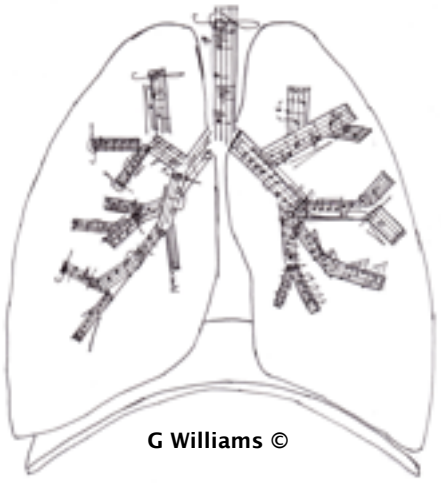
Evaluation of Breath Cycle

Scottish Opera and Gartnavel General Hospital Cystic Fibrosis Service



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Abbreviations

ABRSM	Associated Board of the Royal Schools of Music
ACB	Active Cycle of Breathing
AD	Autogenic Drainage
CF	Cystic fibrosis
DA	Discourse Analysis
GGH	Gartnavel General Hospital
GGHCFS	Gartnavel General Hospital Cystic Fibrosis Service
NHS	National Health Service
RCS	Royal Conservatoire of Scotland
RSES	Rosenberg Self-Esteem Scale
SO	Scottish Opera

Abstract

Although research involving medical advances for CF has been prevalent since the 1930s, there has been very little research to date that has explored the non-medical treatments of the disease. Research shows that the use of non-medical treatments, such as music, have been used either as an alternative or as an adjunct to conventional treatments depending on the condition, and that there is a growing interest in the health benefits of singing for both physiological and psychological wellbeing using both clinical and non-clinical models. The current study explores the impact of a 12 week singing-based project on the psychological wellbeing and musical identity of people with cystic fibrosis (CF). Results show that participants made significant gains in musical development and also reported an increased sense of wellbeing as a result of taking part. There were no significant results found for measures of self-esteem.

To date, many studies in this area have been exploratory in nature. The research thus far has served to offer a number of possible models to employ in future studies but a more refined understanding of the use of singing in therapeutic settings is necessary to develop more coherent mechanisms by which to measure the effects.

1. Research Context

1.1 Overview of the Study

Breath Cycle is a joint project between *Scottish Opera Education* and *Gartnavel General Hospital Cystic Fibrosis Service* (NHS Greater Glasgow and Clyde), and was conceived by Dr Gareth Williams and David Brock. Research and evaluation of the project is being addressed through both the medical and social sciences and conducted by Dr Gordon MacGregor (*Gartnavel General Hospital Cystic Fibrosis Service,* henceforth known as GGHCFS) and Dr Rachel Drury (*Scottish Opera,* henceforth known as SO) respectively.

The project involves patients with cystic fibrosis engaging with a 12 week intervention of fortnightly face-to-face singing lessons from a professional opera singer and repetiteur (accompanist) from SO, and on-line lessons and feedback in the intervening weeks. During this period, a song (music and lyrics) is written for the participants which is learned and recorded (using both audio and visual technology) at the end of the 12 week intervention. As people with cystic fibrosis cannot be in the same room as one another due to cross-infection, the individual parts in the songs are recorded and then digitally mixed to produce a collaborative performance involving all participants.

The project is funded by the *Wellcome Trust* and *Creative Scotland,* and facilitated by GGHCFS, SO Education staff, and freelance artists employed on behalf of SO for the duration of the project.

1.2 Overview of Cystic Fibrosis

Cystic fibrosis, henceforth referred to as CF, is a genetic condition caused by a faulty gene which controls the movement of sodium and water in and out of the cells in the body. Although the condition was already recognised as being caused by a genetic

defect, the CF gene was not discovered until 1989 (Kerem *et al.*, 1989; Riordan *et al*., 1989; Rommens *et al*., 1989). The disease causes the lungs and digestive system to become clogged with thick, sticky mucus, making it difficult to breathe and digest food. CF is a life shortening disease to which there is currently no cure but developments in medical research and treatments are continually improving the prognosis for those affected. When CF was first identified as being separate from celiac disease in 1938, the life expectancy was around 6 months (Davis, 2006). In the 1960s, a child with born with CF was unlikely to live beyond 5 years of age, however, due to medical advances, the life expectancy of a person living with CF currently stands at around 41 years (Cystic Fibrosis Trust, 2014). The ultimate goal is for a person with CF to have a normal life expectancy. CF is recognised as being the most common inherited disorder in the UK with around one in 25 people carrying the faulty gene. NHS statistics suggest that around one in every 2,500 babies born in the UK will have CF equating to around 9,000 people living with the condition across the country (NHS choices online, 2014). Although cases are seen the world over, CF is much more prevalent among North Europeans and their descendants (Genetic Alliance UK, 2012).

1.2.1 Treatments

There are a variety of treatments available to help manage CF, including physiotherapy, exercise, medication, and nutrition. A person with CF will have a regime of daily chest physiotherapy to keep their chest clear and this can be done individually and with the help of a physiotherapist. In addition to medication, this regime includes a series of controlled breathing and huffing exercises that help move the mucus so that it can be expelled via a cough or huff. The most common methods of chest physiotherapy for CF used in the UK are the Active Cycle of Breathing (ACB), and Autogenic Drainage (AD).

1.2.2 Cross-Infection

Studies by LiPuma *et al*. (1990) and Pegues *et al*., (1994) recognised the serious threat that cross-infection can pose amongst people with CF. Different bacteria, or ‘bugs’, grow in the lungs of those with the condition and, although these are usually harmless to people who do not have CF, they can be harmful to those that do (Cystic Fibrosis Trust,

2014). Much like most common respiratory illnesses, the ‘bugs’ can easily be transmitted from one person to another and, therefore, current research continues to recommend that people with CF should not meet face-to-face or share the same space as one another (Vonberg and Gasteier, 2005).

1.3 Aims of the study

As the data were being collected from 2 different sources, an independent researcher working on behalf of SO and clinicians at GGHCFS, the overarching aims of the study were primarily concerned with any impact on the physical and psychological wellbeing of the participants as a result of vocal tuition. For the purposes of this evaluation, only the aims as agreed by the independent researcher and SO will be reported. These aims are as follows:

1. to assess the impact of vocal training on musical development in patients with CF
2. to assess the impact of vocal training on musical identity, and self-esteem in patients with CF
3. to evaluate the project *Breath Cycle* as a whole (as requested by SO)

This report will include analysis and discussion of all quantitative data collected as part of the agreed Scottish Opera research outline.

2. Methodology

The study aims to further the research finding in the field of vocal tuition for people with cystic fibrosis (CF) using validated and reliable empirical assessment resources, in addition to resources designed for this particular study.

2.1 Outcome Measures

Four areas have been identified for use in the study which have arisen out of the existing research literature on music and CF, in addition to the remit set by *Scottish Opera* (SO). These four areas include:

1. Musical development: to assess the musical and vocal development of participants throughout the 12 week intervention period.
2. Musical identity and listening behaviours: to assess how a people with 'fragile voices' identify with singing and music, and to explore current listening behaviours and engagement with opera
3. Self-esteem: to assess any changes in self-esteem (self-worth) during the intervention
4. Personal evaluation and engagement: to assess the participants' opinions and perceptions of the project in addition to its impact in relation to the 3 areas outlined above

2.2 Methodological Overview

The aim of the study is empirically to examine the effects of specialist-led vocal tuition on the self-esteem, sense of musical identity, and musical development of the participants, and to evaluate the project as whole.

2.2.1 Context

It is important to acknowledge that the researcher made relatively few decisions regarding the design of the study, rather it was dictated by the structure of a project (Breath Cycle) implemented by SO, and the criteria of the study as defined by *Gartnavel General Hospital Cystic Fibrosis Service* (GGHCFS).

The concept of Breath Cycle was devised by Dr Gareth Williams and David Brock and facilitated by SO Education and GGHCFS with support from the *Wellcome Trust* and *Creative Scotland.* As Breath Cycle was a joint project, the anticipated outcomes were diverse and ranged from extracting information regarding the physical and mental wellbeing of participants to the exploration of arts-based practices for working with fragile voices, and a foundation for a larger scale opera.

The project was designed to run over the period of 12 months in 3x 12 week blocks. Each block can accommodate 8 participants (24 in total) who are offered 6 one-to-one lessons on a fortnightly basis and 6 online feedback sessions in the intervening weeks from a professional singer and repetiteur. An original song is written specifically for the participants and a performance of this is recorded (both audio and film) at the end of the 12 weeks. The project relies heavily on technology (iPads; Skype; Google+; iTunes; YouTube) to facilitate the online aspect of the project and thereby minimising the attendance at GGH for the participants over the 12 week period.

2.2.2 Design of the Study

A repeated measures design (within-subjects) was employed where participants were asked to complete pre- and post-intervention assessments (including questionnaires and interviews) concerning the outcome measures summarised in section 2.1. The SO creative team and managerial staff were also invited to take part in a pre- and post-intervention interview.

2.2.3 Analytical Approach - Data Collection and Analysis

The study uses a mixed methods approach employing quantitative (questionnaires and measure of self-esteem) and qualitative (interviews) methods that will be analysed using SigmaPlot statistics software and discourse analysis (DA). All quantitative data will be analysed by Dr Gordon MacGregor using SigmaPlot statistics software. Descriptive statistics and DA will be analysed by Dr Rachel Drury.

2.2.4 Participants

A cluster sample of 24 participants were enrolled in the study in accordance with the following selection criteria as set out by GGHCFS:

Inclusion Criteria:

1. Male or female subjects
2. Age: 16 years of age or older
3. Subjects with CF defined as FEV1 predicted ≥ 20% ≤ 95% with no CF exacerbation for 2 weeks
4. Subjects and/or parents or guardians who are able and willing to give written informed consent.

Exclusion Criteria:

1. Subjects who do not conform to the above inclusion criteria.
2. Female and pregnant or breast feeding, or of childbearing potential who are not using acceptable methods for contraception (reliable contraceptive measures include the following: systemic contraceptive [oral, implant, injections], diaphragm with intravaginal spermicide, cervical cap, intrauterine device, or condom with spermicide).
3. Subjects who have undergone lung transplant surgery.
4. Subjects who have had changes in their CF medication (dose or medication type) in the 2 weeks prior to enrolment.
5. Subjects with any other clinically significant lung disease.

6. Any clinically significant disease or condition that may interfere with the study.
7. Subjects who cannot communicate reliably with the investigator.
8. Subjects who are unlikely to cooperate with the requirements of the study.
9. Subjects who have participated in an investigational study within 30 days prior to signing consent.

(MacGregor, Breath Cycle Protocol 2012)

Out of the 24 participants, there were complete results for 15 (mean age of 30; age range from 16 to 54). This was due to participants either choosing to withdraw from the project or being required to withdraw due to ill health.

Table 1: summary of participant numbers, gender, and mean ages for complete results

	BLOCK 1	BLOCK 2	BLOCK 3	BLOCKS 1-3
N of Females	3	4	3	10
N of Males	2	1	2	5
Total N	5	5	5	15
Mean Age* Test Point 1	31	38	20	30
Mean Age* Test Point 2	31	39	20	30

*Mean ages are rounded to the nearest full year

2.2.5 Music Intervention (vocal tuition)

The music intervention consisted of six 40 minute vocal tuition sessions delivered by a professional opera singer (soprano) and repetiteur on behalf of Scottish Opera. The tuition was typical of classical singing technique and included:

- breathing exercises
- exercises for correcting posture
- classical vocal exercises based on scales and arpeggios
- participants' own choice of song (including pop, folk, and musical theatre)
- specific vocal exercises designed by the composer
- songs written by the composer and librettist

The composer observed a proportion of the sessions to ascertain vocal ranges and styles for the original compositions. Members of the SO *Connect* project also observed some sessions, as did various members of the staff at GGH (consultants and physiotherapists). All participants were issued with an iPad for use during the project which enabled them to record and post video clips of their individual practice sessions and gain feedback from the creative team. It also provided them with the opportunity to communicate with one another via *Google+* (where a community had been set up as part of the project) and *Skype.*

2.2.6 Scottish Opera Creative Team

The SO creative team consisted of a composer, librettist, vocal coach, repetiteur, director, filmmaker, and project manager. In addition to this, the *Royal Conservatoire of Scotland* (RCS) provided facilities and an engineer for the recording sessions.

2.2.7 Assessment Resources

A mixture of existing assessments and those developed for the current study were employed to explore the outcome measures as described in section 2.1. These included the Rosenberg Self-Esteem Scale (RSES); music tests; questionnaires; and interviews

A) Rosenberg Self-Esteem Scale

The Rosenberg Self-Esteem Scale (Rosenberg, 1965), or RSES, is a validated and widely used measure of self-esteem in the social sciences (See Appendix A). It

comprises 10 questions that explore feelings associated with self-esteem: 5 of which are positively worded, and 5 that are negatively worded. Using a Likert Scale containing 4 levels (strongly agree / agree / disagree / strongly disagree), the test produces a score out of 30. A score of between 15 and 25 is considered to be in the normal range whereas a score of less than 15 suggests low self-esteem.

B) Music tests

The music tests were used to track participants' musical development as a result of the intervention. The tests were drawn from existing grade 1, 2 and 3 *Associated Board of the Royal School of Music* (ABRSM) Aural Tests, and those developed specifically for the purpose of the study by the researcher in collaboration with the composer, vocal coach and repetiteur (see Appendix B and C). The tests called for both perception and production of musical concepts in order to ascertain if the fragile nature of the voices had an impact on practical application as opposed to understanding. Tests were separated into 3 categories:

1. Pitch Tests: these tests comprise 4 sub-tests which assess the ability of the participants in pitch perception and production. Participants are asked to sing back correctly a pitch played on the piano; to sing back correctly either the higher or lower pitch of 2 pitches played simultaneously on the piano; identify whether a pitch is higher or lower in relation to another; sing back correctly (echo) 2-bar melodic phrases played on the piano.
2. Rhythm and Pulse: participants are asked to clap along to the pulse of a short musical excerpt; clap back (echo) 2-bar rhythmic phrases; clap back a rhythm whilst stamping to the pulse. These tests are designed to assess rhythmic ability and the ability to recognise and produce a steady pulse.
3. Vocal Production: participants are asked to sing a note (F3 for males, F4 for females) for as long as they can manage before running out of breath. This test is designed to measure effectiveness of breath support and stamina for singing.

An articulation test was also piloted but was not used for the purposes of the current study as it was not deemed suitable.

C) Questionnaires

The pre-intervention questionnaire for the participants (see Appendix D) contained a series of closed questions, some in the form of a Likert scale, and was designed to ascertain information in the following areas:

1. The amount of musical experience prior to Breath Cycle (questions 1-5 and 13): this was necessary to control for any outliers within the data collected
2. Listening behaviours (questions 6-11)
3. Musical identity (questions 12 and 14)

The post-intervention questionnaire (see Appendix E) followed a similar structure to the pre-intervention questionnaire and measured the following:

1. Listening behaviours (questions 1-4)
2. Engagement in the project (questions 5 and 6)
3. Musical identity (questions 7 and 8)
4. Self-evaluation of the experience (question 8)

Due to the final structure of the project, certain questions in the participant post-intervention questionnaire were removed for the purposes of the study as they were deemed no longer relevant. This was also true of pre- and post-intervention questionnaires for the SO creative team, neither of which were used in the current study.

D) Interviews

A semi-structured interview technique was employed whereby the interviewer used a list of questions and / or topics to be covered rather than a list of precise questions to

deliver in a specific order. The questions for participants (see Appendix F and G) were designed to elicit information about listening behaviours, musical identity, perceived physical / psychological benefits as a result of taking part, engagement with the project, and general questions regarding project evaluation (as requested by SO). The questions for the creative team (see Appendix H and I) were designed to explore musical identity, professional identity, listening behaviours, development of practice, and general project evaluation. The questions for the SO managerial and office staff (see Appendix J and K) were designed to explore musical / professional identity, expectations of the project with regards to participants, staff, and outcome for SO, and general project evaluation.

2.2.8 Procedure

To minimise any effect that different testing environments may have on the results, the tests and interviews for all participants were to be conducted at *Gartnavel General Hospital* (GGH) as part of the structure of the project. This is also where the vocal tuition was delivered on a fortnightly basis. However, the research days were not factored into the final schedule and, therefore, testing took place in a number of venues which included:

- Gartnavel General Hospital
- Scottish Opera Technical Studios
- Royal Conservatoire of Scotland
- Various home visits across the west of Scotland

The possible impact of this on the data collected will be discussed in relation to the results in section 4.7.

2.2.9 Test Points

The intervention duration and test points for the 3 different blocks of participants were as follows:

Table 2: Summary of Test Points

	BLOCK 1	BLOCK 2	BLOCK 3
Pre-tests (questionnaire; music test; RSES)	6th - 7th February 2013	9th May 2013	9th August - 3rd September 2013
Post-tests (questionnaire; music test; RSES)	25th - 26th April 2013	25th July 2013	21st November 2013 - 14th January 2014
Pre-intervention interview	6th - 9th February 2013	9th May 2013	9th August - 3rd September 2013
Post-intervention interview	25th April - 25th July 2013	25th July 2013	21st November 2013 - 14th January 2014
Intervention	7th February - 25th April 2013	9th May - 25th July 2013	9th August - 20th November 2013

The timeframe for the testing was also affected by the project schedule. Although most post-tests were completed soon after the intervention ended, some happened up to 3 months after this point. This was due to a number of factors including availability of participants and, in turn, the researcher (due to scheduling issues), and participants suffering ill health during the testing period.

Post-tests were scheduled for the participants of Block 2 immediately after the recording session. None of the participants had any previous experience of recording in a studio and some found this to be a highly emotive experience. This had a direct impact on engagement with and performance on the tests, as well as the responses to interview questions. Again, the possible effect on the results gathered will be discussed in section 4.7.

2.2.10 Ethical Considerations

In embarking on this study the researcher has continued to adhere to the 'Ethical Principles for Conducting Research with Human Participants' as set out by the *British Psychological Society* (1990). Various ethical and moral issues are applicable to the study and have been addressed by the following means:

1. Ethical approval gained for the study from the *West of Scotland Research Ethics Service, NHS*
2. Permission granted via a Research Agreement from each individual participant (see Appendix L)
3. Permission granted via Research Agreements (see Appendix M) from the SO creative team delivering the intervention, and SO managerial and office staff

Participation in the study was voluntary and individuals were able to withdraw at any time. The participants, SO managerial and office staff, and creative team taking part were guaranteed anonymity. Due to the small number of participants involved in the study, the even smaller number of artists that made up the creative team, and the SO staff, full transcriptions are not included in the appendices to protect the anonymity of those concerned.

2.2.11 Experimenter Bias

Experimenter and participant expectancy and bias effects, as described by Rosnow and Rosenthal (1997), were explored and every effort to limit any such effect was taken. The experimenter did not facilitate or attend any of the music intervention sessions in order to minimise any bias towards the results. All tests were administrated solely by the experimenter to eliminate any bias between different styles of delivery. Every attempt was made by the experimenter to avoid any bias effect within the test situation.

2.3 Experimental Overview

In addition to the four main areas of research (as described in section 2.1), information regarding previous musical experience and background was explored to control for any outliers within the data, and to provide a context for the analysis. Before the findings of the study are reported, Table 3 provides a summary of the test areas.

Table 3: Summary of test areas

Area	Tests / Questions	Interview
Background	✢Musical experience ✢Instrument ✢Tuition ✢Choir	
Musical Development	Pitch Tests Rhythm Tests Vocal Duration	
Musical Identity / Listening behaviour	Musician? Singer? Creative? Association with opera? * Lyrics reflected identity? * Music reflected identity? Musical Preferences Frequency of music listening Situation of music listening Most recent gig Attendance at opera performance Watched/listened to opera in any other form	Musician? Singer? Creative? How does singing make you feel? What kind of music best describes you and why? How would you describe opera? Do you own an iPod / mp3 player? / is there any classical music on it? *Has the project changed the way you view classical music and opera?
Self-Esteem	Rosenberg Self-Esteem Scale (RSES) Confidence as a singer	

Area	Tests / Questions	Interview
Personal Evaluation and Engagement in the Project	Knowledge of Opera Limitations of condition? ✢Anxiety about SO project * Enjoyment of project * Amount of practice per week * Duration of practice Ability to express emotions (through song) * Sense of achievement in singing lessons * 1-1 lessons - progress * Online - progress * Usefulness of online feedback * Improvement of musical skills? * Sense of accomplishment (overall) * Likely to take part in another SO project * Likely to listen / go to an opera as a result	✢ Expectations of an SO project ✢ What are you hoping to gain from taking part? ✢ What can Scottish Opera learn from you? *Do you feel any physiological benefits from taking part *Will you continue to sing now that the project is over? *What was it like working with the creative team? *How useful were the 1-to-1 / online sessions? *What have you gained from taking part? *Least and most favourite aspect of the project? *What can SO change to make it better?

✢ denotes pre-intervention only
* denotes post-intervention only
all other content used for both pre- and post-intervention tests

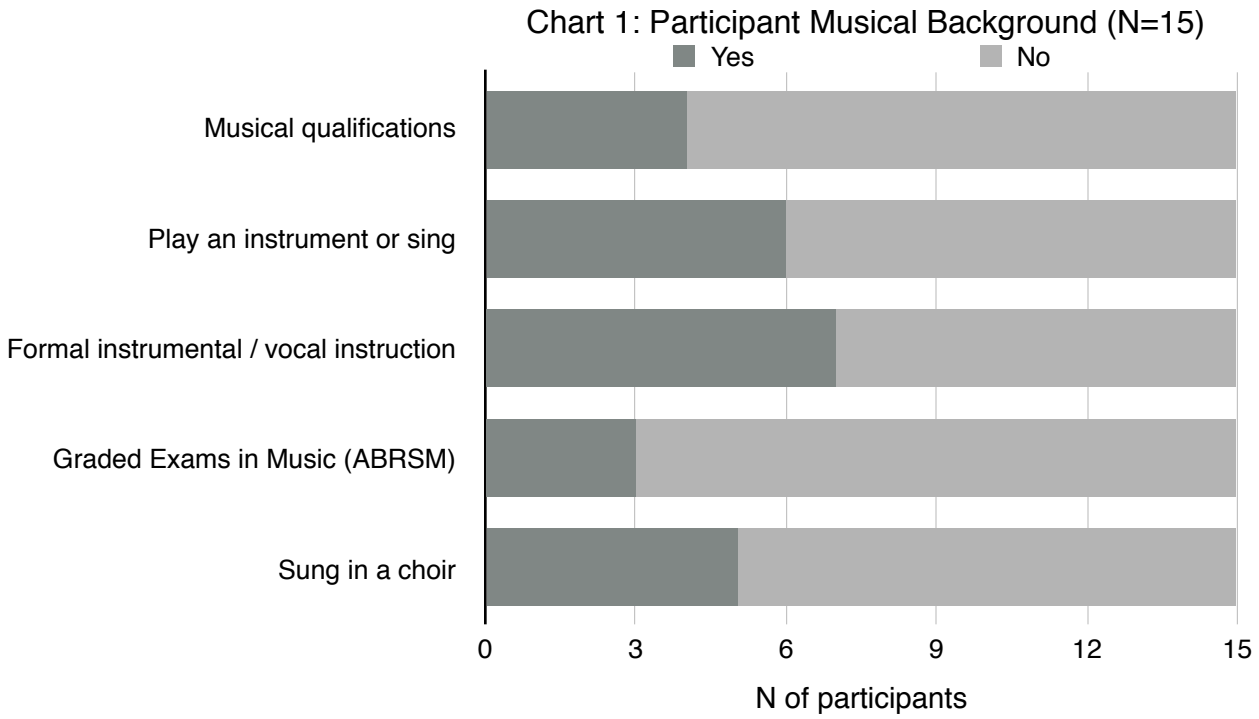
The following chapter will report on the questionnaire and test results only ('Tests / Questions' column in Table 3 above). Budgetary restrictions have prevented analysis of the interview data at this point.

3. Results

This chapter will report the descriptive statistics and results from the quantitative analysis only. All quantitative data from the music tests, Rosenberg Self-Esteem Scale and some of the data collected from the questionnaires were subject to non-parametric tests (Wilcoxon Signed Rank Test) as data were not normally distributed. The implications of these results will be considered in Chapter 4.

3.1 Participant Musical Background

Participants' responses to pre-intervention questionnaires provided information regarding musical background. Chart 1 summarises the results.



When participants were asked about any previous experience in music, 4 reported that they had a school qualification (Standard Grade Music) and 11 reported no formal educational qualification in music. Six participants out of the 15 said that they played instruments and/or sang (keyboard x2; voice x1; flute x2; saxophone x1; guitar x1; and drums x1).

Seven participants reported having experienced formal instrumental tuition, however, 3 of these answered “no” when asked if they played an instrument. Conversely, 2 participants who said they played an instrument have never had formal instrumental tuition.

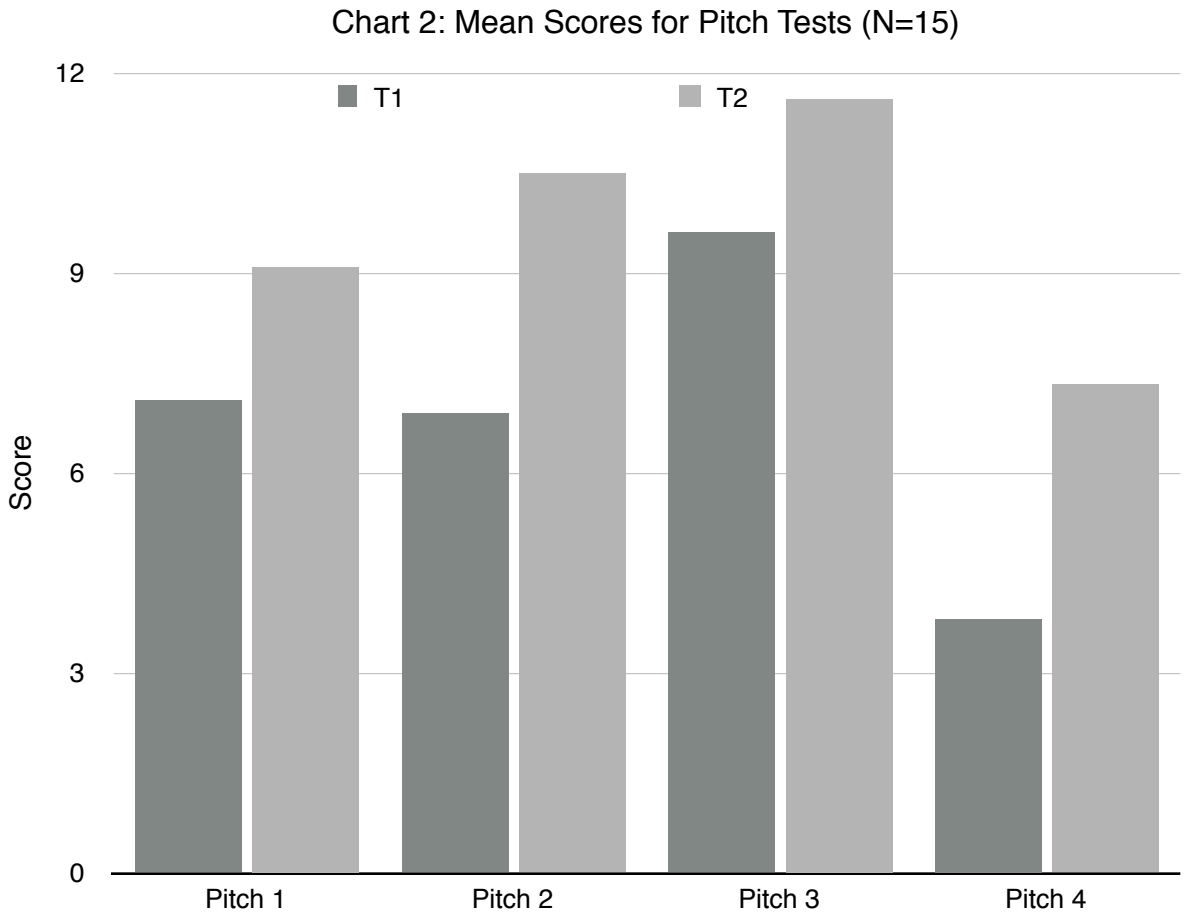
Out of the 4 participants who reported having a Standard Grade qualification in music 1 said he did not play an instrument and has never had formal instrumental tuition; another stated that she does not play an instrument yet has had formal tuition; another reports playing drums and keyboard but has had no formal tuition; and the fourth participant states that they play an instrument and have received formal tuition. Four out of 5 participants in Block 3 play an instrument and 2 have a Standard Grade in music.

Three participants hold ABRSM graded exams (2x Grade 5 and 1x grade 4 practical; 2x theory exams: 1x Grade 6 and the other did not specify). Out of the 5 participants that have previously sung in a choir, 3 play instruments (with 2 having had formal tuition) and 2 report having never played an instrument or had formal tuition.

3.2 Musical Development

Musical development was measured using a variety of tests in the 3 key areas: pitch; pulse; and rhythm and pulse (as outlined in section 2.2.7). Mean scores are presented for each test in addition to levels of significance as calculated by the Wilcoxon Signed Rank Test for non-parametric data.

3.2.1 Pitch Tests

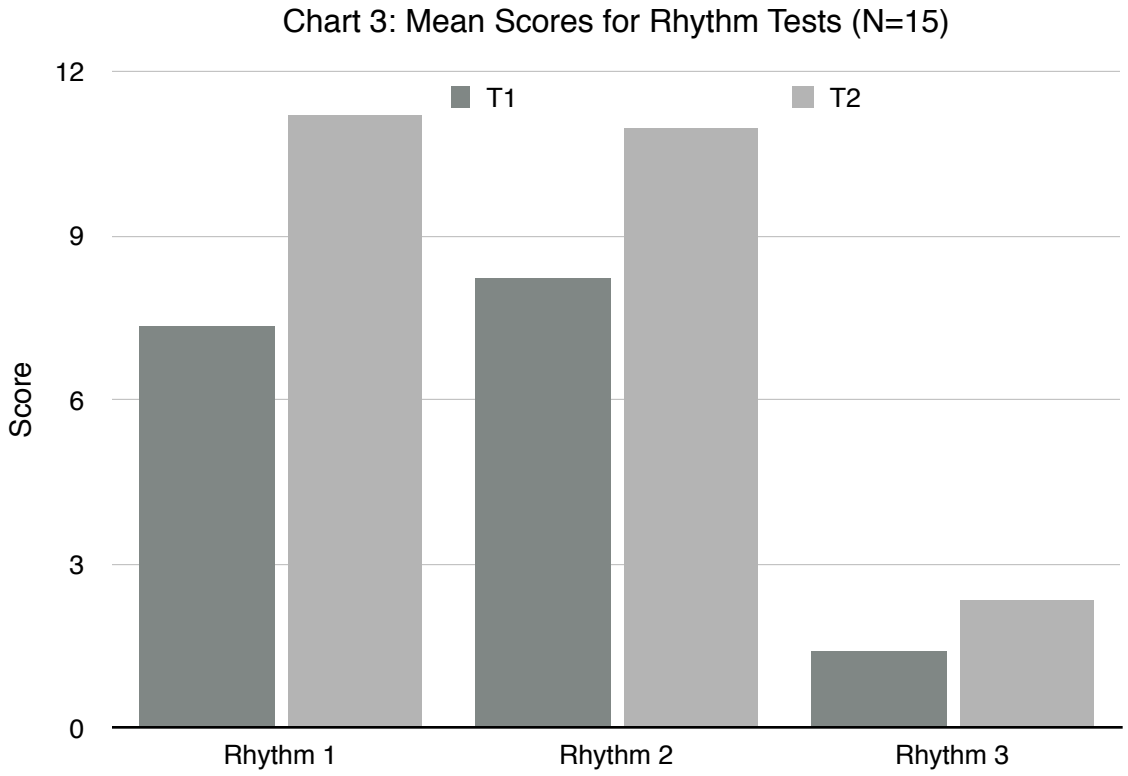


Pitch 1: Pitch Matching 1 (1 note)
Pitch 2: Pitch Matching 2 (2 notes played simultaneously)
Pitch 3: Pitch Perception
Pitch 4: Pitch Sequencing

T1: Test point 1 (pre-test)
T2: Test point 2 (post-test)

All pitch tests yielded significant results and, therefore, show that the participants made significant improvements between test points in these areas. Chart 2 shows the mean scores at both test points (T1 and T2). The Pitch matching 1 test results ('Pitch 1') shows a significance of $Z = 2.39$, $p = .013$. Mean scores for Pitch Matching 2 ('Pitch 2') are significant at the level of $Z = 2.94$, $p = .002$; mean scores for Pitch Perception ('Pitch 3') show a significance of $Z = 2.88$, $p = .002$; and the Pitch Sequencing test yielded mean scores showing a significance of $Z = 3.31$, $p = .001$.

3.2.2 Rhythm Tests



Rhythm 1: Pulse
Rhythm 2: Rhythm Sequencing
Rhythm 3: Rhythm and Pulse

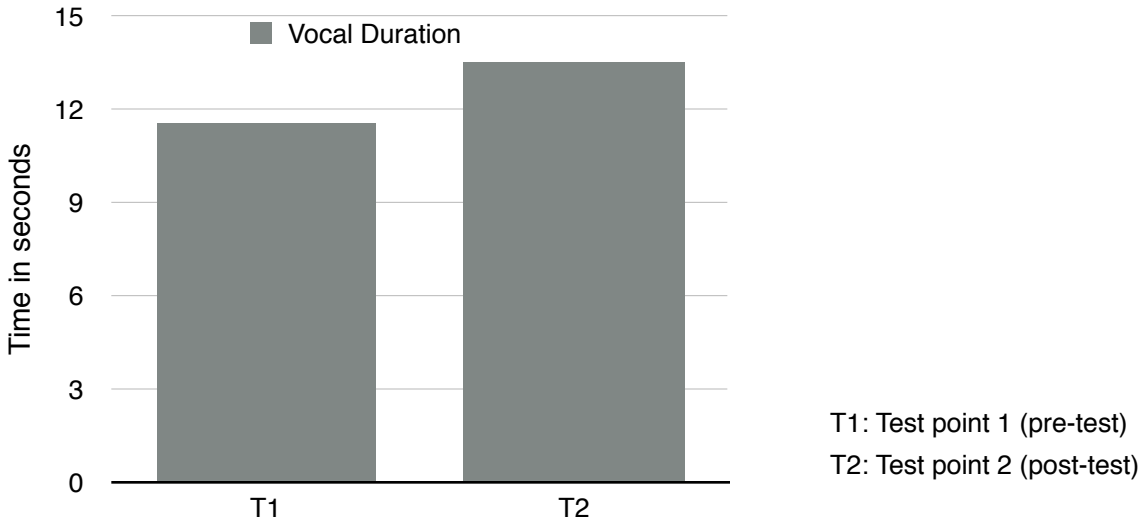
T1: Test point 1 (pre-test)
T2: Test point 2 (post-test)

The mean scores for the Pulse test (‘Rhythm 1’ in the chart) show a significance of Z = 2.57, p = .008; for Rhythm Sequencing (’Rhythm 2’), the significance is Z = 2.97, p = . 001; and Rhythm and Pulse (‘Rhythm 3’) show a significance of Z = 2.62, p = .008. Again, the data show that participants made significant improvements in their rhythmic and pulse related skills as measured by the current tests.

3.2.3 Vocal Duration

The vocal duration test produced no significant result (Z = 1.60, p = .12) which shows that there was not a significant difference in performance between test point 1 and 2.

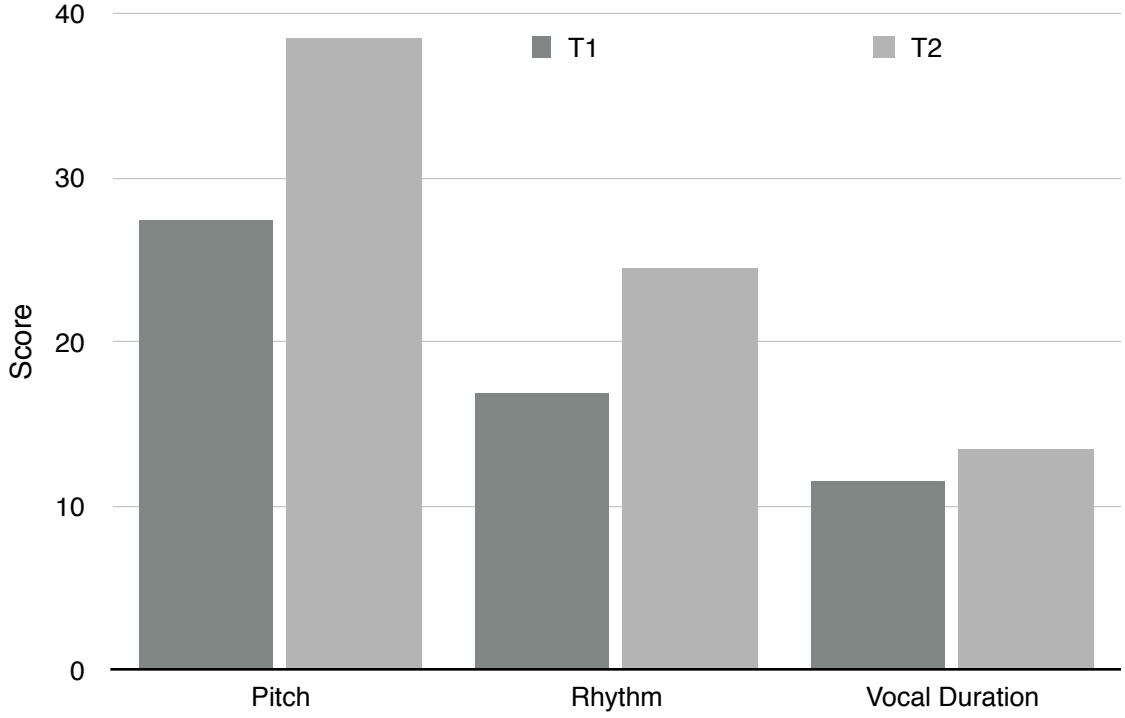
Chart 4: Mean Score for Vocal Duration Test (N=15)



3.2.4 Total Mean Scores

The mean scores for each category of tests were combined to provide total mean scores for pitch, rhythm and pulse, and vocal duration. A summary of these scores can be found in Chart 5. The pitch tests show a significance of Z = 3.42, p = .001; pulse and rhythm tests show a significance of Z = 3.18, p = .001; and vocal duration test produced no significant results (Z = 1.60, p = .12).

Chart 5: Total Mean Scores (N=15)



Pitch: all pitch tests
Rhythm: all rhythm and pulse tests

T1: Test point 1 (pre-test)
T2: Test point 2 (post-test)

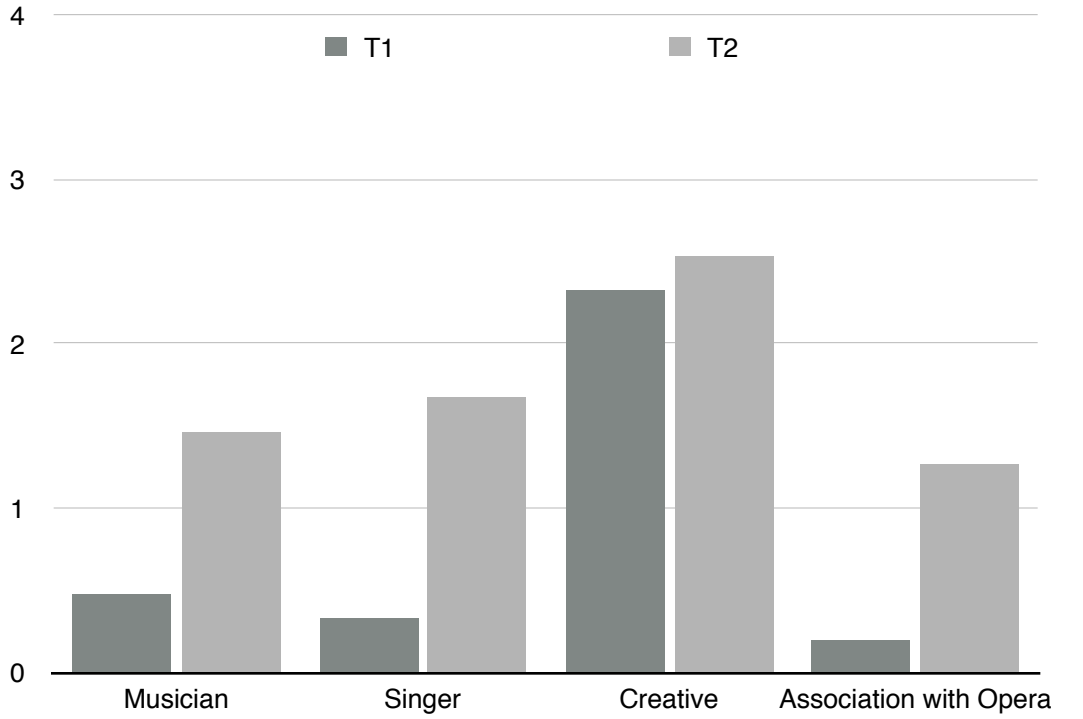
3.3 Musical Identity and Listening Behaviours

3.3.1 Musical Identity

Using a 5 point Likert scale, participants were asked to rate how much they identified themselves as being a musician and singer, as being creative, and how much they identified with opera as an art form. Mean scores are summarised in Chart 6. The results show a significant increase in how much participants identified with being a musician ($Z = 2.72$, $p = .004$) and a singer ($Z = 3.13$, $p = .001$) by the end of the intervention. Results for the association with opera as an art form also increased

significantly (Z = 2.87, p = .002). There was no significant change in the participant scores for regarding themselves as creative (Z = 0.69, p = .557).

Chart 6: Mean Scores for Musical Identity (N=15)

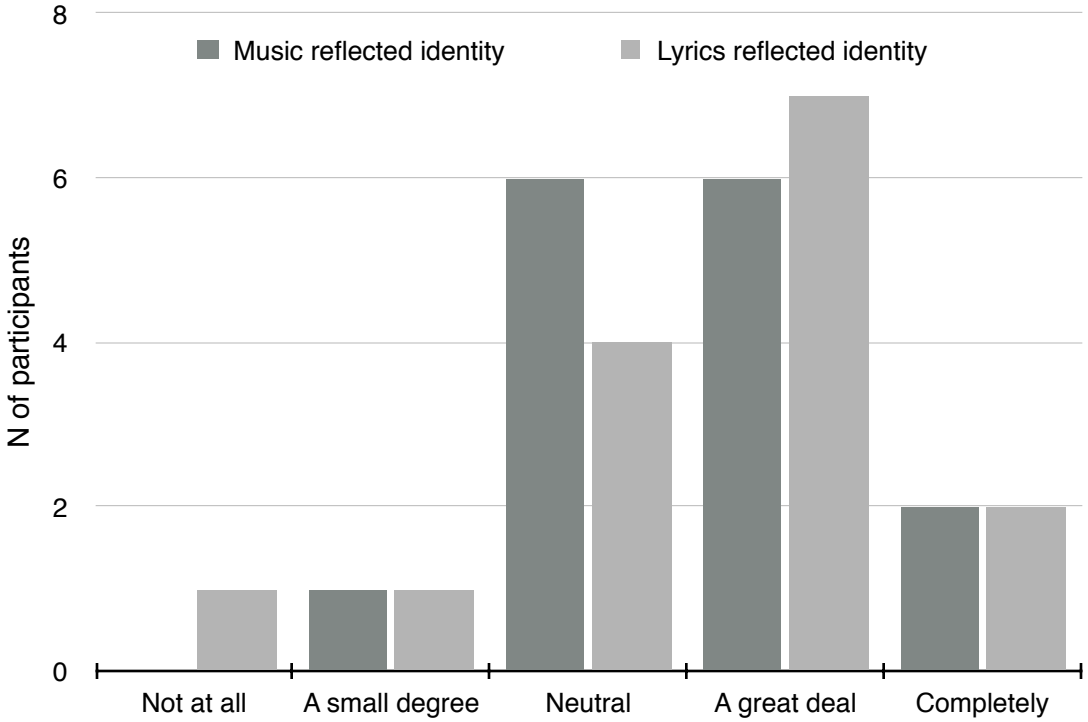


0 = Not at all
1 = A small degree
2 = Neutral
3 = A great deal
4 = Completely

T1: Test point 1 (pre-test)
T2: Test point 2 (post-test)

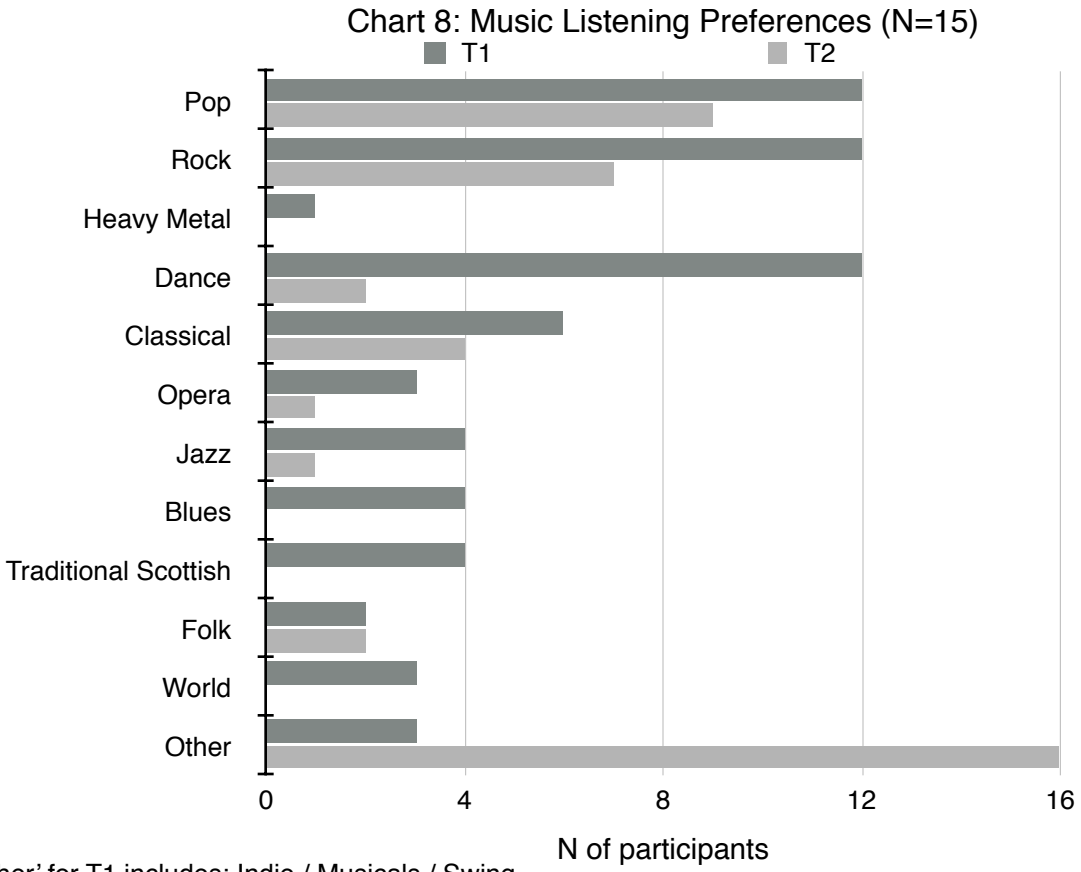
In the post-intervention questionnaire, participants were asked to rate how much the original songs (both music and lyrics) reflected their identity. Chart 7 summarises the responses and the results show that all participants felt the music reflected their own identities to a varying degree, and only 1 participant felt that this was not also true of the lyrics.

Chart 7: Extent to which identity was reflected in Breath Cycle song (N=15)



3.3.2 Listening Behaviours

Chart 8 provides a summary of participant listening behaviours before and after the intervention. The results show that participants listened to a wider variety of music by the end of the intervention than reported at the start. A total of 93% of participants reported that they listen to music every day at both test points. Chart 9 shows that the remaining 7% went from listening 1 to 3 times per week at test point 1, to listening 4 to 6 times per week at test point 2.



'Other' for T1 includes: Indie / Musicals / Swing
'Other' for T2 includes: MC / Breath Cycle songs / Hip-hop / Indie Musicals / Funk / Disco / R and B / Alternative / Soul / Variety (did not specify)

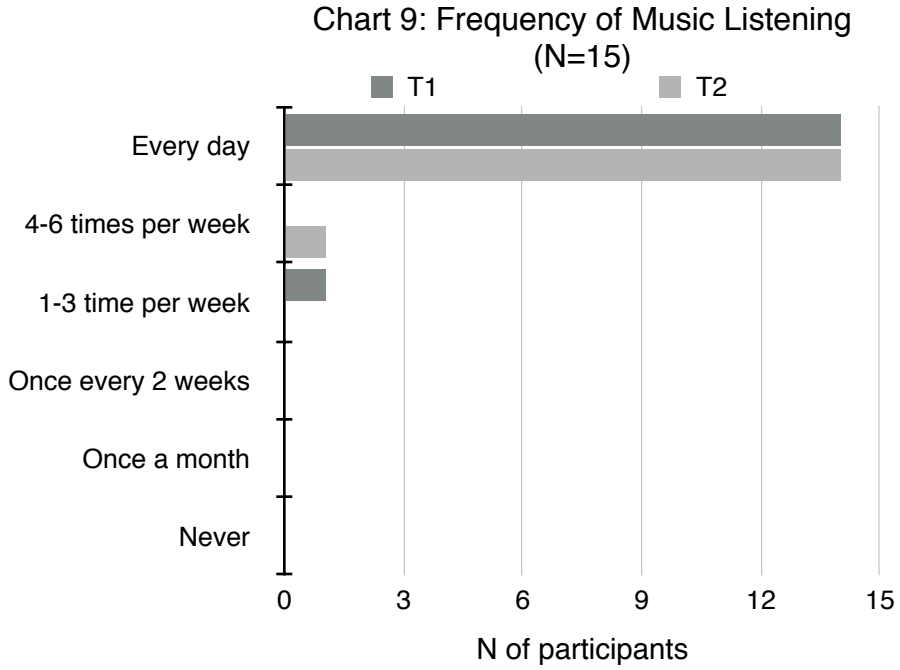
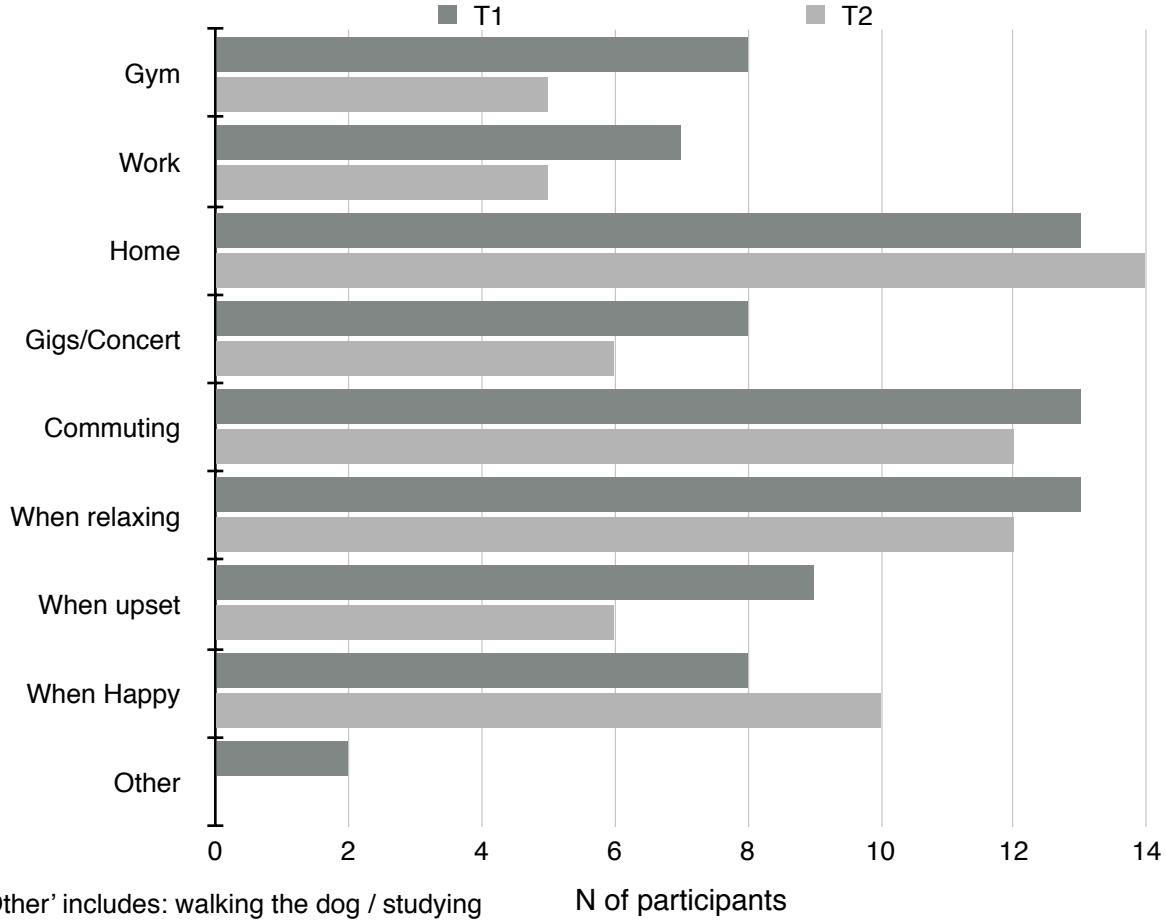


Chart 10 summarises where and when the listening takes place and reveals that the most popular times are when at home, when commuting, and when relaxing. The only categories to show an increase in numbers between T1 and T2 were ‘Home’ and ‘When Happy’. All other categories decreased in numbers at T2.

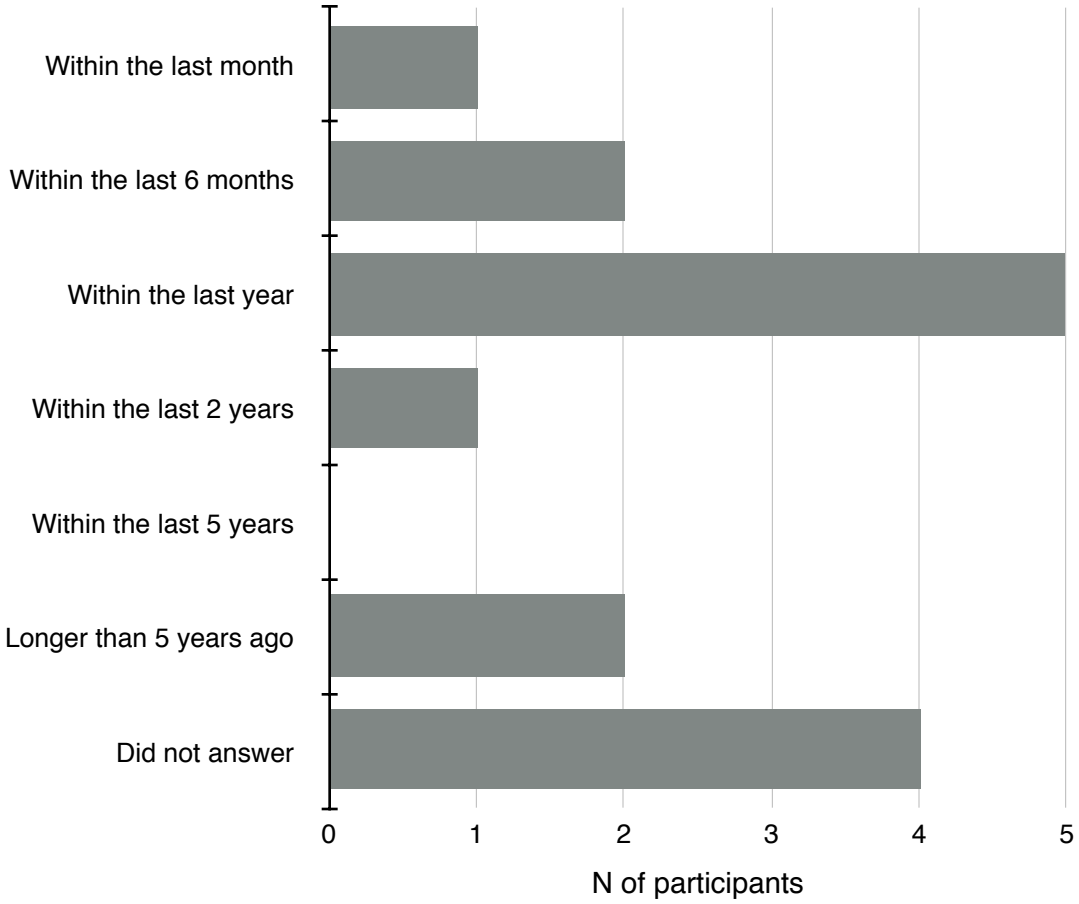
Chart 10: Where and when Music Listening takes place (N=15)



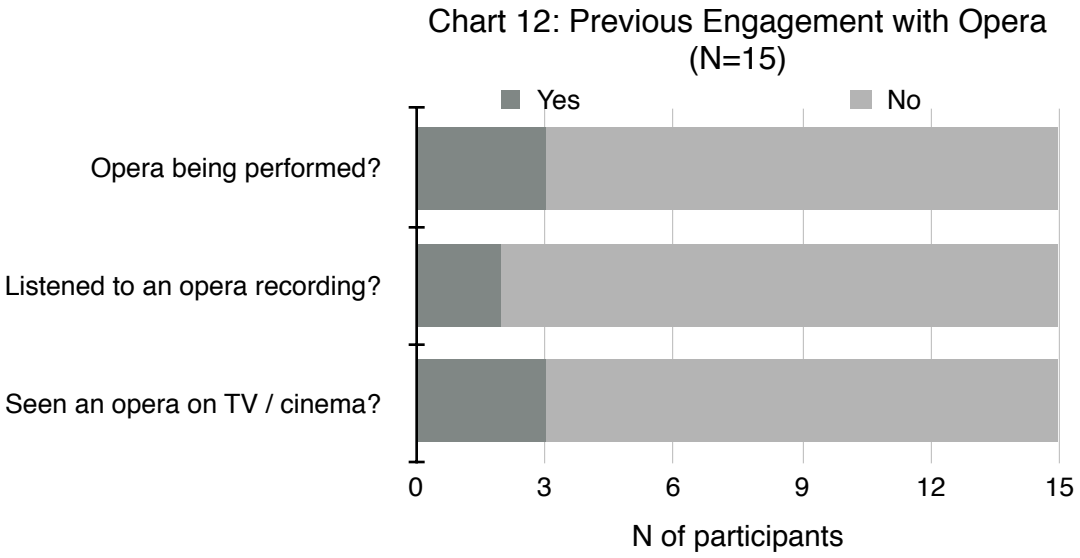
‘Other’ includes: walking the dog / studying

Results also showed that 9 out of the 15 participants had attended a live gig or concert at some point over the course of 2 years (see Chart 11). Two participants reported that it had been over 5 years since they went to see live music and 4 did not answer.

Chart 11: Most recent attendance at a gig or concert (N=15)



With specific regard to opera, 20% of participants stated that they had seen an opera being performed live, and on TV or at the cinema. This shows that 80% of the participants had never seen an opera before and only 13% had listened to a recording of one. Chart 12 summarises the results for previous engagement with opera.



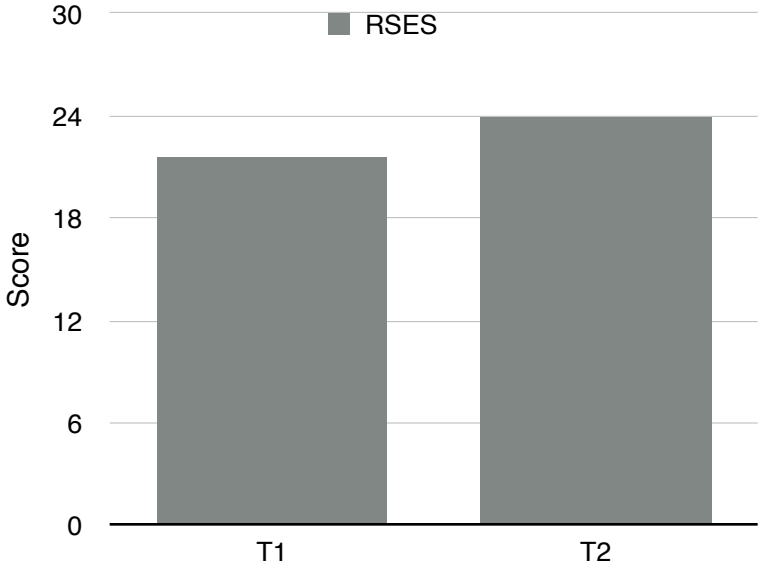
3.4 Self-Esteem

Mean scores and any statistical significance between scores for self-esteem and confidence are summarised below.

3.4.1 Rosenberg Self-Esteem Scale

The results show that, although the mean scores for the RSES were higher by the end of the intervention indicating higher self-esteem, the difference between scores was not statistically significant ($Z = 1.85$, $p = .064$). The mean scores (see Chart 13) also indicate that the participants are within the normal range and, therefore, not regarded as being at risk of having low self-esteem either before or after the intervention.

Chart 13: Mean Scores for Rosenberg Self-Esteem Scale (N=15)

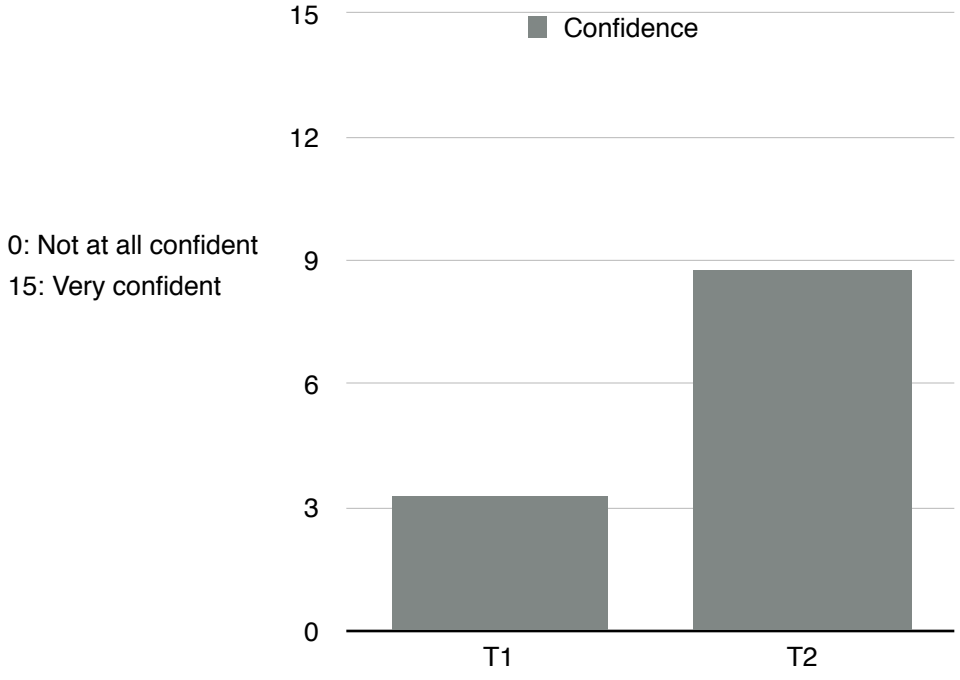


T1: Test point 1 (pre-test)
T2: Test point 2 (post-test)

3.4.2 Confidence as a Singer

Participants were asked to rate their confidence as a singer by making a mark on a horizontal line (15cm in length) which was labelled '*Not at all confident*' at one end, and '*Very confident*' at the other. The mean scores are summarised in Chart 14. The results showed a significant improvement between test points ($Z = 3.30$, $p = .001$).

Chart 14: Mean Scores for Confidence as a Singer (N=15)



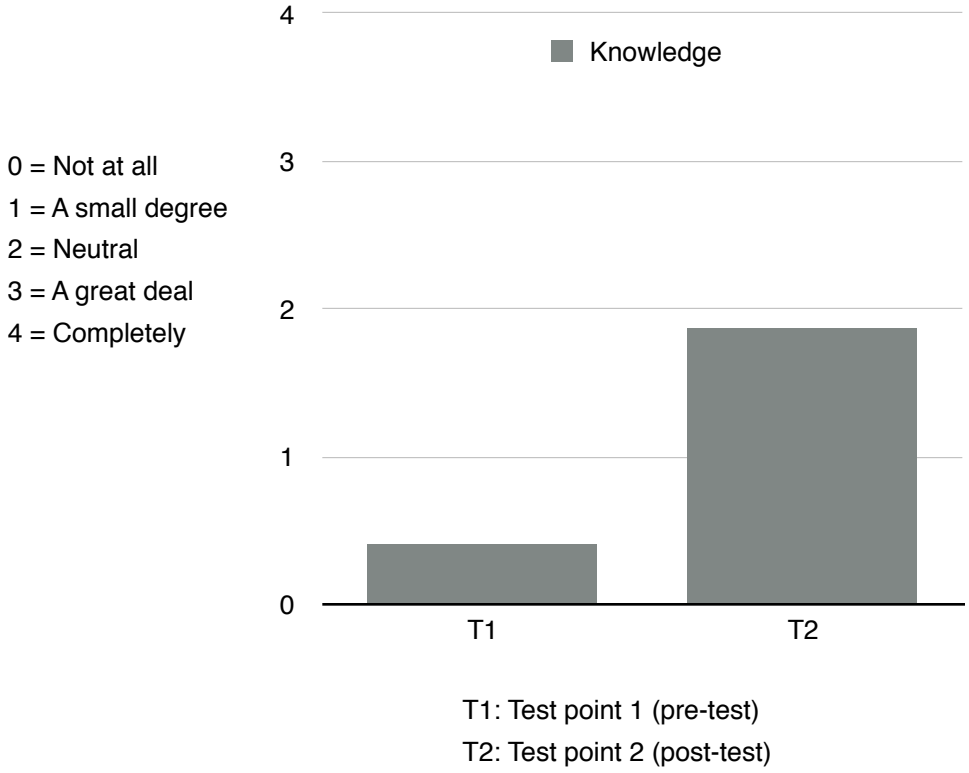
T1: Test point 1 (pre-test)
T2: Test point 2 (post-test)

3.5 Personal Evaluation and Engagement

Participants were asked to measure how knowledgeable they felt about opera at the start and end of the project. The results showed that the perceived knowledge of the art form had increased (see Chart 15), and that this increase was significant ($Z = 2.90$, $p = .002$).

On a 5 point Likert scale, participants were asked to gauge how anxious they felt about taking part in a project by SO and, at the end of the project, how much they had enjoyed the experience. Although for some, the prospect of taking part caused some apprehension, all participants reported having enjoyed the project ‘a great deal’ or ‘completely’ by the end. Mean scores are summarised in Chart 16.

Chart 15: Mean Scores for Knowledge of Opera (N=15)



T1: Test point 1 (pre-test)
T2: Test point 2 (post-test)

Chart 16: Initial anxiety and ultimate enjoyment of the project (N=15)

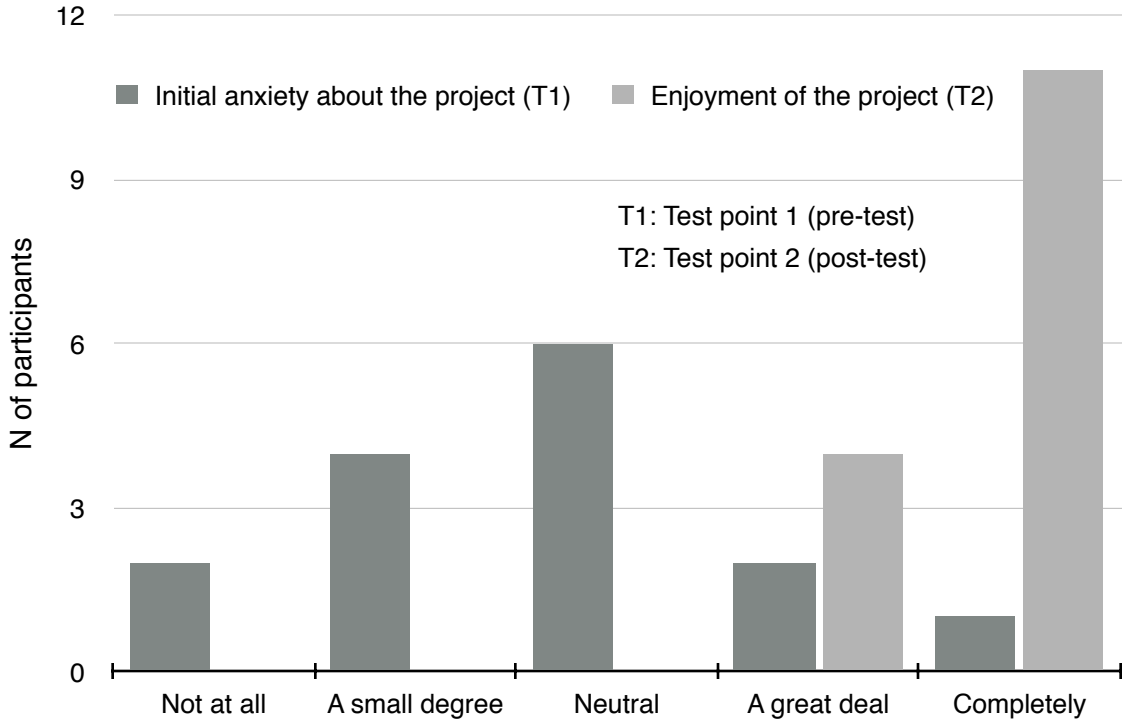
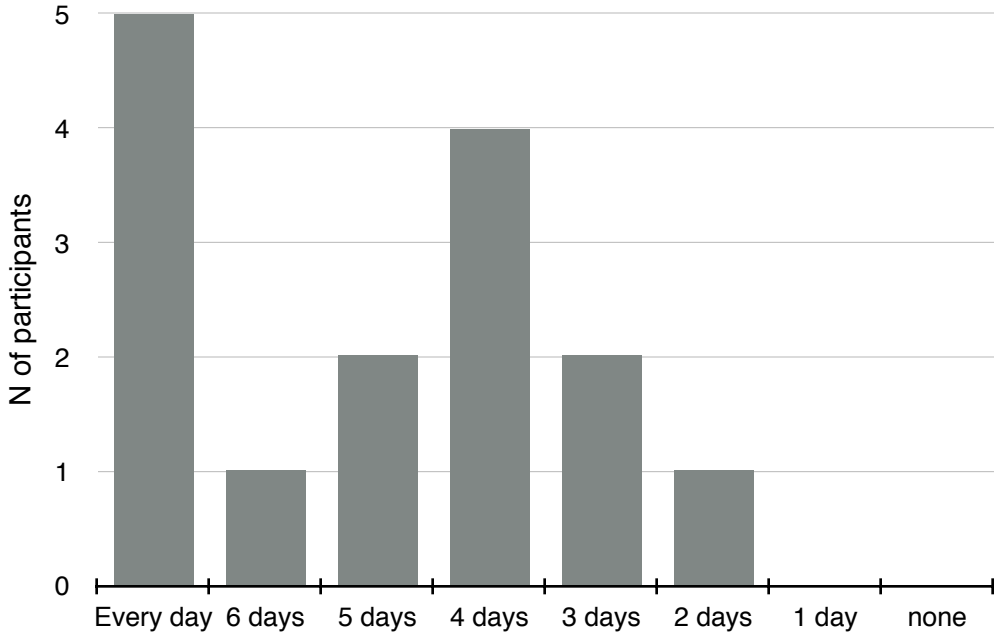


Chart 17: Frequency of practice sessions per week (N=15)

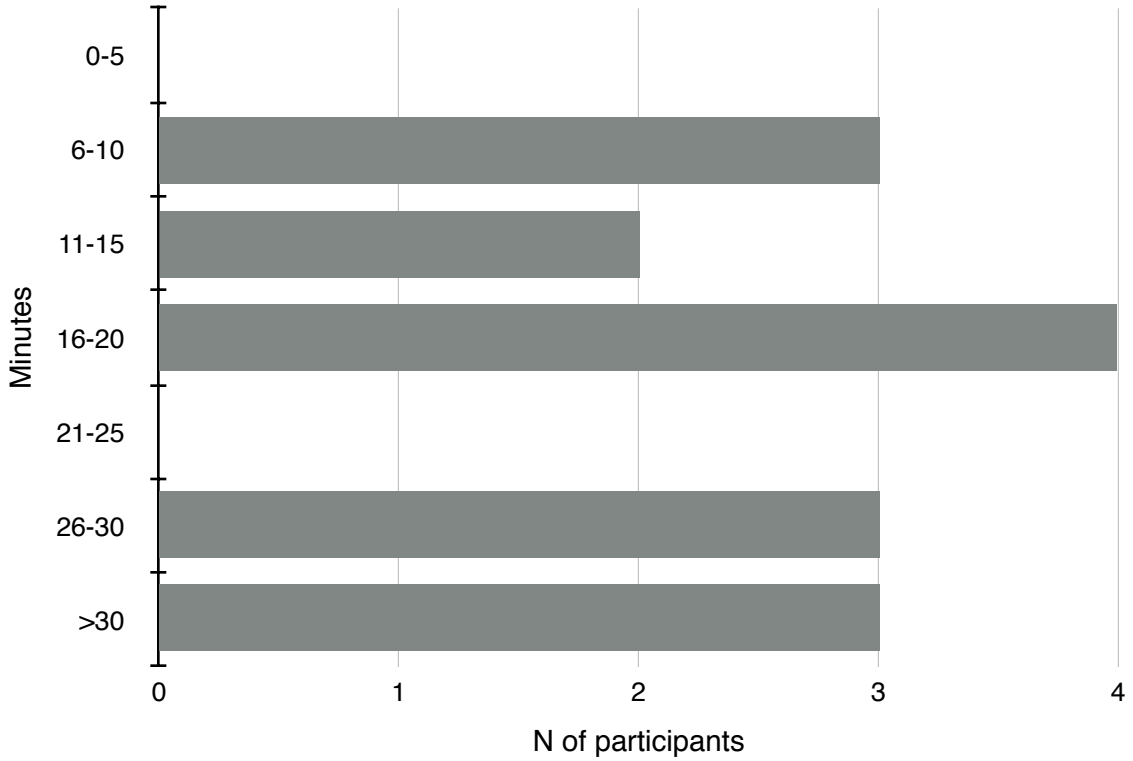


Participants were also asked about their engagement with the project with regards to the amount of practice they did between lessons. Charts 17 and 18 summarise the frequency and length of practice sessions and show that all participants engaged with individual practice sessions outwith the lessons, and the average practice session was between 16 and 20 minutes long.

Participants reported on their ability to express emotions, and whether this was facilitated through song. Chart 19 summarises the results and shows that singing makes little difference to their perceived abilities in this area.

Participants were asked to rate their sense of achievement in singing lessons (Chart 20) and 93% of participants reported a strong sense of achievement whilst 7% stated they only felt this to a small degree.

Chart 18: Duration of practice per day in minutes (N=15)



>30 minutes: 2x 1 hour; 1x did not specify

Chart 19: Ability to Express Emotions (N=15)

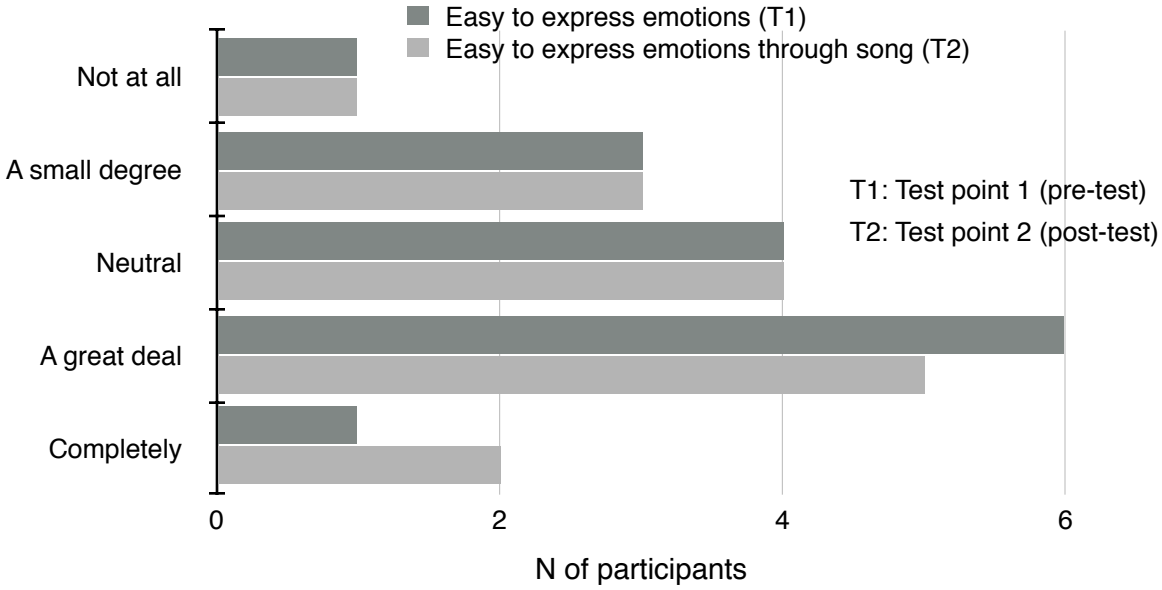
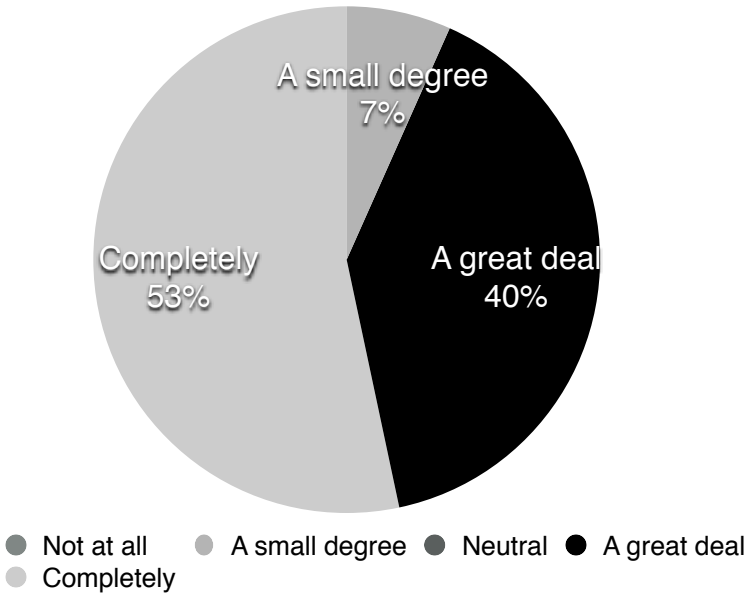
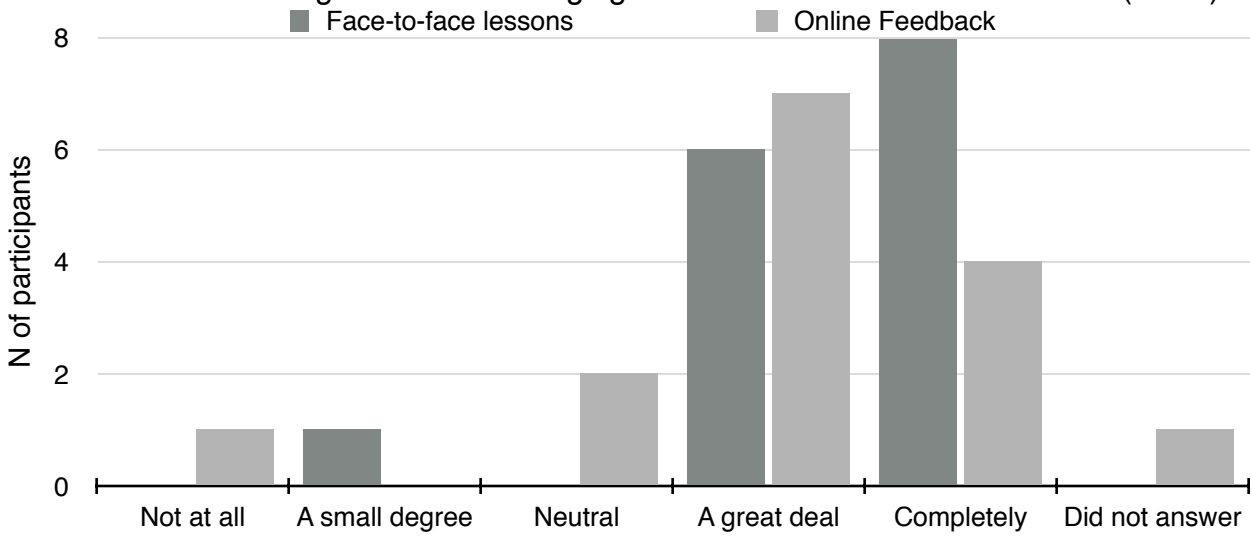


Chart 20: Sense of Achievement in Singing Lessons (N=15)



In addition, they were also asked to rate the progress they felt they had made in various aspects of the project (Chart 21).

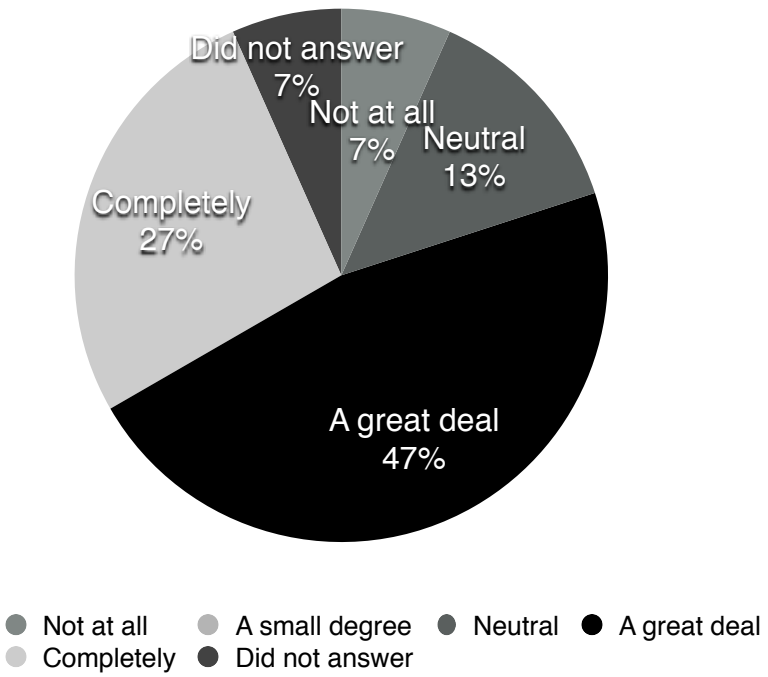
Chart 21: Progress made in singing lessons and from online feedback (N=15)



The results show that 93% of participants reported a feeling of having made good or excellent progress whilst 1 participant (7%) stated they had progressed only a small degree in the singing lessons. One participant also felt that they made no progress through the online feedback and 1 did not answer. The remaining participants felt that the online sessions had allowed them to progress but not as much as the fact-to-face lessons.

The usefulness of the online aspect of the project was also ranked by the participants and the results follow the same pattern as the results for the sense of progress they felt they made from the online sessions (Chart 22).

Chart 22: Usefulness of online feedback (N=15)



There was a very high feeling of improvement among participants regarding their musical development (Chart 23) and an equally strong sense of accomplishment about the overall project (Chart 24).

Chart 23: Development of Musical Skills (N=15)

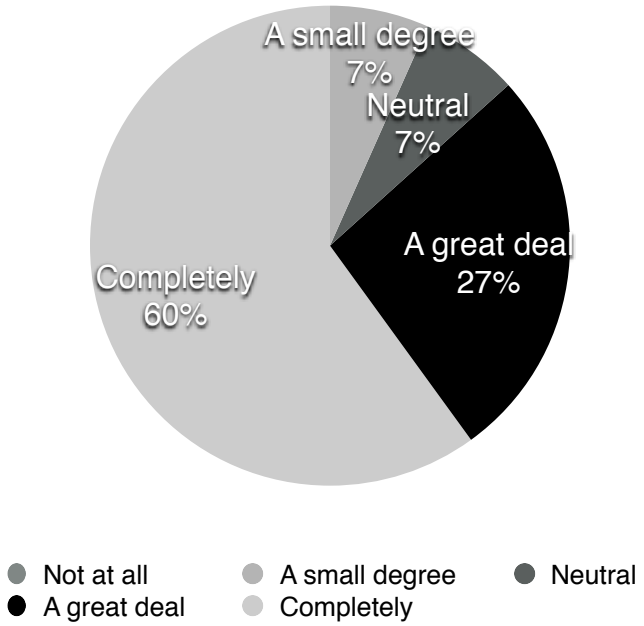
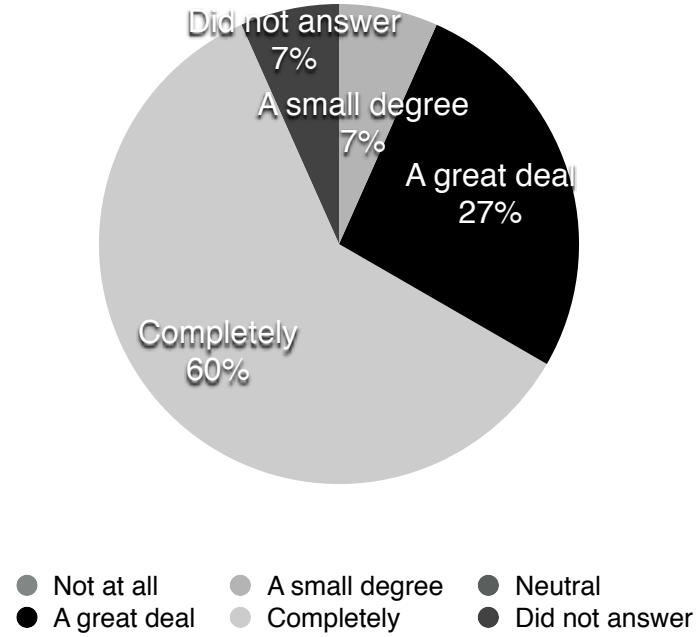
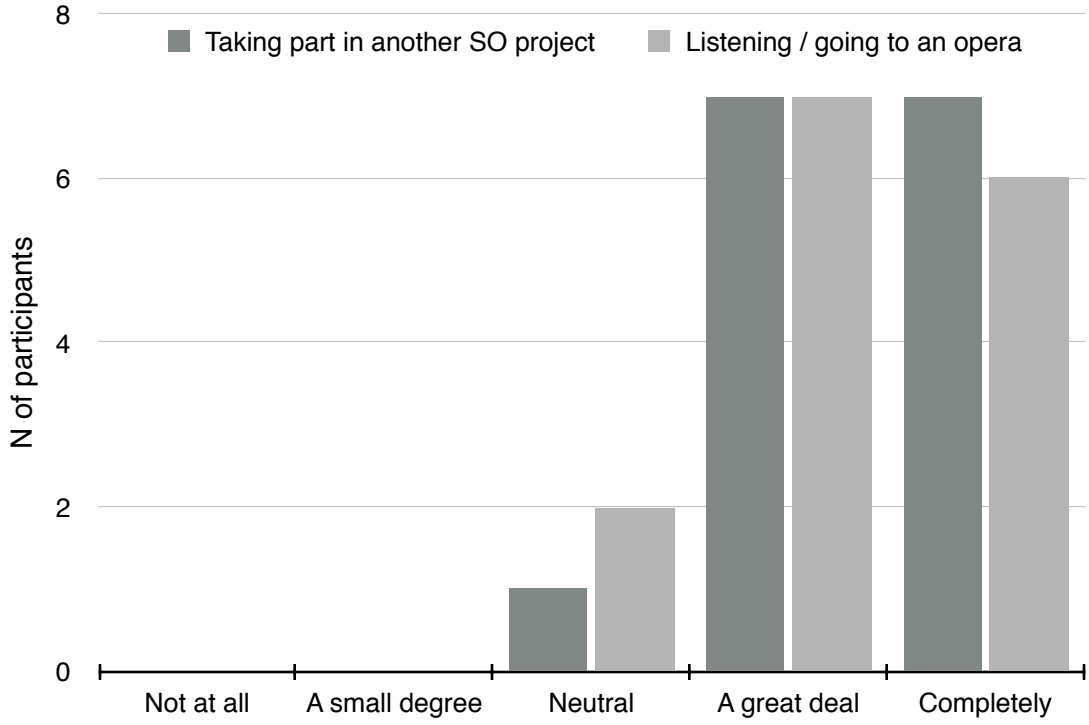


Chart 24: Sense of Accomplishment (N=15)



When asked about the likelihood of engaging with opera as an art form and participating in further SO projects in the future, participants reported a strong interest (see Chart 25). Only 1 participant remained neutral as to whether they would take part in another SO project, and 2 regarding listening to or going to an opera. The remaining participants,14 and 13 respectively, all responded positively to future engagement.

Chart 25: Likelihood of further engagement with opera (N=15)



4. Discussion

Results from the quantitative data will be discussed in relation to the aims of the study and outcome measures described in sections 1.3 and 2.1.

4.1 Participant Musical Background

Gathering information regarding the participant's previous experience of music is important to help understand the results of the study in two different respects. Firstly, to provide context for scores on the music tests (as it would be expected that participants who have music qualifications, such as SQA Standard Grade Music or ABRSM graded exams, would perform better than those without), and secondly, for gaining a better understanding of a participant's musical identity. Interestingly, the results show that, despite having had formal tuition, certain participants do not see themselves as instrumentalists and equally will not assume the label musician. Conversely, a participant who has never had formal tuition on an instrument defines herself as an instrumental player and a musician. This raises an interesting question regarding what it means to play an instrument or sing, and to be a musician. Some individuals seem keen to assume those labels whereas others, sometimes more competent in the discipline, are less keen to define themselves in those terms. The results from this study are limited in respect of exploring this question in detail and, therefore, further research in this area would be necessary.

4.2 Musical Development

The music tests provided an insight into the progress that the participants made over the 3 months of tuition. As the tests called for both perception and production, it has

been possible to ascertain if the fragile nature of the voices had an impact on practical application as opposed to understanding.

It is to be expected that musical ability should increase as a result of 3 months of specialist tuition and the results from the pitch, and rhythm and pulse tests confirmed this. This is likely due to a number of factors including the efficacy of the tuition and also the engagement from the participants. It may also have been expected that the vocal duration test would have yielded significant results due to the 12 weeks of training that the participants received but the results show otherwise. Breathing and breath control is a fundamental aspect of singing (and indeed playing a wind or brass instrument). The vocal duration test has a strong association with overall lung function and it is possible that the condition of CF has limited the progress that can be made in this aspect of singing. Despite the fact that it was not shown to be significant, there was, nevertheless, an increase in the mean score for this test. Another factor which may be at play here is that people with CF engage in daily physiotherapy to keep their lungs clear of mucus. As explained in Chapter 1, the physiotherapy involves a series of breathing exercises (ACB and AD) and, therefore, the individual may already be using more of their available lung capacity already, relative to a person without CF. In other words, it may be that a person without CF will learn to use more of their lungs and show an increase in stamina as a result of singing tuition than a person with CF due to the fact that those with the condition already engage in daily breathing exercises, albeit through physiotherapy rather than singing.

These baseline markers regarding musical and vocal development are important in a study of this kind as there is no existing literature that has explored this area. Although the results may seem rather obvious, they provide an important foundation for building more detailed research in this field.

4.3 Musical Identity and Listening Behaviours

The results go some way to revealing the extent to which participant's musical identity changed during the course of the project. This has important ramifications for arts-based projects as a whole as it shows that outreach and engagement can serve to change the association people feel with certain art forms.

The participants regarded themselves as more of a musician and singer by the end of the intervention and this change was shown to be statistically significant. As the results from the music tests have shown, the participants made significant gains in musical skill, as shown by the tests, throughout the intervention. It can be assumed that the participants themselves were, to a certain extent, aware of their progress and this may have been a catalyst for a growing association with singing and music. The participants' association with opera as an art form was also shown to increase significantly. This is an interesting result. The participants were taught by a singer and repetiteur, and worked with a composer, all of whom are associated with professional opera, but they were not exposed to opera in its traditional form as part of Breath Cycle.

This raises a number of questions, not least, the fundamental question of what constitutes opera. It could be argued that the participants were indeed exposed to opera in its true form: that being a process of using the human voice with instrumental accompaniment to relate a story through lyrics and action. Although the performances did not happen in a traditional setting (i.e. a theatre), they were filmed with the view to producing a performance through these means. Therefore, relaying emotion and meaning through body language was an integral part of the tuition alongside the more obvious goal of supporting vocal development. The counter argument involves taking a more conventional view of opera: the large-scale production of a musical and dramatic work sung by professional voices. This was not an experience that the participants came into contact with as part of the intervention. It could be argued that this kind of experience may have altered the results regarding the association that the participants

felt with ‘opera’ as it is very different from the experience they received in Breath Cycle. The association may well have been more to do with the relationship between the individual participants and the SO creative team than with ‘opera’ itself. Whether this is relevant or otherwise depends on the intended outcome of the project. Certainly in the case of Breath Cycle, one of the aims was to provide an opera-led experience for those who would otherwise be unable to, or find it difficult to, participate (i.e. be a performer) in this particular art form. The results suggest that this experience has allowed them to participate in and associate far more with the medium of opera thereby improving their musical skills and raising their confidence levels. It could be argued, therefore, that the sense of increased musical identity is of greater value to the participants than the development of their musical knowledge and skills.

The results suggested that the participants found that the Breath Cycle lyrics and songs reflected their identities. This could be indicative of the composer and librettist successfully harnessing participants’ individual personalities in the original work. It could also be representative of the fact that participants felt a growing affinity with the original works as a result of the project and, therefore, felt a sense of ownership over the song and the sentiment behind it. A further aspect of Breath Cycle that distances the experience from traditional opera is that the music and libretto were written for the individual participants, as opposed to an existing opera being selected and then learned and performed by the singers. This process added a very personal quality to the project. In this context, the fact that the majority of participants felt that their individual identities were reflected in the music and lyrics is perhaps not surprising. A technique used by singers and actors alike is to assume the role of the character (either in the song or script) and, therefore, it could be argued that a sense of identity with the music and the lyrics will always be present but, the very fact that the Breath Cycle songs were written specifically for the individual participants may make the association even stronger. Further research would be needed to explore this in more detail.

An understanding of musical preferences amongst the participants helps to further the understanding of their musical identity. With regards to listening behaviours, the styles

of music that were most listened to pre-intervention were pop, rock and dance. At the start of the study, only 3 participants out of the 15 had ever seen an opera being performed and only 2 had listened to an opera recording. Interestingly, post-intervention results showed that more participants reported listening to 'other' styles of music than any other, although pop and rock remained popular. This may demonstrate a more open approach to different musical styles as a result of taking part in Breath Cycle but more detailed research would be necessary to support this theory. Less people reported listening to either 'opera' or 'classical' music at the end of the study in comparison to the start. It might have been expected that listening to these styles may have increased as a result of participating in an opera-based project, however, the results could be rationalised when other aspects of the project are taken into consideration, namely: the project did not involve exposure to 'traditional opera' repertoire or performances; and musical material used over the 12 weeks consisted of participant choice and new music composed for the participants as part of the project.

The results for the frequency of music listening are indicative of the importance of music (either listened to consciously or in the background) in the everyday lives of the participants. At both test points, 93% of participants reported listening to music on a daily basis. Considering that many of the participants would not describe themselves as musicians or singers, they undoubtably have a strong affiliation with music and engage with it constantly. Technological advances have brought about huge changes in music consumerism, making music that much more accessible for individuals to engage with. One of the important factors in technological changes has been that music has gone from a social experience (only available in a concert situation) to more of an individual and insular experience (downloading music from across the globe and listening via headphones). This is supported to a certain extent by the results from gig and concert attendance. Only 3 of the participants had been to see a gig in the last 6 months, despite 93% of participants reporting that they listen to music everyday. This would suggest that the listening takes place as a solitary experience. Music listening is a vastly different experience to taking part in making it and, therefore, Breath Cycle afforded the participants the opportunity to experience music in a different way. It could also be

argued that this experience may increase the understanding and appreciation of music which can be realised when listening to others perform.

Many people use music as a background to everyday activities such as commuting, studying, doing a workout at the gym etc. This would suggest that the quality of music listening is not particularly high: when a person is driving to and from work, the main focus would be on controlling the car rather than listening to the music. Another aspect of music listening is to manipulate emotions and, therefore, behaviours of ourselves and others around us. Listening to music when relaxed, happy and upset were also popular answers amongst participants. It is not clear from the results gained from this study whether the participants use music in order to relax, or when relaxed, are more likely to want to listen to music. Further research would be necessary for more conclusive results. Interestingly, there was more of an association with listening to music when happy than when sad at test point 2 in relation to test point 1. This might suggest that music has become a happier association for participants as a result of taking part in the project. This argument is also supported by the results for overall sense of achievement and enjoyment of the project.

4.4 Self-Esteem

The fact that the self-confidence of the participants with regards to singing showed a significant increase after 12 weeks of tuition is not unsurprising. One would expect that, as the skill base increased (as shown by the music tests), so did the confidence in the skill. In addition to this, results showed that the association with singing and music also changed and again, it would follow that greater association with a discipline would lead to greater confidence in it.

It is important to recognise that both the confidence rating and the RSES are self-assessments. This means that what is being reported is the participant's own perception

of confidence and self-esteem as opposed to the results from an objective measurement. With regards to the RSES results, it is entirely possible that the test was not sensitive enough to measure any changes in self-esteem due to the relatively small sample size and the brevity of the intervention (12 weeks). The post-intervention results were higher than the baseline scores but the difference was not great enough to produce a significant effect. However, it is encouraging to note that the mean scores at both pre- and post-intervention tests fell within the 'normal range' and, therefore, participants were not regarded as being at risk of having low self-esteem either at the start or end of the study.

There are numerous studies extolling the benefits of group singing for wellbeing (Clift and Hancox, 2001; Unwin *et al*., 2002). The concept of 'group singing' is different in the current study as participants cannot be in the same room as one another due to cross-infection. Although one of the final outcomes of Breath Cycle is to produce audio and visual recordings of inclusive songs, the participant experience is one of performing solo lines to be digitally mixed with those of others. Viewed as a number of participants completing their roles in order to produce a single entity (i.e. the song), it could be argued that the concept of 'group singing' remains intact, albeit in a different format to the experience of singing in a choir. However, for people with CF, the concept of coming together as a group to perform a song can only be done via technology.

4.5 Personal Evaluation and Engagement

As previously discussed, it is important to acknowledge the personal evaluation of the project as well as the quantifiable progress (i.e. musical development and physiological markers) that occur as a result of the intervention. Perceived improvements in quality of life can be equally as important, if not more, than improvements shown by objective measures in quality of life. Participants reported an increase in their knowledge of opera as a result of taking part in addition to a strong overall sense of achievement and enjoyment of the experience.

The engagement levels with the project were high. The majority of participants reported frequent practice sessions with 5 out of 15 stating that practice happened every day. Looking at the data in greater detail, the results suggest that the more the participants engaged with the practice and online learning opportunities, the more they got from the project as a whole. Further case study analysis would be necessary to explore this in detail.

With regards to the tuition, more participants felt they made better progress through the face-to-face sessions than the online sessions. However, the online sessions were clearly useful for the participants presumably to support and reinforce the progress made in the face-to-face lessons. Those that answered 'not at all' useful, or simply did not answer that particular question, by their own admission, chose not to engage in the online opportunities as opposed to engaging with it and not finding it useful. The online aspect of the project is hugely important, not least because the participants cannot meet in the same room as one another. Further research into the technical possibilities for this kind of project would be beneficial for this and similar projects to thrive.

The majority of the participants felt that their musical skills developed greatly over the course of the project and this was also echoed by the results of the music tests. In this particular instance, there was a quantifiable means of showing progression that was mirrored by participant experience. This is an important finding with regards to the concept of using singing as a means to support existing physiotherapy to aid chest clearance. Engagement levels with daily physiotherapy can be low, particularly with adolescents (Quittner *et al*., 2000), and singing may offer them a different means of chest clearance whilst developing other useable skills that can be transferred to general musical development and beyond. There is also an argument here for utilising wind and brass instrumental tuition for a similar purpose.

Despite many of the participants never having seen or listened to an opera in the past, the results suggest that there is a strong likelihood that 85% of them would go and see

an opera in the future. Moreover, 93% report that they would be likely to engage in another SO project if the opportunity arose. With regards to musical identity, these results helps support the argument that the participants have a stronger identity with music, singing, and opera as an art form as a result of taking part in Breath Cycle. Furthermore, they are more likely to engage with opera and opera-related projects in the future. This is also an important finding as the term ‘opera’ tends to conjure up certain images and assumptions and, therefore, may well colour an individual’s initial view as to what an opera-based project may, or indeed may not, entail. For some, these assumptions may be enough to feed a certain amount of anxiety about the project and possibly prevent them from engaging in the first place. The results of the current study show that even participants who were anxious about the project are far more willing to identify with opera as a result of taking part.

4.6 Other Considerations

It is important to note that all of the creative staff working on Breath Cycle had their own outcomes in mind. These included a development of knowledge of working for and with people with fragile voices, developing pedagogy and technique, developing the groundwork for a larger scale work about CF, and exploring technological issues surrounding online capabilities for interactive singing. It should also be acknowledged that the motivation of the participants to take part may well have been to help with their condition, rather than to learn about opera and music in general.

4.7 Limitations of the study

There are a number of limitations of the current study that must be acknowledged in conjunction with the results that have emerged.

1. The sample size is relatively small (N = 15) which limits the extent to which the results can be generalised back to the community of CF patients as a whole.

2. The project itself (Breath Cycle) is bespoke and, therefore, care should be taken when relating the results concerning the impact of arts-based projects on engagement, identity, and physical and mental wellbeing to other initiatives and indeed other participant groups.

3. The research test points were not included in the final schedule for the project which caused a number of factors that could have affected the data gained.
    I. Both pre- and post-tests were conducted in a number of different environments which may have affected the results. Participants may have felt more relaxed when tested in their homes than in a hospital ward (due to association) or at the Scottish Opera / RCS buildings (due to unfamiliarity).
    II. Post-intervention tests were scheduled directly after the final recording sessions at the RCS. Participants are not familiar with the recording environment or process and some found it to be a highly emotive experience to the point where they were unable or unwilling to complete the post-tests in full. This had a direct impact on the reliability and usability of the data gathered at this stage in the study.

5. Future Considerations

Breath Cycle is a groundbreaking project that has opened up a very interesting line of enquiry for practising artists and minority groups within society. In partnership with GGHCFS, this field of research has many possibilities. Furthermore, the results offer an insight into participant experience of Breath Cycle that can be fostered for other arts-based projects. Consideration for future work that have arisen directly out of this research include:

1. Joint analysis of results from the SO commissioned research and that of GGHCFS to explore significant findings, correlations and trends, thereby informing areas for future research into:
    I. how the arts, and medical and social sciences can inform current knowledge about CF and impact positively on the quality of life for people living with the condition
    II. how the arts can complement current and developing treatments in medical science
    III. how medical science can inform artistic practice and understanding

2. Analysis of interview data and case study analysis of the results would provide a more detailed understanding of the impact of the project on individual experience, and how this can inform future work

3. The possibility of opera-based projects involving instrumental tuition in addition to singing tuition to explore the impact on respiratory functioning

4. Greater communication between SO and all research partners to ensure enough preparation time for effective scheduling and delivery of the project

Cross-disciplinary research of this nature can be incredibly fruitful for all involved. Through *Scottish Opera* and *Gartnavel General Hospital Cystic Fibrosis Service*, Breath Cycle has served to forward the knowledge and understanding of the impact of singing on the physical and mental wellbeing of patients with CF, and the efficacy of outreach projects in this field. Furthermore, artists have been able to develop their own methodology in a variety of disciplines as a result of their role in Breath Cycle and this knowledge will feed back into their future work in the arts industry. Above all, Breath Cycle demonstrates the importance for arts organisations to engage with medical and social science research and indeed vice versa. The more collaboration, the greater the understanding and the wider the possibilities.

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Appendix A

Rosenberg Self-Esteem Scale (Rosenberg, 1965)

The scale is a ten item Likert scale with items answered on a four point scale - from strongly agree to strongly disagree. The original sample for which the scale was developed consisted of 5,024 High School Juniors and Seniors from 10 randomly selected schools in New York State.

Instructions: Below is a list of statements dealing with your general feelings about yourself. If you strongly agree, circle SA. If you agree with the statement, circle A. If you disagree, circle D. If you strongly disagree, circle SD.

1	On the whole, I am satisfied with myself.	**SA**	**A**	**D**	**SD**
2*	At times, I think I am no good at all.	**SA**	**A**	**D**	**SD**
3	I feel that I have a number of good qualities.	**SA**	**A**	**D**	**SD**
4	I am able to do things as well as most other people.	**SA**	**A**	**D**	**SD**
5*	I feel I do not have much to be proud of.	**SA**	**A**	**D**	**SD**
6*	I certainly feel useless at times.	**SA**	**A**	**D**	**SD**
7	I feel that I'm a person of worth, at least on an equal plane with others.	**SA**	**A**	**D**	**SD**
8*	I wish I could have more respect for myself.	**SA**	**A**	**D**	**SD**
9*	All in all, I am inclined to feel that I am a failure.	**SA**	**A**	**D**	**SD**
10	I take a positive attitude toward myself.	**SA**	**A**	**D**	**SD**

Scoring: SA=3, A=2, D=1, SD=0. Items with an asterisk are reverse scored, that is, SA=0, A=1, D=2, SD=3. Sum the scores for the 10 items.

The scale ranges from 0-30. Scores between 15 and 25 are within normal range; scores below 15 suggest low self-esteem.

Appendix B

Breath Cycle - Scottish Opera

Pre- and Post-Intervention Music Tests

Client ID: _____ Age: _____ Gender: male / female

Birth Date: (D) ___ / (M) ___ / (Y) ___ Today's date: (D) ___ / (M) ___ / (Y) ___

1. Pitch Tests

1.1 Pitch Matching

Individual pitches to be played on the piano* and participant is to sing it back. The participant will be allowed a second attempt on each item if necessary. Example pitch (piano) to be played before each attempt.

*focus is on pitch matching as opposed to voice matching

	Male Pitch	Female Pitch	Attempt 1		Attempt 2	
			Correct	Incorrect	Correct	Incorrect
1	A4	A4				
2	F♯3	F♯4				
3	B♭4	B♭4				
4	E3	E4				
5	G3	G4				
6	C4	C4				
TOTAL						

If the participant correctly answers 4 or more items (taking into account both attempts) then the following test (**Pitch Matching from 2 Notes Played Simultaneously**) can be administered. If the participant correctly answers 3 or less items in this test, go straight to test **1.3 Pitch Perception.**

1.2 Pitch Matching from 2 notes played simultaneously

Two pitches will be played simultaneously on the piano and participants will be asked to sing back either the higher or lower pitch as instructed. The participant will be allowed a second attempt on each item if necessary. Example pitches (piano) to be played before each attempt.

If no correct responses have been given in both attempts for three pitches in a row, stop the test.

	Male Pitch	Female Pitch	Pitch	Interval	Attempt 1		Attempt 2	
					Correct	Incorrect	Correct	Incorrect
1	D3 and A4	D4 and A5	H	5th				
2	E ♭ 3 and G3	E ♭ 4 and G4	H	3rd				
3	G3 and C4	G3 and C4	H	4th				
Stopping point if no correct responses have been given at this point.								
4	B ♭ 4 and D ♭ 4	B ♭ 4 and D ♭ 4	H	m3rd				
5	E3 and B4	E4 and B5	L	5th				
6	F ♯ 3 and A ♯ 4	F ♯ 4 and A ♯ 5	L	3rd				
7	E ♭ 3 and A ♭ 4	E ♭ 4 and A ♭ 5	L	4th				
8	G3 and B ♭ 4	G4 and B ♭ 5	L	m3rd				
				TOTAL				

H = participant to sing the higher pitch

L = participant to sing the lower pitch

1.3 Pitch Perception

Participant must correctly identify whether the 2nd pitch played by the piano is higher or lower than the first. The participant will be allowed a second attempt on each item if necessary. Example pitches (piano) to be played before each attempt.

	Pitch 1	Pitch 2	Attempt 1		Attempt 2	
			Correct	Incorrect	Correct	Incorrect
1	D4	F4				
2	C4	F♯ 3				
3	E4	F4				
4	G4	E5				
5	C4	B4				
6	E3	D3				
TOTAL						

1.4 Pitch Sequencing

The participant will sing back (echo) three 2-bar melodic phrases played on the piano. The participant will be allowed a second attempt on each item if necessary. Example melody (piano) to be played before each attempt.

	Melody	Pitch					
		Attempt 1			Attempt 2		
		3 or more mistakes	1-2 mistakes	No mistakes	3 or more mistakes	1-2 mistakes	No mistakes
1	Melody 1						
2	Melody 2						
3	Melody 3						
TOTAL							

2. Rhythm Tests

2.1 Pulse

The participant will be asked to clap along to the pulse of a short musical excerpt on the second time of playing. Three excerpts will be played in total and the participant will be allowed a second attempt at each if necessary.

	Pulse	Pulse					
		Attempt 1			Attempt 2		
		Inconsistent	some inconsistencies	consistent	Inconsistent	some inconsistencies	consistent
1	Pulse 1						
2	Pulse 2						
3	Pulse 3						
	TOTAL						

2.2 Rhythm Sequencing

The participant will clap back (echo) three 2-bar rhythmic phrases played on the piano. The participant will be allowed a second attempt on each item if necessary. Example rhythms (piano) to be played before each attempt.

	Rhythm	Rhythm					
		Attempt 1			Attempt 2		
		3 or more mistakes	1-2 mistakes	No mistakes	3 or more mistakes	1-2 mistakes	No mistakes
1	Rhythm 1						
2	Rhythm 2						
3	Rhythm 3						
	TOTAL						

2.3 Pulse and Rhythm

The participant will be asked to clap the last rhythm of the previous test (Rhythm Sequencing) before repeating it whilst stamping their feet to the pulse. An example will be provided before their first attempt.

	Rhythm and Pulse			
	Rhythm		Pulse	
	Consistent	Inconsistent	Consistent	Inconsistent
Attempt 1				
Attempt 2				
TOTAL				

3. Vocal Production

3.1 Note Duration

The participant will be asked to sing a note (F3 for males, F4 for females) for as long as they can manage before running out of breath. A vocal example will be given before each attempt. Three attempts will be given.

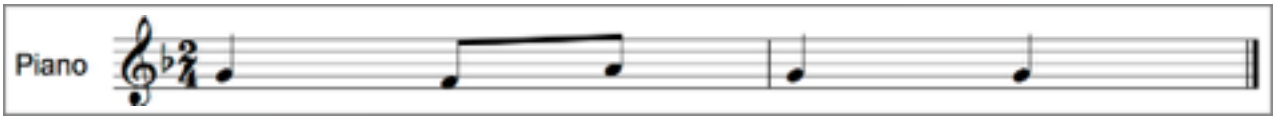
	Vocal Production			
	Duration	Pitch		
	Time (secs)	Consistent throughout	Became flatter	Became sharper
Attempt 1				
Attempt 2				
Attempt 3				

Appendix C

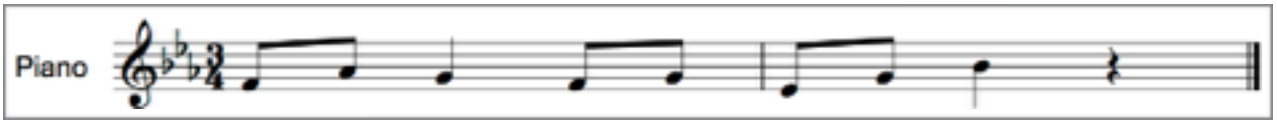
Breath Cycle - Music Tests (Excerpts)

1.4 Pitch Sequencing

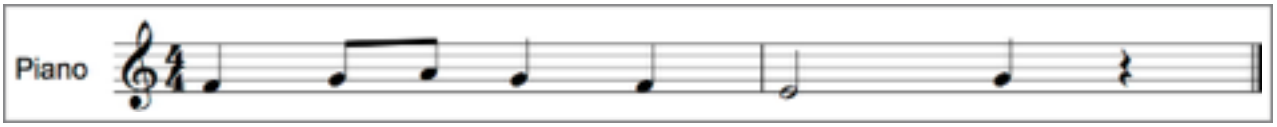
Melody 1 (ABRSM Test 1B No. 8 p.4)



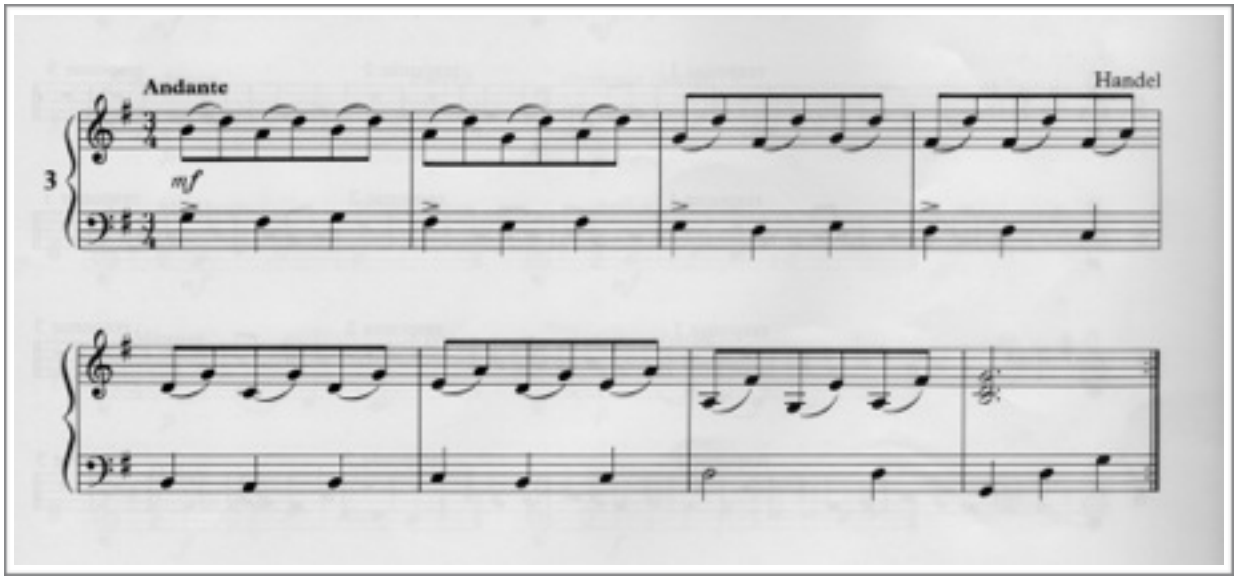
Melody 2 (based on ABRSM Test 2B No. 5 p.9)



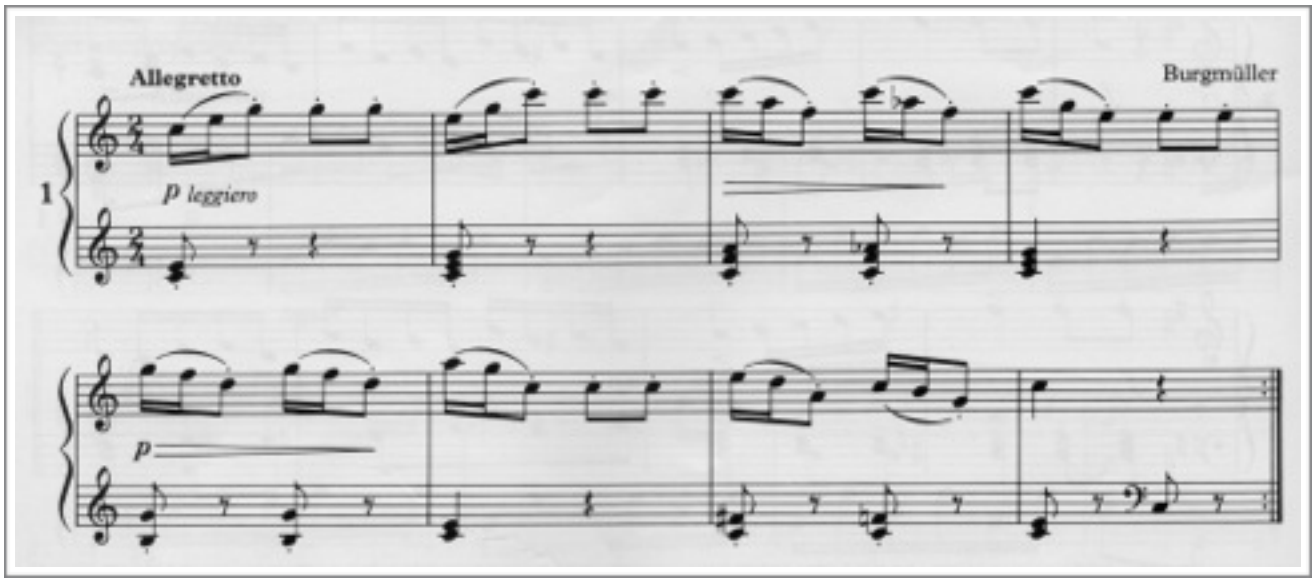
Melody 3 (ABRSM Test 3B No. 3 p.14)



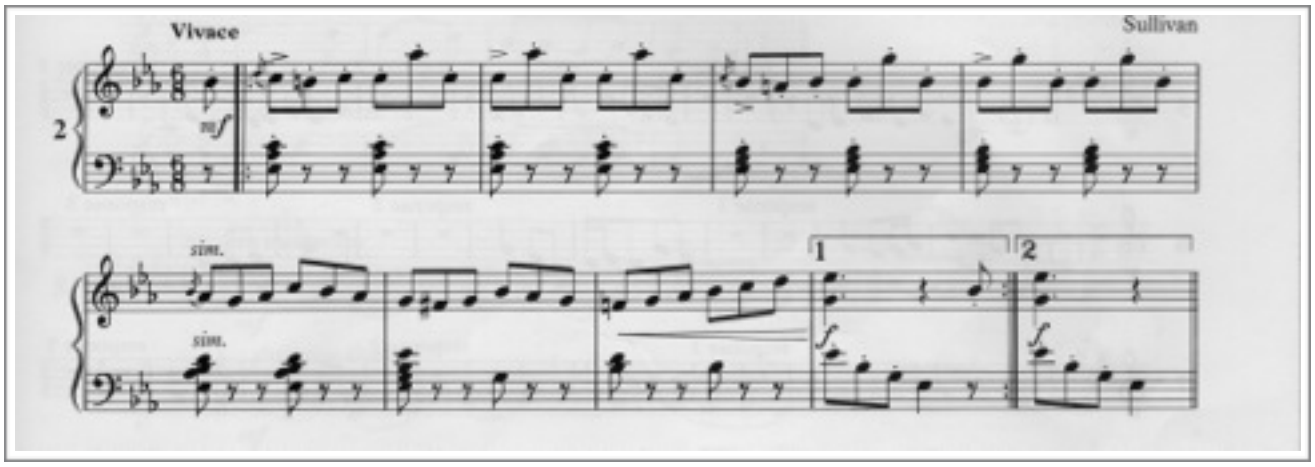
2.1 Pulse
Pulse 1 (ABRSM Test 1A No.3 p.3)



Pulse 2 (ABRSM Test 2A No.1 p.8)

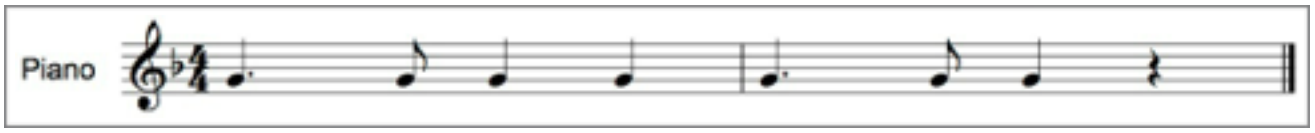


Pulse 3 (ABRSM Test 3A No.2 p.13)

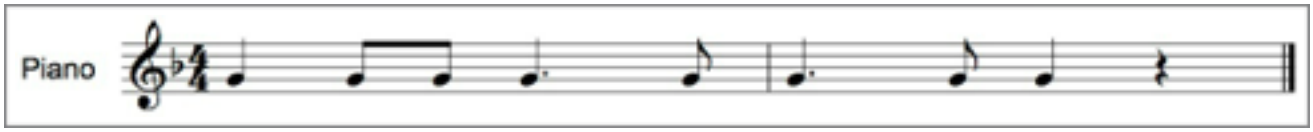


2.2 Rhythm Sequencing

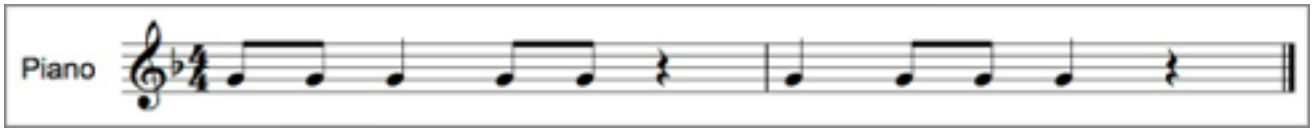
Rhythm 1



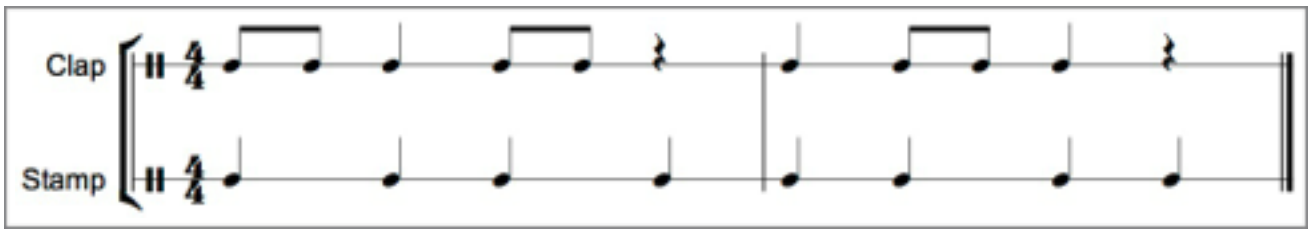
Rhythm 2



Rhythm 3



2.3 Pulse and Rhythm



Appendix D

Breath Cycle - Scottish Opera
Pre-Intervention Questionnaire (participants)

Client ID: _____ Age: _____ Gender: male / female

Birth Date: (D) ___ / (M) ___ / (Y) ___ Today's date: (D) ___ / (M) ___ / (Y) ___

1. How much musical experience have you had in the past?

Standard Grade Music (or equivalent) yes / no

Higher Grade Music (or equivalent) yes / no

Further Music training (university level) yes / no

Other _____

2. **Do you play an instrument / sing?** yes / no Discipline _____

~~**3. Have you ever written your own song before?** yes / no~~

4. Have you had formal instrumental / vocal tuition in the past? yes / no

If yes, in what discipline and for how long? _____

5. Do you hold any Associated Board Grades (or equivalent) yes / no

Highest practical grade_____ Highest theory grade _____

6. **What kind of music do you listen to? (circle all that apply)**

Pop Rock Heavy metal Dance Classical

Opera Jazz Blues Traditional Scottish Folk World

O t h e r

_____

7. How often do you listen to music? (circle one)

Every day 4-6 times per week 1-3 times per week

Once every 2 weeks Once a month Never

8. When do you listen to music? (circle all that apply)

At the gym At work At home When relaxing

At gigs/concerts When upset When happy When commuting

Other _____

9. **Have you ever been to see an opera being performed?** yes / no

If yes, what and where? _____

10. Have you ever listened to an opera or seen one on TV / at the cinema? yes / no

If yes, what and where? _____

11. **What was the last gig / concert you went to see?**

Band / ensemble _____ When did you go? _____

12. **How confident do you feel as a singer? (mark on the line below)**

Not at all confident Very confident

↓ ↓

13. Have you ever sung as part of a choir before? yes / no

14. Answer the following questions by ticking the relevant box:

	Not at all	A small degree	Neutral	A great deal	Completely
To what extent do you see yourself as a musician?					
To what extent do you see yourself as a singer?					
To what extent do you see yourself as creative?					
To what extent do you feel knowledgeable about ‘opera’?					
Is opera an art form you associate yourself with?					
To what extent are you anxious about participating in a project run by Scottish Opera?					
Do you consider yourself to be a confident singer?					
Do you find it easy to express your emotions?					
Do you feel that your condition may limit you in terms of what can be achieved in this project?					

Appendix E

Breath Cycle - Scottish Opera
Post-Intervention Questionnaire (participants)

Client ID: _____ Age: _____ Gender: male / female

Birth Date: (D) ___ / (M) ___ / (Y) ___ Today's date: (D) ___ / (M) ___ / (Y) ___

1. Over the last 12 weeks how often have you listened to music? (circle one)

Every day 4-6 times per week 1-3 times per week

Once every 2 weeks Once a month Never

2. Over the last 12 weeks what music have you listened to?

_____

3. Over the last 12 weeks when have you listened to music? (circle all that apply)

At the gym At work At home When relaxing

At gigs/concerts When upset When happy When commuting

Other _____

4. Have you listened to any music that you don't normally listen to, or have never listened to before over the last 12 weeks? yes / no

If yes, what has that music been? _____

5. **Since the project began, how many days have you practised singing in a week? (circle one)**

Every day 6 days 5 days 4 days

3 days 2 days 1 day None

6. **When you do practise, how long is it for? (circle one)**

0-5 mins 6-10 mins 11-15 mins 16-20 mins

21-25 mins 26-30 mins More than 30 minutes (please specify) _____

7. **How confident do you feel as a singer? (mark on the line below)**

Not at all confident Very confident

↓ ↓

---

8. **Answer the following questions by ticking the relevant box:**

	Not at all	A small degree	Neutral	A great deal	Completely
To what extent do you see yourself as a musician?					
To what extent do you see yourself as a singer?					
To what extent do you see yourself as a creative?					
To what extent have you enjoyed the experience?					
To what extent do you feel knowledgeable about 'opera'?					
Is opera an art form you associate yourself with?					
Did you feel a sense of achievement in your singing lessons?					
Do you consider yourself to be a confident singer?					

	Not at all	A small degree	Neutral	A great deal	Completely
~~Did you feel a sense of achievement in your song writing sessions?~~					
~~Did you find it easy to express your emotions when writing / singing songs?~~					
To what extent do you think the lyrics created reflect your individual identity / sense of self?					
To what extent do you think the music created reflects your individual identity / sense of self?					
Do you feel you made good progress in the face-to-face singing lessons?					
Do you feel you made good progress in the online singing lessons?					
How useful was it to have online feedback on excerpts you posted on iScore between lessons?					
Do you think your musical skills improved throughout the study?					
Do you feel a sense of accomplishment?					
Do you feel that your condition has limited you in terms of what you have achieved in this project?					
How much more likely are you to take part in another Scottish Opera project as a result of this project?					
How much more likely are you to listen to or go to an opera as a result of this project?					

Appendix F

Breath Cycle - Scottish Opera

Pre-Intervention Interview Questions (participants)

The following questions will be used as prompts for the interview situation:

1. What does the term ‘opera’ make you think of? / How would you describe opera?
2. What kind of expectations do you have of a project facilitated by Scottish Opera?
3. Do you see yourself as being musical?
4. Do you see yourself as being a singer?
5. Do you see yourself as being creative?
6. How does it make you feel when you sing?
7. What kind of music do you associate with? / What kind of music best describes who you are? - why?
8. Do you own an iPod or other mp3 device? / Is there any classical music on your playlists?
9. What are you hoping to gain from taking part in this project? (Personal level / in general terms)
10. What do you think Scottish Opera will learn from this project? / What are you able to teach us?

Appendix G

Breath Cycle - Scottish Opera

Post-Intervention Interview Questions (participants)

The following questions will be used as prompts for the interview situation:

1. What does the term 'opera' make you think of? / How would you describe opera? / Do you think the project has changed the way you view opera or classical music?
2. Do you see yourself as being musical / a singer / creative? why? how has that changed since the start of the project?
3. How does it make you feel when you sing? why?
4. What kind of music do you associate with? / What kind of music best describes who you are? - why?
5. Do you own an iPod or other mp3 device? / Is there any classical music on your device? If so, what?
6. Do you feel any physiological benefits from taking part in this project? If so, what?
7. Do you think you will continue to sing once this project finishes?
8. Did you find the singing lessons or song writing sessions cathartic in any way? Did they serve a purpose in expressing emotions and being able to communicate them in a different way? Does music and singing make it easier to deal with emotions? /Did you feel that singing gave you a different means of expressing yourself?
9. How did you find it working with the creative team?
10. How useful did you find the online lessons and feedback? How useful did you find the face-to-face lessons?
11. What do you feel you have gained from taking part in this project? / What has been the most / least enjoyable aspect of this project?
12. What do you think Scottish Opera can do to improve this project if it is run again? / What could we change to make it better? / What could we have done to improve your experience of the project?

Appendix H

Breath Cycle - Scottish Opera

Pre-Intervention Interview Questions (creative team)

The following questions will be used as prompts for the interview situation:

1. What does the term 'opera' make you think of? / How would you describe opera?
2. What kind of expectations do you have of a project facilitated by Scottish Opera?
3. How do you define yourself as a professional? / What do you see as being your job title? / What do you do? / How would you describe the work you do?
4. What is your identity? (singer / composer / instrumentalist / animateur / teacher / musician) / Do you see yourself as a performer?
5. Do you see yourself as being creative in your art form? / Does / will your work incorporate cross-disciplinary practice? / How has this / will this affect the way that you work (in this project / in other work)?
6. How does it make you feel when you perform / compose?
7. How does it make you feel when facilitating others to perform / compose?
8. What kind of music do you associate with? / What kind of music best describes who you are? - why?
9. What is your role in this project?
10. What are you hoping to gain from this project? (Personal level / in general terms)
11. What challenges do you think you will come across during this project? (personal level / professional level)
12. What do you see as being Scottish Opera's role in this project?
13. What do you think Scottish Opera will learn/gain from this project? / What are you able to teach them?

Appendix I

Breath Cycle - Scottish Opera

Post-Intervention Interview Questions (Creative Team)

The following questions will be used as prompts for the interview situation:

1. Do you think the project has changed the way you view opera as an art form?
2. How do you define yourself as a professional - has this changed since the start of the project?
3. Has your work on this project meant working differently to the way you usually work? How do you think this will impact on the way you work in future projects?
4. What do you feel you have gained from this project? (personally / professionally / technically / physically / psychologically)
5. What has been the most / least enjoyable aspect of this project?
6. Do you feel a sense of achievement having done this project? / What do you feel those achievements are? (personal / shared)
7. What have you personally brought to the project?
8. How did you find working with the participants? What was your relationship with them - did the fact that they were CF sufferers impact on this?
9. How did you find working with the rest of the creative team?
10. How useful did you find the online lessons and feedback? How useful did you find the face-to-face lessons?
11. What challenges have you come across during the project? (personal level / professional level)
12. Did you feel that Scottish Opera provided appropriate support during the prep time and running of this project?
13. What do you think Scottish Opera can do to improve this project, or your experience of working on it, if it is run again? / What could have been improved? / What worked well? / What have Scottish Opera gained?
14. Any other comments

Appendix J

Breath Cycle - Scottish Opera

Pre-Intervention Interview Questions (Scottish Opera)

The following questions will be used as prompts for the interview situation:

1. What does the term 'opera' mean to you? / How would you describe opera?
2. What is your role within Scottish Opera?
3. What is you role in the facilitation of this specific project?
4. What are your expectations of the project?
5. What are your expectations of the participants?
6. What are your expectations of the creative team? / What do you think their expectations are of you?
7. What do you think is expected from a project delivered by Scottish Opera in general terms?
8. In your experience do people have pre-conceived ideas as to what a project by Scottish Opera will involve? / If so, how do you address this?
9. This project combines 2 different disciplines (performing arts and medical science) both of which contain various sub-disciplines (those associated with SO: composer/singer/rep/research, and those associated with NHS: consultants/MDs/physio/research). What challenges does this create and how has this changed your approach to this particular project (in comparison to other projects the SO deliver)?
10. What are you hoping to gain from this project? (Personal level / in general terms)
11. What do you see as being Scottish Opera's role in this project?
12. What do you think Scottish Opera will learn/gain from this project?

Appendix K

Breath Cycle - Scottish Opera

Post-Intervention Interview Questions (Scottish Opera)

The following questions will be used as prompts for the interview situation:

1. What is Scottish Opera's role in this project?
2. What were Scottish Opera's aims of this project?
3. What was your role?
4. This project has been cross-disciplinary (the arts and medical science) how have you found the experience of working on a project with the NHS?
5. What challenges have you come up against?
6. What were your expectations from the creative team - did they fulfil these expectations?
7. The working environment for this project is not necessarily one that the creative team will have had training for - given the nature of the project how have Scottish Opera supported the creative team during the project?
8. What do you think the creative team expected from Scottish Opera?
9. What do you think the creative team has gained from the project?
10. What have the participants gained from the project?
11. What has Scottish Opera gained from the project?
12. If this or a similar project happens again, what would Scottish Opera do differently?
13. Is Scottish Opera planning to run this or a similar project in the future?

Appendix L

Breath Cycle

Scottish Opera Evaluation

Principal Researcher: Dr Rachel Drury

Evaluation Information - Participants

You are being invited to take part in an evaluation commissioned by Scottish Opera of the *Breath Cycle* project (in partnership with Gartnavel General Hospital Cystic Fibrosis Service and Scottish Opera). Please read the information below and sign the 'Research Agreement' at the end.

Aims of the evaluation:

1. To assess the impact of vocal training on musical development in Cystic Fibrosis patients
2. To assess the impact of vocal training on identity, and mental wellbeing in Cystic Fibrosis patients

On completion, the evaluation will be submitted to Scottish Opera and participants will not be personally identified. Your contributions will remain anonymous. This will also be true of any material published thereafter.

The evaluation will be used by Scottish Opera to show the benefits of Scottish Opera Education outreach programmes with the view to publicising outreach work, and securing funding opportunities for future projects. The results may also be published by the researcher in relevant journals.

The evaluation will consist of the following measures to be completed at the start and the end of the project:

- Rosenberg Self-Esteem Scale
- A questionnaire on musical knowledge and identity
- A recorded interview lasting approximately 30 minutes
- A short musical test (to be administered during the first and last vocal lessons)

Research Agreement

Please read the points below before signing the agreement.

I understand the aims of the evaluation

I understand what this evaluation will be used for

I understand that any information I provide will remain anonymous

I understand that the interviews will be recorded

I understand that any technology used during this project will remain the property of Scottish Opera

I understand that I can withdraw from this project at any time without having to provide a reason

I agree to take part in this evaluation

Signature: _____

Print name: _____

Date: _____

Countersigned by researcher:

Signature: _____

Print name: _____

Date: _____

For further information please contact:

Rachel Drury

r.drury@rcs.ac.uk

M. 07967 391 993

Appendix M

Breath Cycle
Scottish Opera Evaluation
Principal Researcher: Dr Rachel Drury

Evaluation Information - Creative Team and SO staff

You are being invited to take part in an evaluation commissioned by Scottish Opera of the *Breath Cycle* project (in partnership with Gartnavel General Hospital Cystic Fibrosis Service and Scottish Opera). Please read the information below and sign the 'Research Agreement' at the end.

Aims of the evaluation:

1. To assess the impact of vocal training on musical development in Cystic Fibrosis patients
2. To assess the impact of vocal training on identity, and mental wellbeing in Cystic Fibrosis patients
3. To assess the impact on the development of the creative team, and to evaluate the project as a whole

On completion, the evaluation will be submitted to Scottish Opera and participants will not be personally identified. Your contributions will remain anonymous. This will also be true of any material published thereafter.

The evaluation will be used by Scottish Opera to show the benefits of Scottish Opera Education outreach programmes with the view to publicising outreach work, and securing funding opportunities for future projects. The results may also be published by the researcher in relevant journals.

The evaluation will consist of the following measures to be completed at the start and the end of the project:

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I understand that any technology used during this project will remain the property of Scottish Opera

I understand that I can withdraw from this research at any time without having to provide a reason

I agree to take part in this evaluation

Signature: _____

Print name: _____

Date: _____

Countersigned by researcher:

Signature: _____

Print name: _____

Date: _____

For further information please contact:

Rachel Drury

r.drury@rcs.ac.uk

M. 07967 391 993