating in the final performance of It Wasn’t All Yellow.

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Alongside aleatoric music, a second potentially useful field to compare the portfolio with is relational art – described in *Relational Aesthetics* (1998), by Nicolas Bourriaud, as a movement towards art that facilitated social, shared experiences. This, he found, emphasised the capacity of art to be interactive and elicit discussion.

The practice of artists who identify with Bourriaud’s vision of relational art relies on unique, interpersonal interactions, and as such utilises an open-ended medium, where process is more important than outcome. Take for instance *Untitled (FREE)* by Rirkrit Tiravanija (1992). Here, the artist converted a gallery into a kitchen, cooking and serving rice and Thai curry to patrons. Tiravanija’s intention was for his art to be realised through the experiences and conversation that this democratised environment stimulated. Bourriaud defines relational art as:

> A set of artistic practice which take as their theoretical and practical point of departure the whole of human relations and their social context, rather than an independent and private space.

The sense of community and interactivity in relational art, its interplay between artist and audience, and its emphasis on an open-ended process over outcome, are all notable similarities to my portfolio.

However, a key difference is that whilst relational art is similarly indeterminate, the role of author in the portfolio was more authoritative, the aesthetic more formulaic, and outcomes more fixed. Though this rigidity cannot capture the same spontaneity and sociability of relational art, the portfolio’s approach of leveraging collective opinion creates an opportunity for the crowd to form a cohesive whole. It is through this capacity that further distinctions between sole authored and collective composition can be identified.

Firstly, crowd-composition is a platform for an artistry that many within the collective may not be able to engage with independently. Notation, instrumentation and the use of DAWs are examples of tools that my works utilised, but are inaccessible to those without training. Therefore, the collective surpasses a sole agent if the abilities of the sole agent in question are lesser than the scope of the crowd-composition system. This brings to mind James Surowiecki’s notion that the opinion of a diverse collective can better that of an individual expert. I have found that this does not entirely translate to my approach, partly because the necessary artificiality of my works

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133 Rebecca Stokes, “Rirkrit Tiravanija: Cooking Up an Art Experience,” INSIDE/OUT, MoMA, February 3, 2012, [https://www.moma.org/explore/inside_out/2012/02/03/rirkrit-tiravanija-cooking-up-an-art-experience/](https://www.moma.org/explore/inside_out/2012/02/03/rirkrit-tiravanija-cooking-up-an-art-experience/).
suppressed any potential for novel musical outcomes, and also because music is a subject far more ineffable than any of the fact-based examples given by Surowiecki. However, as crowd-composition can empower those without training, it is clear that another distinction lies with its capacity to elevate the ability of the collective above that of inexperienced sole agents.

Secondly, crowd-composition results in a collectively-determined music, the function of which can be entirely different to that of a sole authored music. This stems from the sense of authorship amongst the crowd that emerged through a heightened level of engagement, as it did in the final performance of *It Wasn’t All Yellow*: the sense that participants liked, and felt responsible for, the resultant music. To understand this, it is worth considering the technology Bronze. Bronze hopes to “revolutionise music playback, (by) enabling artists to release non-static, generative, augmented music”\(^{136}\). One of its functions is to reconstitute a fixed music into any number of context-based or time-related themes – such as “workout” or “summer” – reflecting modern listening habits\(^{137}\). This presents an entirely new paradigm for artists to compose for their audiences. It is one example of how music is evolving in the digital age, as consumption shifts to an experience-based economy where “goods and services are no longer enough”\(^{138}\), providing some context for the kind of role that crowd-composition could play in the future. Though a crowd-composed music may be worthless to anyone else, through a sense of authorship, it has value to those that produced it. This is another distinction between collective and sole authored composition: crowd-composition has potential for novel (and commercial) applications by facilitating unique relationships between audience and music.

In summary, this reflection identified six distinctions between a sole authored and collective compositional process. Four relate to aspects of crowd behaviour – that the collective is subject to distinct, interactive behaviours:

1. The crowd can be drawn to impactful decision-making;
2. The crowd is likely to exhibit crowd humour;
3. The crowd can be driven by herd mentality; and,
4. The crowd’s frame of reference when composing is generally narrow.

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In the case of the last point, however, though this may be common to crowd-composition, it is more a product of the system than of the collective. Therefore, this may no longer be relevant if future systems are constructed differently.

The final two distinctions are as follows:

5. The crowd’s ability can surpass that of a sole author, if the sole author in question is unable to interact individually with the tools that the crowd-composition system utilises.

6. As creative contributors, contrasting with conventional music consumption, members of the crowd have a unique relationship with a composition.
Chapter 7  Conclusion

7.1  The journey

In the first phase of my research I explored examples of internet music, where networks form the medium within which a musical project is undertaken. Informed by the literature, I identified three fundamental categories of internet music:

1. *Networked environments for experts to engage with performance and compositional practice;*
2. *Networked environments where participants influence the creativity of experts;*
3. *Networked environments where communities become central components of a creative process.*

Observing that the third category strongly related to collaborative models seen in crowdsourcing, I chose this as the subject of my doctoral project because it was a burgeoning and relatively unexplored field that suited my personal assets. Subsequently, I reviewed works that included community participation in order to seek models that best utilised the potential of a networked group dynamic. I coined the term crowd agency to evaluate the level of creative control participants had within relevant works. My study of *Crowdsound* by Brendon Ferris (2015-17) was particularly illuminating, with its use of polling to leverage a collectively-determined composition. It was in *Crowdsound* that I saw the greatest potential for high crowd agency and so decided to focus my compositional efforts on Ferris’ model, though I was also able to learn techniques and approaches from related innovative projects.

In preceding work, I produced an overview of crowdsourcing initiatives in order to better understand this approach. Through this research, I came to recognise *Crowdsound* as a model which utilised crowdvoting and I began to refer to this approach as crowd-composition.

Building on this initial research, I designed four original crowd-composition works. *CrowdComp, HyperCello, It Wasn’t All Yellow* and *ElectroQuiz* represent four stages of my pursuit for a model that would best harness the crowd – both in terms of the quality of their interaction, and in the music that that interaction produced. Through the lens of evaluative features outlined in Chapter 5’s methodology, each successive work was examined using voting and survey data, anecdotal evidence from performers and participants alike, as well as reflections on the musical results. Based on this information, I was able to experiment with and assess various techniques and conditions.
Consequently, my portfolio led to a number of discoveries on the effectiveness of particular elements, which are relevant to crowd-composing within a concert-environment.

These findings, a fundamental aspect of my project’s contribution to the field, are presented in the following section.

7.2 Sharing the lessons learned

The first portion of this section relates to the construction of polls and system structure.

In CrowdComp, I facilitated a work in which the crowd gradually constructed a melody, note by note, through a succession of polls. I now see this approach as flawed, largely because it was difficult for participants to distinguish between pitch options and calculate the effect those options would have on the evolving melody. This issue persisted even when I provided assistance, and was still the case when participants were trained musicians. However, I am sure there is potential for the specifics of such an approach to be improved. For instance, a note-by-note system with clearer, more explicit options, may be better suited; such as contrasting percussive notes, as opposed to scalar pitch options. Hoping that this idea would lead to more calculable polls, this particular example was trialled in HyperCello. However, though I felt at the time that the percussive polls, in contrast with scalar variants also presented in the workshop, produced a more positive response, there was no conclusive evidence. Ultimately, I decided to move away from note-by-note polls, and so did not explore this idea any further.

Following critical reflection, I came to view three fundamental problems with the note-by-note approach. Firstly, because of the comprehension issues discussed above, I was not convinced that this was the best approach for harnessing crowd agency. Secondly, the approach is very slow, which makes it hard to sustain participant engagement; it necessitates repetitive polling, where the same question can be asked well past the point of boredom. Finally, this slowness meant that only a small amount of material could be produced in a workshop, and I found this to be ineffectual in creating a meaningful experience for participants.

I also learned that crowd-composition benefits greatly from a varied system. Crowds are likely to lose interest if they are not confronted with new perspectives and challenges. Variety can be applied to poll content, for example, by offering a different assortment of options to the same question. Structural variety can be found in asking a range of questions with diverse purposes, as well as in utilising different participatory mechanisms. This can be achieved by including volunteered contributions, which has the additional benefit of enhancing crowd agency by expanding creative potential beyond that of the work’s predetermined system. Notably, I learned
that a particularly effective tool is to allow for moments where verbal contributions from the crowd, *en masse*, generate poll content that is later voted on. Relative to inviting individuals to contribute to a musical material, this example is both more engaging, and results in a material more representative of collective opinion.

Crowd-composing in a concert-environment combines creative and performance practices. Creative in the sense that an experimental process is undertaken that engages the critical and decision-making abilities of individuals in a group; and performance in that, within a fixed timeframe, a constructed experience is delivered that is intended to be entertaining. Whilst there is a degree of overlap between these two paradigms (e.g. creative pursuits may also feature a performative aspect), the motivation and emphasis is different, and this resulted in a tension at times in the portfolio. For instance, in accord with conventional artistic motivations, I wanted each work to have an impactful ending – a culminating moment that brings a sense of closure, clarity and fulfilment. However, there is a risk that this urge will clash with the creative nature of the work, as a creative pursuit is not likely to bring about such thrilling moments or satisfying resolutions. In the worst case, such a device may trivialise preceding decisions and therefore negate central aspects of the experience that make it meaningful. I have found that these concerns must be balanced, and that one particularly effective strategy is to leave the most transformative decisions until last. That being said, not all authors will relate to this concern.

The next section relates to supporting the notion that crowd and creative process are interdependent.

Crowdvoting can be an impassive tool, making it a mechanism for creativity that participants find unstimulating, which affects both engagement and musical results. Over the course of this portfolio, I explored various conditions to offset this issue, aiming to create an environment where participants were engaged and sensed that their contributions had value.

The first of these is that strong crowd cohesion must be facilitated. If majority strength – the percentage of votes that selected the winning option – is continually weak, then the bulk of participants will feel ineffective. Not only will this alienate individuals from the process, it will also inevitably produce an ingenuine musical result, as determinations will be less representative of collective opinion. I aimed for my workshops to have a mean overall majority strength of 50% or more, as this would indicate that the musical result reflected the opinion of a majority proportion of the crowd. Whilst the commentary has noted issues with this approach, I found it a useful goal nonetheless. I learned two main ways to achieve this:
Chapter 7

1. Restrict option quantities. As option quantity increases, so too does the diffusion of votes. I found success in 3-option polls, which frequently attained mean majorities of 60%. I did see potential in utilising 2-option polls, which guarantee a minimum of 50% majority strength by way of theoretical probability. However, I feared that if used too frequently, they would become counterproductive to facilitating interdependency, as their limited choice may be perceived negatively. In addition, the differential majority of 2-option polls tended to be lesser than that of 3-option polls, which is an outcome that potentially supports 3-option polls, though this is in need of further study.

2. Introduce a composition objective, such as an invitation for participants to make thematic decisions about their composition. This provided a criterion against which options could be appraised, strengthening crowd cohesion by uniting participants around associated options. A composition objective also helped in other ways. It produced a more congruent resultant music by guiding decision-making that was otherwise likely to be disordered without this filter. In turn, fulfilment of the composition objective was satisfying for participants, which further supported interdependency. Finally, a composition objective appeared to foster a more cooperative environment, whereas previously participants were more competitive and individualistic. A cooperative atmosphere created opportunities for humour, conversation and creative collaboration, which were all beneficial to the process.

The second is that the system must be transparent. This point echoes guidance in the literature, however, the interpretations below are relevant to this specific model:

1. Do not conceal the system’s mechanisms. The following lessons served to make explicit the role the crowd had within the process.

   • Display the ensuing voting data following each poll;
   • Visibly perform the resolution of multiple majorities;
   • To assist comprehension, demonstrate and showcase poll options and resultant changes.
2. Utilise human elements in the performance space, as these embody a more tangible, familiar backdrop. Additionally, as with the use of verbal contributions, these created more opportunities for humour, conversation and creative collaboration.

- In terms of materialising a crowd-composed music, live instrumentalists were found to be more effective than controllers;
- Contrasting with an automated process, the use of a moderator to lead a workshop was also more effective.

### 7.3 The moderator role

As part of this conclusion, one element of the research I wanted to address is that of moderation, and how central it is to my portfolio.

Though somewhat understated up to this point, the moderator role represents a significant personal journey within the project. Although my initial approach to moderation, as described in the *HyperCello* commentary, was more discreet, I quickly found that my natural proclivities led me to enact the role in a more animated and directorial manner. However, I sensed some tension and discomfort in myself during this first experience, as well as a need to improve my ability to engage an audience. Therefore, during the 2016-17 academic year, I underwent public speaking training. Working with an online tutor, together we identified two elements of my personality that should be emphasised when moderating: conversation and humour. In addition, we identified causes of my public speaking anxiety, which also served to obstruct the aforementioned personality traits: scripting and excessive preparation. This tuition involved finding opportunities to speak wherever I could. I delivered presentations to friends, seminars in the university, and spoke at youth music concerts in my capacity as a tutor for the SMS. I even sang karaoke! I believe that the effect of this training is clear from my growing confidence with the moderator role as the portfolio progressed, as seen in the accompanying video footage.

With this in mind, the portfolio developed alongside my moderating ability, and as my confidence with moderating grew, so too did its role within the crowd-composition experience. The structure, tone and materials of later workshops were built around my personality. My sense is that these elements would not translate well if others took on the role, and therefore the works are arguably diminished by my absence. Furthermore, their systems became increasingly complex, requiring an understanding and skillset that might make moderation less feasible for some. In particular, whilst the *ElectroQuiz* workshop performance pack is comprehensive, I consider it to be largely hypothetical, as I am not certain that others could learn and deliver the probabilistic engine due to
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its scale. Even I struggled with this aspect at times, and revisions to the works often involved simplifying ideas to accommodate moderation.

It is also interesting to note the ways in which I held an unconscious influence over proceedings. Building on what I had learned from the training, my approach to moderation involved bulleting key structural points, and allowing for freedom and dialogue between these moments. This helped me to express myself and, by extension, best deliver the moderator role in the workshops. However, whilst this led to experiential benefits, such as the informality and authenticity of the workshops that are discussed in Chapter 6, it also involved unforeseen consequences. For instance, there were times where I jokingly pointed out a certain type of option that had received little attention and I would then find that that same option would garner more votes in the next poll. In addition, my personal preferences occasionally led to an increased enthusiasm when introducing options, and participants noted in discussion that this made certain options more attractive. My approach to moderation made it difficult to remove such influences, and they likely played a part in shaping the experience and outcomes, which reinforces the notion that I was inextricably linked to the portfolio.

Despite this conclusion, I believe there is room for the works to be treated as blueprints, which would perhaps enable broader use. Others may consider, for example, replacing the rhythmic notes and scale used in HyperCello, or the source material of It Wasn’t All Yellow. Similarly, time constraints could be reintroduced, crowds could be separated into groups to generate competition, the workshop process could be drawn out to make time for discussion between polls, etc. In short, a moderator with a different background and personality would create a unique participatory experience, and this may lead to distinct outcomes to evaluate.

7.4 Final words

I was drawn to crowd-composition because it is an innovative model, one that has emerged primarily through the cultural impact and affordances of modern technologies. In addition, though it is an experimental practice, it is also highly relevant in broader terms. As noted previously, crowd-composition appears to be part of a larger movement, where many people are seeking more critical or creative roles in the media they consume. Therefore, this research has fascinated me as I have been able to investigate the potential of a burgeoning philosophy, particularly as it pertains to the outcomes of my specific approach.

One of these outcomes has been the facilitation of meaningful experiences. My research has been able to show that participants can be engaged through enjoyment in the process and satisfaction
with their creation; immersed through a novel and authentic experience; and be fulfilled through the accomplishment of an unfamiliar challenge, and the knowledge learned through that task. Most significant for me is the capacity crowd-composition has to elicit emotional responses. The laughter, tension and competition that emerged in my workshops far surpassed my initial expectations.

Alongside the entertaining and educational properties of crowd-composition, my research also indicated that it can broaden the capacity of artistic pursuits. Chapter 6 identified two advantages of collective creativity over more conventional, sole authored creativity:

- The crowd’s ability can surpass that of a sole author, if the sole author in question is unable to interact individually with the tools that the crowd-composition system utilises.
- As creative contributors, contrasting with conventional music consumption, members of the crowd have a unique relationship with a composition.

In addition, my research has offered insights into crowd behaviour, specifically in regards to the crowd’s decision-making. I have been able to show that the collective can be drawn to impactful decisions, humour and pranking, as well as herd mentalities. These are interesting because they are unique to crowd-composition, further setting it apart from conventional practice.

My research has also revealed some of the limitations of crowd-composition, particularly in terms of my central crowdsourcing mechanism – crowdvoting. For instance, this approach meant that one decision had to be reached before another could be made. This created an additional challenge because the attention of a large group of people had to be managed simultaneously and continuously. Ultimately, these issues meant that my works became heavily steered by formulaic rigidity and predeterminations.

Relating to this was an issue with crowd cohesion. Weak majority strength led to a number of problems, but my solutions – particularly the reduction in option quantities – were an additional factor that led to a loss of creative potential. This outcome conflicted with the agency and freedom that I originally viewed as central to the crowd-composition aesthetic, and it was also at times viewed negatively by participants, who wanted to experience genuine creative control. In theory, the implementation of a less factional system, such as proportional representation, could have negated this issue. However, I chose not to employ this particular example as it would have likely added an unfeasible amount of time to each poll.

Another issue was the inadequacy of crowdvoting in engaging participants. Though engagement eventually became a highly successful element of my works, the impassivity and slow tempo of
Crowd voting made engagement a fundamental issue throughout my journey. The act of voting was not a satisfying mechanism for participants, and without peripheral features – namely, the use of human elements in the form of the instrumentalists and moderator – engagement failed. I have also suggested that this issue was the main culprit of the three crowd behaviours mentioned previously. Of course, as distinct qualities of collective creativity, these behaviours are not necessarily negative. However, when recurrent, they diminish the creative potential of crowd-composition. This was one of my criticisms of ElectroQuiz, in that, within a system that had the potential for enormous musical variety, three performances resulted in largely similar materials.

To conclude, I maintain there is significant potential in crowd-composition, particularly in creating meaningful experiences. However, its capacity as a creative tool has been shown to be more limited. Future research could explore this further by experimenting with alternative mechanisms for leveraging collective opinion, ones that would support more flexible and open systems. This may lead to systems where the input of authors, such as myself, imposes less on the resultant music. Such revisions may better unlock creative potential, and therefore perhaps come closer to realising Surowiecki’s “wisdom of the crowds”.
Appendix A  CrowdSequencer

*CrowdSequencer* was a fifth crowd-composition work produced over the course of this doctoral project, and was initially intended to be included in the portfolio. This appendix will provide a brief summary of the work, and outline why it was omitted.

The work was made in collaboration with post-graduate student Maria Petriti, and was submitted as part of their MSc Web Technology thesis[^139]. It was a Web-environment work, launched on [http://crowdsequencer.herokuapp.com/](http://crowdsequencer.herokuapp.com/) in August, 2018. The site remains live, though it was monitored closely for only 14 days.

*CrowdSequencer* represented a significant departure from the voting system used in previous works. Instead of polling items one by one, participants had access to a number of voting opportunities at any given time. Participants voted by choosing to upvote or downvote options, a mechanism which was conveyed through thumb signal metaphors, as can be seen in Figure 73. Upvoting would generate a +1 score for the option, strengthening its position, whilst downvoting led to a -1 score. Where applicable, the option with the highest score specified the crowd’s collective determination. If an option was downvoted to a score of -3, it was then deleted.

![Figure 73 – ‘CrowdSequencer’ voting mechanism.](image)

Three modules contributed to the music of *CrowdSequencer*:

1. Title – participants determined the title of the work.

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Appendix A

This module polled contributions from participants, who were free to write anything as a title option.

2. **Tempo** – participants determined the tempo of the work.

3. **Composition** – participants contributed to, and voted on, notes in a grid that generated the musical material of the work.
The composition grid allowed participants to add notes, as well as vote on the contributions of others. This took inspiration from the mix of crowd creation and crowdvoting seen in *SwarmSketch* by Peter Edmunds, which we hoped would enhance engagement in the work, as it ensured that participants were always involved. This was a reaction to an issue with previous works, where participants felt left out when their choices were rarely in the majority.

The grid mimics the design of a step sequencer, which is a device that divides bars into equal time-intervals, and allows users to manually enter notes into a repeating sequence without the need to play them in. Participants were able to place notes across a chromatic range of pitch options, test how they would sound within the material before submitting, and set the value of the note.

Unfortunately, the work met with problems that led to it being somewhat unsuccessful. Firstly, recruitment was unsatisfactory. This took place as an open call, largely on social media platforms, and our efforts failed to entice many to interact with the work. Secondly, those that did participate were reluctant to return, and so participant turnout was poor. By the fourth day, only a handful were visiting the site, as can be seen in *Figure 77*:

![Figure 76 – ‘CrowdSequencer’ composition grid.](image)
Finally, our voting mechanism was also problematic, as it strongly favoured the earliest contributions. Additionally, participants appeared to be unwilling to downvote. This meant that no deletions occurred, and so the grid became progressively fuller, without any revisions taking place.

Due to the nature of my collaboration with Maria, who completed \textit{CrowdSequencer} at the end of her studies in Southampton, we were unable to address these issues and produce a revised version of the work. Therefore, I concluded that \textit{CrowdSequencer} was not strong enough to include in my portfolio.

![Figure 77 – ‘CrowdSequencer’ participant retention.](image)
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