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Ebb and Flow: An Exploratory Study of Flow and Wellbeing in Virtual Choirs

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Abstract

Previous studies have shown that group singing elicits benefits for wellbeing as well as experiences of flow. However, the sphere of enquiry for research on group singing is mostly limited to in-person rather than virtual engagement. COVID-19-induced lockdowns and social distancing measures put choirs in the unique position of having to operate online in order to continue rehearsing. The present study contributed to a small but growing body of literature examining wellbeing and flow in virtual choirs. Research questions asked whether online singing is associated with wellbeing benefits and flow, and further enquired as to whether wellbeing outcomes were mediated by flow. A cross-sectional mixed-methods design was used in the present study which consisted of three phases: (1) a preliminary survey, (2) choir intervention and (3) semi-structured interviews. The samples comprised nineteen participants of whom fifteen were females and sixteen were White British, 108 participants of whom 81 were female and 103 were White British, and eight interviewees of whom six were female, respectively. Mixed ANOVAs, a *t*-test and mediation analyses were performed on quantitative survey data, while a thematic analysis was conducted to analyse qualitative interview data. Results suggested that online singing is associated with general wellbeing enhancement and the promotion of flow; additionally, the relationship between online singing and wellbeing was mediated by flow. This study imparts two conclusions warranting future study which are that (1) virtual choir engagement can elicit wellbeing benefits as well as flow and (2) group contexts may enhance flow experiences.

Keywords: virtual choir; wellbeing; flow; mixed-methods

1. Introduction

Mental illness incurs significant costs for individuals, communities and health care systems across the world, with financial costs before the COVID-19 pandemic amounting to an estimated £105 billion each year in England alone (Department of Health, 2009). Growing recognition of the personal as

well as economic costs have led to an increasing interest in group singing for its health and wellbeing benefits over the last two decades (Dingle, Clift, Finn, Gilbert, Groarke et al., 2019). Several systematic reviews have linked group singing with enhanced wellbeing and increased self-esteem in the general population (Clift, Hancox, Staricoff, and Whitmore, 2008), along with increased lung health (Irons, Petocz, Kenny, and Chang, 2019) and reduced risk of experiencing a range of mental health disorders, including depression (Daykin, Mansfield, Meads, Julier, Tomlinson et al., 2018), anxiety (Williams, Dingle, and Clift, 2018) and stress (Clift, Nicol, Raisbeck, Whitmore, and Morrison, 2010). However, the primary studies reviewed suffer from several methodological limitations, which include small samples, non-random sampling, limited follow-up and lack of control groups. Nonetheless, convergence in findings reflects the potential wellbeing benefits of group singing, which according to Stewart and Lonsdale's (2014) findings surpass the reported wellbeing benefits of solo singing. However, a drawback of their study is that some participants took part in both conditions, meaning wellbeing scores may reflect the aggregate effects of the two activities. In response to COVID-19 restrictions curtailing in-person (IP) rehearsals, this study addresses the question of whether it is possible to translate the demonstrable wellbeing benefits of IP group singing to virtual adaptations of choirs. In addressing this question, the introduction section is divided into two parts. The first part conceptualises the robust link between group singing and enhanced wellbeing, postulating that flow may account for the benefits choir members derive from rehearsals, while the second part examines existing research on choirs and flow online, synthesising findings of relevance to the present study.

1.2. Group Singing, Wellbeing and Flow

Defining Wellbeing

Preliminary definitions of wellbeing emphasise an affective state in which positive affect (PA) outweighs negative affect (NA; Bradburn, 1969), while later definitions have construed wellbeing as flourishing, which denotes a state of positive psychological functioning (Seligman, 2011). The definition of wellbeing used in the current study therefore consists of three dimensions: PA, NA and flourishing. Broadening the definition of wellbeing to include flourishing challenges conceptions of wellbeing as simply a state of happiness, reframing it as a dynamic process that encompasses optimal functioning, which elicits among other feelings positive emotions. While various scales have been developed to measure wellbeing, in the present study affect and flourishing were used as per the definition, as both psychological constructs are operationalised in self-report measures.

The Flow Concept

One of the ways by which singing may enhance wellbeing is through Csikszentmihalyi's (1975) concept of flow. This describes a subjective state in which a person experiences total absorption in an activity, to the extent that their consciousness is entirely rooted in that moment in a way that is enjoyable and intrinsically rewarding (Csikszentmihalyi, 1975; 1997). To date, there has been no research investigating the mediating role of flow in the relationship between group singing and wellbeing, which the current study seeks to address in its quantitative enquiry. When in flow people describe a merging of action and awareness resulting in a loss of self-consciousness, a sense of mastery over the activity itself, and an altered sense of time due to task engrossment (Csikszentmihalyi, 1975). In inducing flow, the activity itself should set clear goals, strike a challenge-skill balance whereby the activity affords some challenge to the individual within the scope of their ability, while also providing immediate feedback (Nakamura and Csikszentmihalyi, 2002). A limited body of work on social flow (Nakamura and Csikszentmihalyi, 2002) has investigated flow experiences at the group level, broadening the sphere of enquiry for flow which has traditionally been limited to the experiences of individuals undertaking solo pursuits (Jackson and Kimiecik, 2008). Research indicates that there is a positive association between social flow and the quality of interpersonal relationships (Bakker, Oerlemans, Demerouti, Slot, and Ali, 2011; Salanova, Rodríguez-Sánchez, Schaufeli, and Cifre, 2014), although findings are limited by their exclusive reliance on self-report measures, the accuracy of which varies according to various psychological factors (Baumeister, Vohs, and Funder, 2007). Nonetheless, this suggests that shared

activities like group singing, in facilitating social bonding, may allow participants to achieve greater levels of absorption in the activity itself.

Flow and IP Engagement in Group Singing

Qualitative evidence suggests that musical engagement is conducive to a state of flow, with frequent recollections of people ‘being lost in the music’ and ‘caught in the moment’ interpreted as markers indicative of flow (Baker and MacDonald, 2013; Diaz, 2013; Wrigley and Emmerson, 2013). Anecdotal reports are reinforced by quantitative data, as Keeler et al. (2015) reported findings that indicate group singing can induce social flow, although findings are limited by the small sample size ($N = 4$). Moreover, whether the experience of four professionals translates to amateurs warrants further exploration. Nonetheless, it is posited that group singing is flow-inducing because it is cognitively and socially stimulating (Bailey and Davidson, 2002; Livesey, Morrison, Clift, and Camic, 2012). Importantly, this research highlights the complexities of distinguishing between the cognitive and social components of group singing and their respective influences on flow experiences.

1.3. Choir Engagement and Flow in an Online Context ***Online Engagement in Group Singing***

Engagement in virtual choirs (VCs) has rapidly risen with COVID-19-related national lockdowns and social distancing measures prohibiting IP choir rehearsals. A mixed-methods study by Philip et al. (2020) of a choir for people with chronic obstructive pulmonary disease (COPD), which moved online in response to the UK lockdown, showed a prospective connection between VC attendance and improved depression, as well as enhanced balance confidence. However, as the sample consisted of people with COPD, the results are of limited generalisability to the wider population. Furthermore, contrary to quantitative findings suggesting positive wellbeing outcomes, qualitative data indicated that some participants did not experience their usual sense of enhanced wellbeing in VC. Similarly, qualitative findings reported by Draper and Dingle (2021) suggested that psychological wellbeing was lower for groups operating virtually rather than IP, although retrospective reflection on IP rehearsals may have introduced an element of nostalgia that biased participants’ responses. A study of VC experiences in Scandinavia during a partial lockdown indicated that participants missed the social aspects of IP rehearsals more than other dimensions, such as flow, breathing training and aesthetic experience (Theorell, Kowalski, Theorell, and Horwitz, 2020). Likewise, Daffern, Balmer and Brereton’s (2021) thematic analysis (TA) of survey data drawn from a large sample ($N = 3948$) during the UK’s first lockdown suggested that participants missed the social dimension of rehearsals in VC, although the context of societal lockdowns likely contributed to participants valuing socialisation highly. While qualitative research is useful in providing an insight into the experiences of those partaking in VCs, quantitative data, which is currently limited to Philip et al.’s (2020) study, is crucial in quantifying wellbeing outcomes for VC engagement. The current study aims to help rectify this with a mixed-methods design, which explores the role of flow in mediating the relationship between VC engagement and wellbeing outcomes.

Flow Experiences Online

While there is currently no comprehensive research on flow in the context of VCs, making this study’s exploration novel, Chen (2007) reported findings that indicated online activities, specifically gaming, are amongst the most flow inducing of all pursuits, although technology reviewed in the study is now heavily outdated. More recently, Cruea (2020) has argued convincingly that online gaming is well-suited to inducing a state of flow because it meets each of the preconditions set out by Nakamura and Csikszentmihalyi (2002), in providing clear goals and timely feedback while also adjusting challenges to players’ capabilities. Whether an online activity like VC that delivers a singular experience to multiple

users, rather than a tailored service to the individual user, can successfully meet these criteria has yet to be explored, but will be addressed in the qualitative component of this study. Moreover, certain elements of the online environment, in allowing for distraction, have been proposed to reduce optimal focus (Thatcher, Wretschko, and Fridjhon, 2008), suggesting that being online can hinder as well facilitate flow.

2. Aims, Research Questions and Hypotheses

To date, few studies have examined the impact on wellbeing of VC engagement, or given due consideration to the processes that mediate potential related wellbeing benefits. This gap in the literature has increased in importance with the COVID-19 pandemic, due to which choirs have had to suspend activity or move to an online mode of delivery, with fears of aerosol transmission prolonging the return of IP choir rehearsals (Williams and Underhill, 2020). Hence, the current study was set up to help address the underexplored effects of VC, by assessing wellbeing outcomes associated with online singing practices and examining the contribution of flow to these outcomes. Additionally, qualitative research was used as a means of providing an insight into the experiences of those engaging in VC.

Based on literature reviewed, the following research questions (RQs) and hypotheses are proposed:

Do online singing practices contribute to an increase in overall wellbeing?

Hypotheses:

1. Participants will demonstrate significantly higher levels of self-reported wellbeing after engaging in the online singing intervention.
2. Participants in the group condition will demonstrate a significantly greater increase in levels of self-reported wellbeing than participants in the solo condition.

Does singing online as a group produce more flow than singing online solo?

Hypothesis:

1. Participants in the group condition will demonstrate significantly higher levels of self-reported flow than participants in the solo condition.

Does flow mediate the relationship between online singing practices and overall wellbeing?

Hypothesis:

1. Flow will act as a mediator of the effects of the online singing intervention on the wellbeing of participants.

3. Methods **Study Design**

The present study assessed wellbeing and flow in online group singing practices using a mixed-methods, cross-sectional design. Quantitative and qualitative data were collected from choir members in the form of survey and interview responses across three phases of the study which comprised a (1) preliminary survey (PS), (2) choir intervention and (3) eight semi-structured interviews.

Phase 1

This first phase involved a fifteen-minute survey which was distributed to collect data on the optimal conditions under which VCs operate. Participants were asked to specify the ideal length of an online choir session, whether a socialisation break was taken, and whether their audio was on or off while rehearsing. These findings then informed how the intervention phase of the study operated.

Phase 2

The choir intervention phase of the study comprised a two-group pre-test/post-test design which involved participants completing a survey prior to and following an intervention session. The surveys were created using Qualtrics software and accessed via an online link distributed by the choir director. The pre-intervention survey comprised sociodemographic questions, as well as self-report measures assessing affect and flourishing, providing a baseline measure for each. Following completion of the survey, choirs took part in one of two conditions to which they had been randomly allocated. The group condition involved choirs rehearsing as a group with their cameras on, while the solo condition entailed choir members rehearsing individually with their cameras switched off. As determined by the PS, participants rehearsed for thirty minutes in the assigned condition during which they were asked to keep their audio off. It was intended that there would be a third control condition in which participants would listen to the music repertoire they ordinarily sang in choir. However, choir directors recognised that participants would be paying for a session that would fail to deliver if the singing element was taken out. Since baseline data provided a comparison point, a control was deemed nonessential, and heeding the advice of choir facilitators this condition was removed. Following the session, participants completed a post-intervention survey, which included the same pre-measures of wellbeing and an additional measure of flow. The intervention session was delivered by choir directors who used Zoom video conferencing software and read aloud a script on behalf of the researchers.

Phase 3

Semi-structured interviews were conducted following intervention completion. There were twenty-seven open-ended questions in total, but the researchers were flexible in their approach to questioning allowing for a discussion of issues of relevance that emerged. The interviews were recorded and transcribed using Microsoft Teams software, with the researchers cross-checking the transcripts with the original recordings to minimise potential errors. Interviews lasted between forty and sixty minutes.

3.1. Sample

Population and Eligibility

Phase 1. Adults were eligible to participate if they were a member of a virtual or IP choir previously or currently. The sample ($N = 19$) comprised twelve participants who attended VC at the time of completion (63.2%), four who no longer attended VC (21.1 %), and three who had not engaged in VC (15.8 %). Fifteen of the sample were female (78.9%) and four were male (21.1%), and sixteen identified as White British (84.2%) and three as White but not British (15.8%).

Phase 2. Participants were recruited from adult community choirs which were eligible to partake if they were non-paid, UK-based, of an amateur level, and sang aloud rather than using British Sign Language. As preliminary findings substantiated anecdotal reports that suggested fewer people were attending choirs since they moved online, each choir was required to have a minimum of fifteen attendees. Additionally, it was stipulated that participants had to provide informed consent to confirm that they had adequate command of the English language and the cognitive ability to understand the consent procedure. As shown in Figure 1, a total of 136 participants were eligible to take part in the intervention. Of these, twelve failed to provide an identifying code to link their pre-test and post-test surveys, and sixteen completed only one of the two surveys. This resulted in a sample that comprised 108 participants, of whom sixty-eight were randomly assigned to the group condition (63.0%) and forty were in the solo condition (37.0%). Participants were adults aged over twenty-five years, and the sample predominantly identified as White British ($n = 103$, 95.4%) and female ($n = 81$, 75.0%). Participant ethnicity and gender breakdown did not differ significantly across conditions. As participants were recruited from UK choirs, at the time of partaking in the intervention participants were presumably living with COVID-19 social

distancing measures in place and limits on one's social contact. An overview of sociodemographic variables is provided in Table 1.

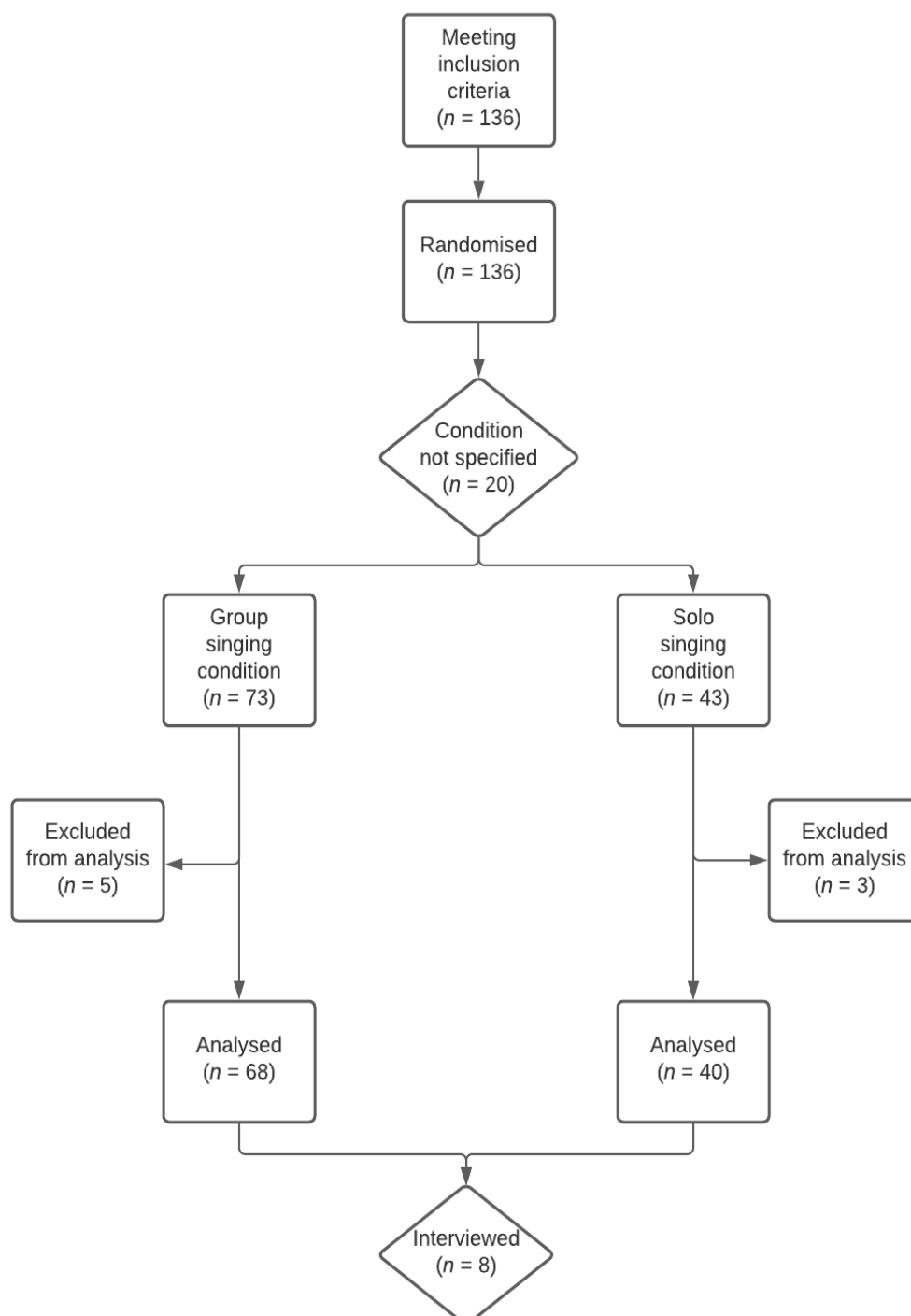
Table 1. Sociodemographic Characteristics of Participants in Phase 2

Characteristic	<i>n</i>	%
Gender		
Female	81	75.0
Male	27	25.0
Age		
26-45	6	5.6
46-65	29	26.8
66 or above	73	67.6
Ethnicity		
White British	103	95.4
Other White background	3	2.8
Prefer not to say	1	.9
Other	1	.9
Occupation		
Employed (full-time)	15	13.9
Employed (part-time)	10	9.3
Unemployed	1	.9
Retired	77	71.3
Home parenting	1	.9
Caregiver	1	.9
Other	3	2.8
Mental health diagnosis		
Yes	5	4.6
No	102	94.4
Prefer not to say	1	.9
Mental illness symptoms ^a		
Yes	2	1.9
No	99	91.7
Prefer not to say	3	2.8

Note. This table lists only the response options that participants selected. ^a These statistics represent those who provided a response rather than the full sample.

Phase 3. There were eight interviewees, of whom six were female (75.0%) and two were male (25.0%).

Figure 1. Flowchart of Participants in Phases 2 and 3



Power Analyses

To achieve adequately powered analyses, G*Power (Faul, Erdfelder, Lang, and Buchner, 2007) was used to perform an *a priori* power analysis for each statistical test that was intended to be used in the study. Originally, a one-way analysis of variance (ANOVA) was planned to investigate differences in flow scores across three conditions: group singing, solo singing and group listening. A power analysis using the *F* tests function and the algorithm for ANOVA determined that a total sample size of 159 participants was needed to detect differences between the three groups with 80% probability. Hence a choir sample of twelve was calculated on the basis that sufficient power could be achieved with each choir having only fourteen members participate in the intervention.

The decision to remove the group listening condition resulted in the statistical test being changed, and the sample size being recalculated accordingly. An independent-samples *t*-test was proposed to investigate whether there was a significant difference in flow scores between participants in the two conditions: group singing and solo singing. An estimate for effect size was based on Cohen's (1988) guidelines, as comparable studies providing a guide for an appropriate estimate were lacking. Following Cohen's guidelines $\delta = .50$ was entered into the power analysis, with the following input parameters: α (two-sided) = .05, power = .80, allocation ratio = 1:1. The result obtained suggested that $N = 128$ ($n_1 = 64$; $n_2 = 64$) was required for this analysis. Recent qualitative findings suggested that technological barriers had presented as a common issue during choir rehearsals (Daffern et al., 2021; Draper and Dingle, 2021). In accounting for the possibility that technological difficulties would prohibit some participants from completing the intervention, the researchers decided to keep twelve choirs in the sample, reducing the number of participants from each choir required to achieve power from fourteen to eleven.

A mixed ANOVA was planned to assess group differences in wellbeing scores and to detect significant condition*time interactions. An *a priori* power analysis was performed, for which the effect size was estimated using Cohen's (1988) guidelines as there was a shortage of similar studies to provide a reliable estimate. To retrieve the suggested sample size, $f = .25$ was inserted into the power analysis, along with $\alpha = .05$, power = .80, number of groups = 2, and number of measurements = 2. The power analysis result indicated that the estimated sample size for this analysis was 98 participants, which was due to be exceeded.

A mediation analysis was proposed to test whether the effect of online singing on wellbeing was mediated by flow. An *a priori* analysis provided a sample size estimate for this analysis using the *F*-tests function and the algorithm for linear multiple regression. Based on Cohen's (1998) guidelines, due to the dearth of prior research to inform an estimate, a medium effect size estimate of $f^2 = .15$ was inserted into the analysis, with $\alpha = .05$, power = .80, and number of predictors = 2. The result of this power analysis yielded a sample size estimate of 68 participants, which was due to be exceeded.

4. Procedures

Recruitment

Phase 1. Convenience sampling took place on social media, with the research team sharing a link to the Qualtrics survey on Twitter, Facebook, Instagram and WhatsApp. On these platforms, people were asked or opted to share the survey with friends and followers.

Phase 2. Convenience sampling was used for choir recruitment. The research team invited 200 choir directors to partake in the study using publically available email addresses of choir groups, while also publicising the intervention using social media. Despite these efforts, it was not possible to recruit the twelve choirs as planned, with a total of eight choirs being recruited instead. As one of these did not complete the intervention within the required timeframe, a total of seven choirs took part in the intervention, of which four were in the group condition and three were in the solo condition. Choir groups

were non-randomised to allow participants in the group condition to rehearse with their fellow members rather than people they did not know.

Phase 3. Following the intervention, participants were invited to email the researchers if they were interested in being interviewed, information sheets were then distributed to these participants, after which willing volunteers registered by email. From the twelve volunteers, the researchers randomly selected eight participants to be interviewed.

Ethical Considerations and Approval

The present study was approved by the University of Edinburgh's Clinical Psychology Ethics Committee on 12th May 2021 (see Appendix A). Prior to this, both researchers completed three online training courses on data management and data protection. The University acted as Sponsor for this project (see Appendix B).

For each phase of the study, prior to participation, written consent was obtained from participants using an electronic signature platform, confirming that they had read and understood the participant information sheet. Upon completion, debrief forms were shared with participants which provided details of the study's aims, anticipated results, and relevant wellbeing resources should the contents of the survey(s) or interview have caused distress.

4.1. Measures

Positive and Negative Affect Schedule (PANAS; Watson, Clark, and Tellegen, 1988)

This measure comprises ten items that assess PA and ten items measuring NA. Each item consists of an adjective, such as 'excited,' that represents a facet of feeling either positive or negative, that participants rated on a 5-point scale, from "1" (Very slightly or not at all) to "5" (Extremely). Scores for the PA and NA subscales were then summed up from their respective items, with higher scores representing higher levels of said affect. The PANAS is well supported as a psychometrically sound measure of subjective wellbeing in the general population (Carvalho, Andreoli, Lara, Patrick, Quintana et al., 2013; Humboldt, Monteiro, and Leal, 2017). In the present study, Cronbach's alphas were .91 and .95 for the PA subscale and .81 and .86 for the NA subscale in the pre-and post-intervention surveys, respectively.

Flourishing Scale (FS; Diener, Wirtz, Tov, Kim-Prieto, Choi et al., 2010)

This measure consists of eight items, each of which is a self-referencing statement, for example "People respect me," for which participants rated their level of agreement on a 7-point Likert scale, from "1" (Strongly disagree) to "7" (Strongly agree). An overall score was given by the sum of ratings, with higher scores indicating higher levels of psychological flourishing. The FS displays robust psychometric properties (Hone, Jarden, and Schofield, 2014; Howell and Buro, 2015), and previous studies have used the measure in conjunction with PANAS to assess respondent's wellbeing (e.g., Baker, Rickard, Tamplin, and Roddy, 2015). Cronbach's alphas were .90 and .91 for the pre-and post-intervention surveys, respectively.

Flow State Questionnaire of the Positive Psychology Lab (PPL-FSQ; Magyaródi, Nagy, Soltész, Mózes, and Oláh, 2013)

The PPL-FSQ measures two dimensions of flow, (1) the balance between challenge and skills and (2) absorption in the activity, using twenty items that participants rated on a 5-point Likert scale, from "1" (Strongly disagree) to "5" (Strongly agree). A sample item is "This task was not too difficult." After

reverse scoring necessary items, total scores were calculated by summing the ratings, with higher scores indicating greater levels of flow. Exploratory factor analyses have yielded results that indicate the measure is psychometrically robust (Magyaródi et al., 2013), and a Cronbach's alpha of .95 in this study determined that the scale had a high level of internal consistency.

4.2. Analysis Plan

Quantitative Analyses

Statistical analyses were conducted using IBM's Statistical Package for Social Sciences (SPSS), Version 25.0.

The first two hypotheses were examined using a mixed ANOVA, which determined whether the different conditions or time points influenced wellbeing outcomes, while also investigating condition*time interactions. Examination of studentized residuals for values greater than ± 3 was used to detect outliers. Preliminary analyses followed to assess whether there were any violations of the assumptions of (a) normality of distribution, (b) homogeneity of variances, and (c) equality of covariances, as determined by visual inspection of normal Q-Q plots, the Levene's test and Box's M test, respectively (Laerd, 2015).

An independent-samples *t*-test was used to assess the hypothesis for the second RQ postulating that the group condition would facilitate higher levels of flow than the solo condition. In running the analysis, boxplot inspection identified any significant outliers, normal Q-Q plots determined normal distribution, and the Levene's test checked for violations of the assumption of homogeneity of variances (Laerd, 2015).

To examine the hypothesis for the third RQ, that flow mediates the relationship between intervention engagement and wellbeing outcomes, a mediation analysis was conducted using *PROCESS* macro for SPSS (Hayes, 2017). Mediation is tested through running regressions (Baron and Kenny, 1986); hence it was required that the data met the five assumptions of the regression model. The following tests ensued: (a) scatterplots were plotted to examine linearity; (b) normal P-P plots and histograms established whether residuals were normally distributed; (c) scatterplots assessed homoscedasticity; (d) the Durbin-Watson statistic ensured residuals were independent; (e) Mahalanobis distance and Cook's distance checked for significant outliers; and (f) a point-biserial correlation was run between the predictor and mediator variables to detect multicollinearity (Laerd, 2015).

Thematic Analysis

The research team chose to conduct a TA of the semi-structured interviews, triangulating these with quantitative data to provide a more comprehensive understanding of VC experiences. All interview data was inputted into NVivo, a qualitative data analysis programme, and analysed inductively for codes to ensure that the themes reflected the data set in its entirety (Braun and Clarke, 2006). Braun and Clarke (2006) identified six steps that provided a framework for conducting the TA. The first step was to become familiar with the data which involved the researchers reading the transcript several times. The second step was to generate initial codes which the researchers undertook using NVivo software. The transcript was sieved for meaningful excerpts of data that constituted a code (Braun and Clarke, 2006), and these units were organised into 'nodes.' The two researchers completed coding independently and where possible used the language of participants to name nodes allowing for coding commonalities. A weighted kappa coefficient test indicated that there was moderate agreement between the two coders, $\kappa = .51$. The third step entailed a search for themes, which comprise coded extracts that are united by a central idea conceptualising something important for the RQ(s) (Braun and Clarke, 2020). For this, codes were compiled into main themes and subthemes that were relevant to the analysts' respective RQs. While an inductive analysis was conducted, the generation of themes did not take place in a theoretical vacuum but was informed by recognition of relevant theoretical assumptions informing the coders' subjectivities,

facilitating a reflexive approach to the TA (Braun and Clarke, 2020). This was a recursive analytic process as themes were revisited and revised accordingly, accomplishing step four, to review themes. Following this, step five was to define and name themes, which involved a final stage of theme refinement, as themes were identified as latent or semantic (see Appendix D). Step six comprised the write-up during which, in true recursive style, one of the sub-themes was repositioned (OC as less pleasurable).

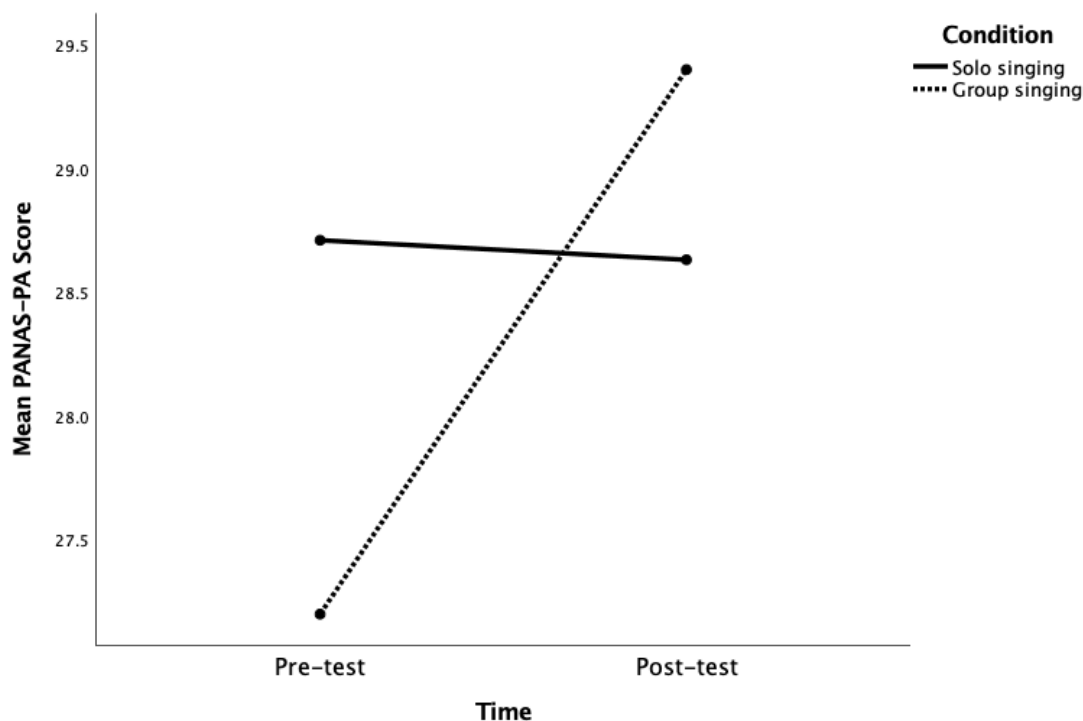
5. Results

Tests of Differences

Differences in PA

A mixed ANOVA was conducted, for which the within-subjects factor consisted of pre-test and post-test scores for the PA subscale of PANAS, and the between-subjects factor comprised group or solo singing. An inspection of studentized residuals identified no outliers and an examination of the Normal Q-Q plots determined data were normally distributed. Based on the Levene's test (pre-test $p = .11$, post-test $p = .22$) and Box's M test ($p = .45$), data met the assumptions of homogeneity of variances and covariances, respectively. While the profile plot in Figure 2.1 indicated that there might be an interaction effect, the test output determined that there was no statistically significant condition*time interaction, $F(1,101) = 2.16$, $p = .14$, partial $\eta^2 = .02$. Additionally, the main effects showed there was no significant difference in mean PA scores prior to and following the intervention, $F(1,101) = 1.87$, $p = .17$, partial $\eta^2 = .02$, and nor was there a significant difference across conditions, $F(1,101) = .06$, $p = .80$, partial $\eta^2 = .001$. The descriptive statistics and the number of participants included in each mixed ANOVA are presented in Table 2.

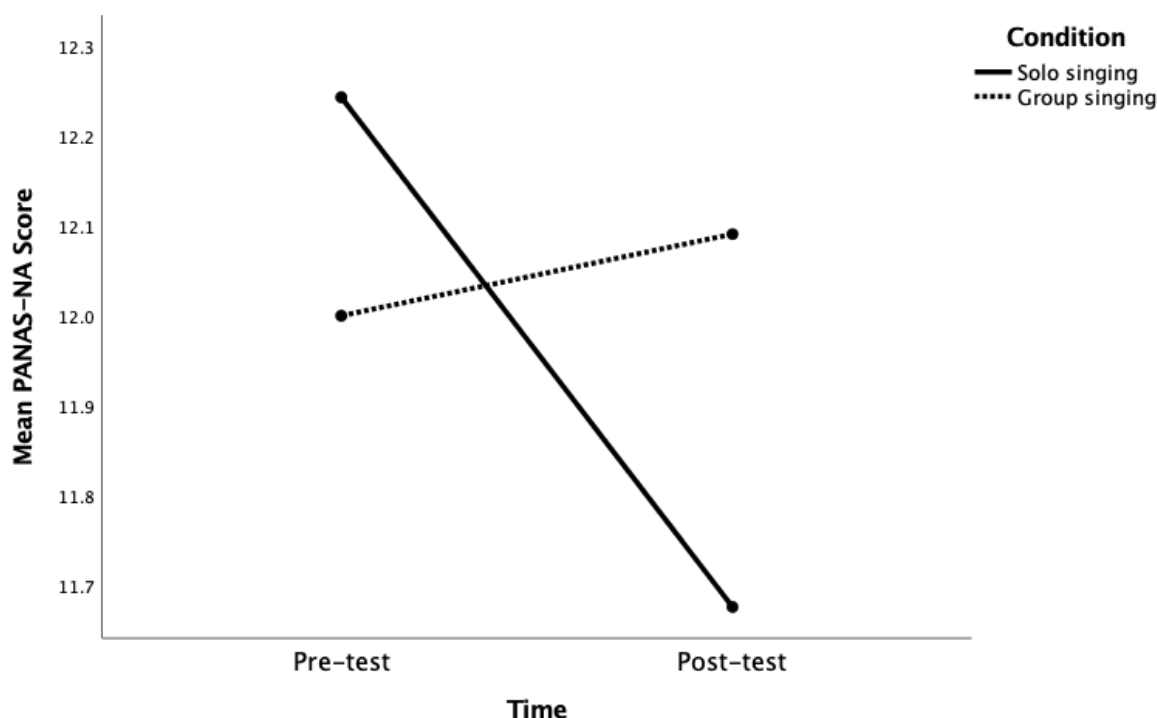
Figure 2.1. Pre-Test and Post-Test Measures of PA Across Conditions



Differences in NA

A second mixed ANOVA was run for the NA subscale of PANAS. Inspection of the Normal Q-Q plots indicated that data were not distributed normally. However, since ANOVAs are somewhat robust to violations of normality (Blanca Mena, Alarcón Postigo, Arnau Gras, Bono Cabré, and Bendayan, 2017; Schmider, Ziegler, Danay, Beyer, and Bühner, 2010), and data were similarly skewed for each condition minimising related problems, the decision was made to proceed with the analysis. Inspection of studentized residual values identified five outliers, however these had scores that were within the range of possible values for the PA subscale, warranting the inclusion of these cases in the analysis. There was homogeneity of variances, as indicated by the Levene's Test (pre-test $p = .85$, post-test $p = .71$), however data violated the assumption of homogeneity of covariances, as concluded from the Box's M test ($p = .001$). While differing slopes in Figure 2.2 might indicate a condition*time interaction, the output determined that there was no significant interaction, $F(1,101) = .81$, $p = .37$, partial $\eta^2 = .01$, and nor was there a significant main effect for time, $F(1,101) = .42$, $p = .52$, partial $\eta^2 = .004$, or condition, $F(1,101) = .02$, $p = .90$, partial $\eta^2 < .001$.

Figure 2.2. Pre-Test and Post-Test Measures of NA Across Conditions



Differences in Flourishing

A third mixed ANOVA was conducted, with FS scores as the within-subjects factor and condition as the between-subjects factor. Based on the Normal Q-Q plots, flourishing scores were approximately normally distributed. Inspection of studentized residuals identified two outliers, however as there was no theoretical basis on which to explain and therefore exclude these cases, they were retained unchanged in the data file. The assumption of homogeneity of variances was met (pre-test $p = .40$, post-test $p = .59$), as assessed by the Levene's test, while data violated the assumption of covariances ($p < .001$), as determined by the Box's M test. As one might suppose from Figure 2.3, the analysis showed that there was no significant interaction effect, $F(1,101) = .03$, $p = .87$, partial $\eta^2 < .001$, no significant

main effect for time $F(1,101) = 1.66, p = .20$, partial $\eta^2 = .02$, and nor was there a significant main effect for condition, $F(1,101) = .03, p = .86$, partial $\eta^2 < .001$.

Figure 2.3. Pre-Test and Post-Test Measures of Flourishing Across Conditions

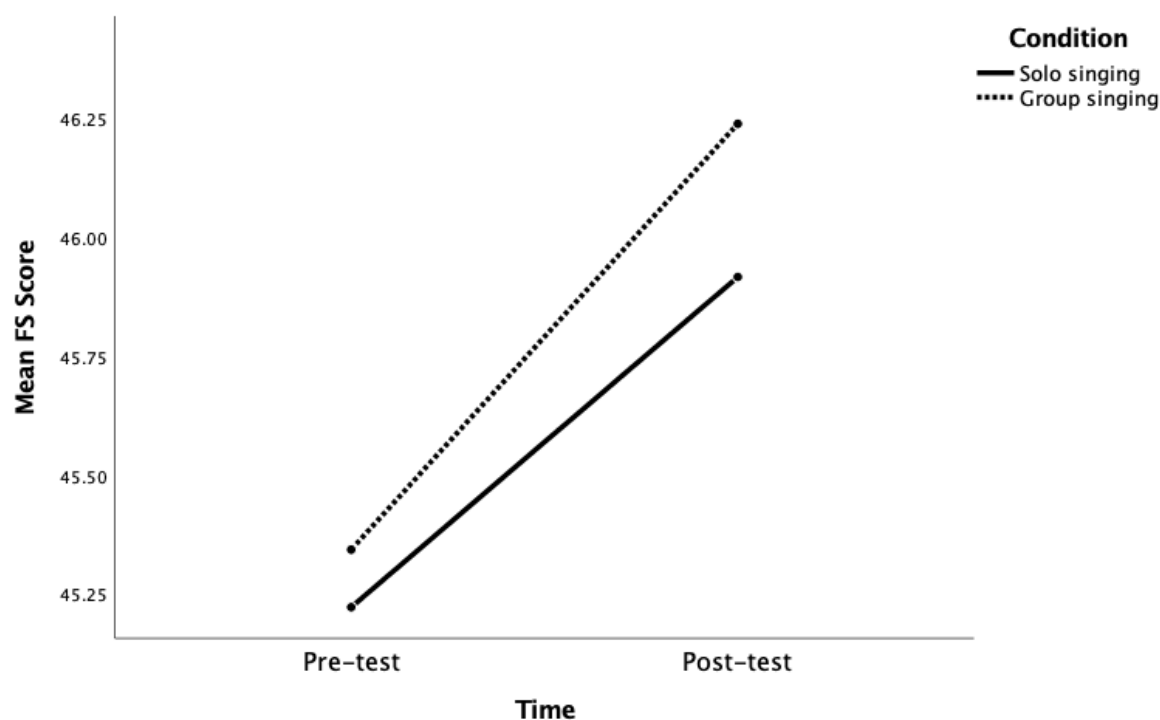


Table 2 presents the sample size, mean scores and standard deviations for the sub-samples of group and solo singing at pre-test and post-test.

Table 2. Descriptive Statistics Table for Wellbeing Variables

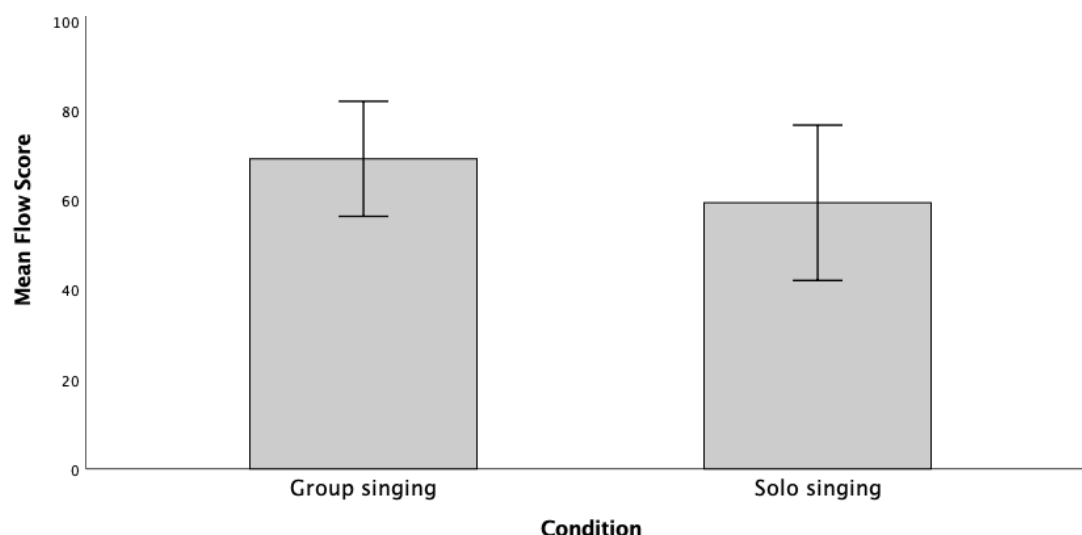
		Group singing					Solo singing			
		Pre-test		Post-test			Pre-test		Post-test	
Wellbeing variable	<i>n</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PANAS-PA	65	27.20	7.22	29.40	9.56	38	28.71	5.67	28.63	9.07
PANAS-NA	66	12.00	3.05	12.09	3.99	37	12.24	4.16	11.68	4.06
FS	67	45.34	7.95	46.24	6.71	36	45.22	5.97	45.92	5.99

Differences in Flow

An independent-samples *t*-test was conducted to determine whether there were differences in flow scores between participants in the group and solo conditions. Three participants in the solo condition had missing data, hence they were excluded from this analysis ($n = 105, 97.22\%$). As the Levene's test for equality of variances was significant ($F = 3.21, p = .08$), violating the assumption of homogeneity of variances, a Welch *t*-test was run. There were no outliers, as determined by boxplot inspection, and flow scores for participants in each condition were approximately normally distributed, as determined by

Normal Q-Q plots. As represented in Figure 3, the output indicated that there was a statistically significant difference in mean flow scores between participants in the group condition ($M = 69.21$, $SD = 12.84$) and the solo condition ($M = 59.41$, $SD = 17.34$), with participants in the former condition scoring higher than the latter, $M = 9.80$, 95% CI [3.30, 16.30], $t(57.90) = 3.02$, $p = .004$.

Figure 3. Comparison of Mean Flow Scores in the Group and Solo Singing Conditions

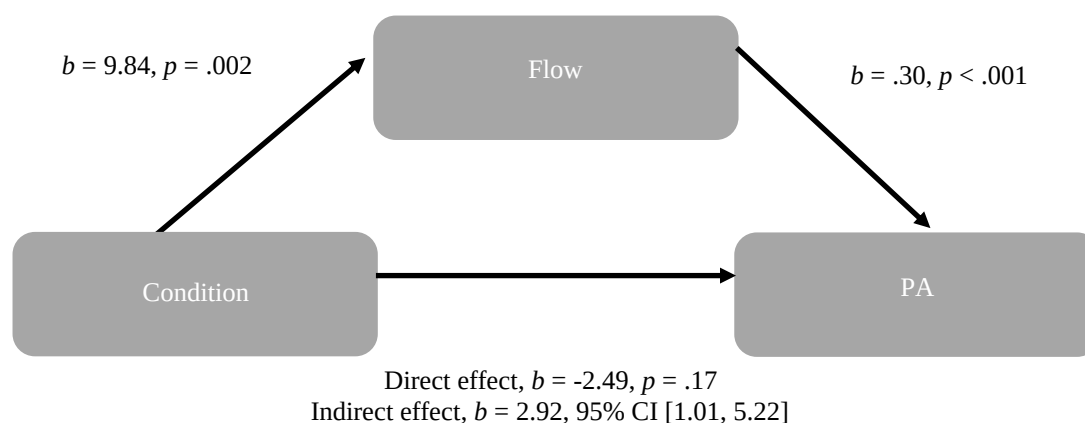


Tests of Prediction

Predicting PA Outcomes

A mediation analysis was run to determine whether the relationship between condition (predictor variable) and post-test scores for the PA subscale of PANAS (outcome variable) could be explained by their relationship with flow (mediator variable). A scatterplot of PA scores against condition showed a linear relationship between variables. Data were normally distributed, as assessed by inspection of normal P-P plots and histograms. There was homoscedasticity and independence of residuals, as determined by inspection of the scatterplot of standardised residuals versus standardized predicted values, and a Durbin-Watson statistic of 1.80, respectively. Inspection of the Mahalanobis distance and Cook's distance detected no outliers, with maximum values of 8.93 and .30, respectively. A point-biserial correlation between condition and flow scores indicated that data met the assumption of collinearity in all three mediation analyses, $r_{pb}(103) = .31$, $p = .001$.

Figure 4.1. Model of Condition as a Predictor of PA, Mediated by Flow

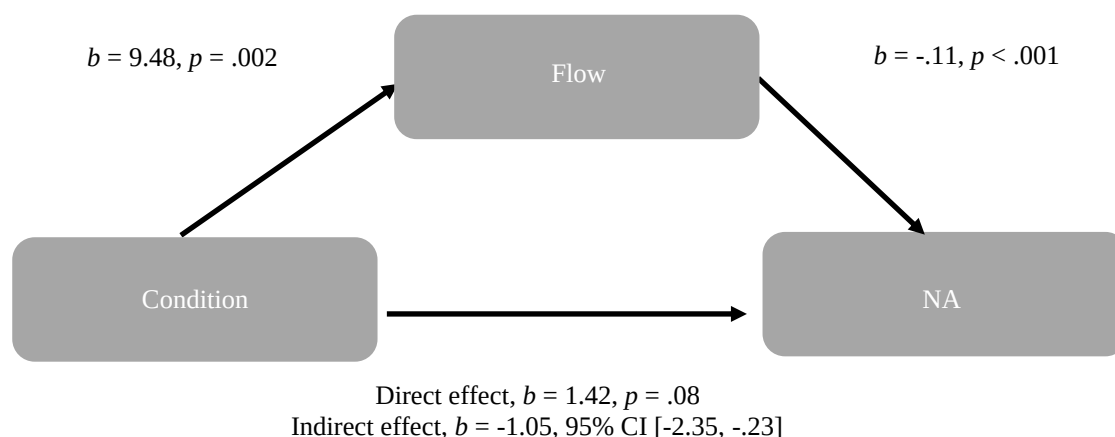


As is standard procedure (Agler and De Boeck, 2017), mediation was determined according to whether a significant indirect effect was present, irrespective of whether there was a total effect. The test output showed that there was a significant indirect effect (IE) of condition on PA scores through flow, $b = 2.92$, 95% BCa CI [1.01, 5.22], as the 95% confidence interval (CI) for the IE estimate does not contain zero. The results of the mediation analyses are set out in Table 3.

Predicting NA Outcomes

A second mediation analysis was run with the post-test scores for the NA subscale of PANAS as the outcome variable. Visual inspection of a scatterplot of NA scores plotted against condition did not reveal a linear relationship between the two variables, and normal P-P plots and histograms showed that data were not normally distributed, indicating violations of the assumptions of linearity and normality, respectively. Moreover, there was evidence of funnelling in the scatterplot of standardised predicted values, demonstrating that data violated the assumption of homogeneity of variance. The data met the assumption of independent errors, as assessed by a Durbin-Watson value of 2.22, and there were no outliers, as indicated by maximum values of 13.82 and .60 for Mahalanobis distance and Cook's distance, respectively.

Figure 4.2. Model of Condition as a Predictor of NA, Mediated by Flow

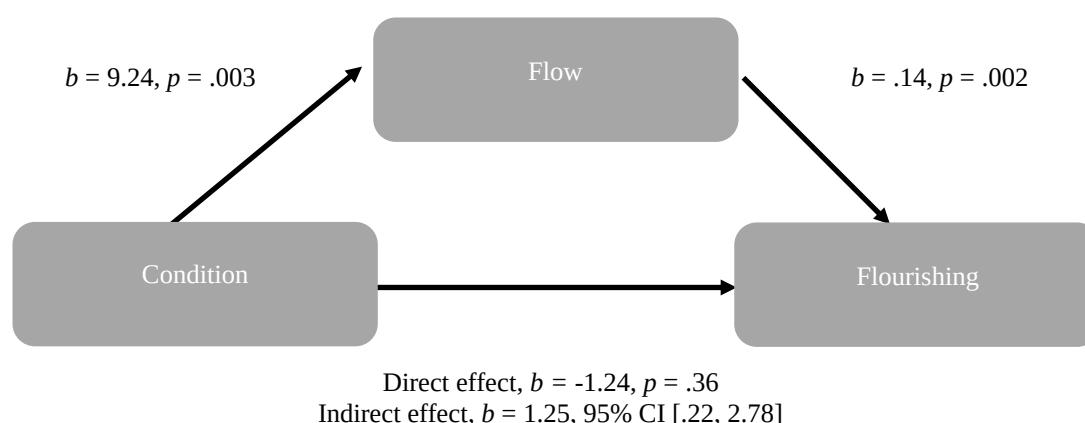


The resulting output suggested that there was a significant IE of condition on NA scores through flow, $b = -1.05$, 95% BCa CI [-2.35, -.23], as determined by the 95% CI of the effect size measure, which does not cross zero.

Predicting Flourishing Outcomes

The outcome variable comprised post-test scores for the FS in the third mediation analysis. Visual inspection of a scatterplot of FS scores against condition established linearity, and inspection of normal P-P plots and histograms determined that data were distributed approximately normally. The scatterplot of standardised residuals indicated homoscedasticity and a Durbin-Watson statistic of 2.07 ensured independence of residuals. No outliers were identified, with maximum values of 9.33 and .26 for Mahalanobis distance and Cook's distance, respectively.

The analysis output determined there was a significant IE of condition on FS scores through flow, $b = 1.25$, 95% BCa CI [.22, 2.78], as the 95% CI does not contain zero.

Figure 4.3. Model of Condition as a Predictor of Flourishing, Mediated by Flow**Table 3.** Mediation Summary Table for Wellbeing Variables

Path	<i>F</i>	<i>df</i>	<i>b</i>	<i>t</i>	<i>p</i>	<i>LLCI</i>	<i>ULCI</i>	<i>R</i> ²	<i>SE</i>
PANAS-PA									
<i>a</i>	10.47	1.00	9.84	3.24	.002**	3.81	15.87	.09	3.04
<i>b</i>	13.97	2.00	.30	5.28	< .001**	.19	.41	.22	.06
<i>c</i>	.05	1.00	.43	.22	.82	-3.39	4.24	< .001	1.92
<i>c'</i>	13.97	2.00	-2.49	-1.39	.17	-6.05	1.07	.22	1.79
IE	-	-	2.92	-	-	1.01	5.22	-	-
PANAS-NA									
<i>a</i>	9.73	1.00	9.48	3.12	.002**	3.45	15.50	.09	3.04
<i>b</i>	9.79	2.00	-.11	-4.40	< .001**	-.16	-.06	.17	.03
<i>c</i>	.19	1.00	.37	.44	.66	-1.29	2.03	.002	.84
<i>c'</i>	9.79	2.00	1.42	1.77	.08	-.17	3.02	.17	.80
IE	-	-	-1.05	-	-	-2.35	-.23	-	-
FS									
<i>a</i>	9.06	1.00	9.24	3.01	.003**	3.15	15.32	.08	3.07
<i>b</i>	5.27	2.00	.14	3.25	.002**	.05	.22	.10	.04
<i>c</i>	< .001	1.00	.01	.01	.99	-2.64	2.66	.00	1.34
<i>c'</i>	5.27	2.00	-1.24	-.93	.36	-3.88	1.41	.10	1.33
IE	-	-	1.25	-	-	.22	2.78	-	-

Note. $n = 102$, 94.44%. Path *a* = predictor → mediator; path *b* = mediator → outcome; path *c* = predictor → outcome; path *c'* = predictor → outcome, when controlling for mediator; IE = predictor and mediator together predicting outcome. The CI is a BCa bootstrapped CI based on 5000 samples. *LL* = lower limit; *UL* = upper limit. * $p < .05$. ** $p < .01$.

6. Thematic Analysis

An inductive analysis of the semi-structured interview content identified four main themes that were of relevance to this study's RQs: (1) absorption in singing, (2) challenge-skill balance, (3) co-creation and (4) wellbeing. Coding and thematic maps are available in appendices C and D, respectively.

Absorption in Singing

Absorption in singing, defined here in terms of immersion and heightened concentration as a facet of flow, was experienced to varying degrees by VC participants. One interviewee described feeling intrinsically motivated, and therefore absorbed in VC, while a second person recognised that the choir director played an important role in facilitating task absorption.

'I think because I'm interested, I don't think I feel cut off from it and unabsorbed.'
'You need direction and the quality of the direction has a lot to do with it.'

For some, VC did not appear to facilitate task absorption. Their reasons centred around distractions, poor internet connectivity, and so-called 'Zoom fatigue'.

'there are distractions when you're online because you can take your camera off and you could do something else. And then, of course, that immediately disengages you.'
'it's stuck with the limitations of time lags'
'My eyes would get very tired'

Relatedly, VC rehearsals resulted in increased self-consciousness, which might help to explain reports of people feeling less absorbed.

'I'm just aware that there I am chucking it out in my back bedroom and you know god knows what the neighbours make of this.'
'And being aware we're on camera as well.'

Quite striking was the loss of self-consciousness that some VC members experienced in rehearsals, although reservations were expressed that self-consciousness may be regained when choirs return to being IP, with fears of being out of practice.

'you lose your inhibition for singing in front of people'
'I think self-consciousness might well come into it until we can really test out how we sound with other voices.'

Challenge-Skill Balance

The struggle to overcome musical challenges was identified by choir members as an enjoyable part of IP rehearsals.

'there's self-competition elements and I like that, I enjoy pitching myself against not so much my colleagues, but against the music. Yeah, difficult music'
'the motivation and determination to be challenged'

Challenging oneself was an aspect of choir rehearsals that continued to give some members enjoyment when choirs moved online, with technology providing an additional challenge to be accomplished.

‘I’m not getting any help from the people around me, so I’m having to do it all myself. And that’s more of a challenge. And that gives me pleasure.’

‘I’m not very tech minded and so in a way I quite like the challenge of seeing if I could make it work for me’

However, for those lacking digital competency, the challenge presented by virtual attendance created a barrier to participation that some felt ill-equipped to deal with, warranting calls for additional support to help people develop these skills.

‘it’s a lack of confidence in the computer that keeps me from doing anything’

‘increased awareness of how to use the technology that’s available would help.’

There was a sense amongst interviewees that the challenges associated with singing increased in VC, which for some participants appeared to unbalance the equilibrium between challenge and skill, that is a hallmark of the flow experience.

‘And of course we haven’t got another person in your part next to you who is singing the right notes.’

‘You come away thinking I didn’t do that very well’

Other participants felt that singing ‘alone’ provided an opportunity to hone their vocal skills, or at least maintain their voice.

‘you can analyse what you’re doing personally better’

‘I’m ensuring that my voice is still tuned’

Although, with choir directors unable to give direct feedback, which is a crucial component in facilitating flow, it is plausible to think that perceived challenges may have outweighed perceived skills for some.

‘you don’t get any feedback. You haven’t got immediate interaction with the conductor or leader.’

Co-creation

Co-creation through singing was almost unanimously construed as being at the heart of the choir experience, with VC failing to replicate this element of singing together in person.

‘[VC] takes away so much of the reason that you sing, ‘cause I sing to be with other people, to be part of a bigger group, part of the whole, creating something bigger than I can create on my own’

‘You know, really what it feels like to hear the tenors and the bases and, and fitting everything together, the whole musical thing that you just don’t get when you are singing on your own’

The inherent limitations of existing video conferencing software were felt to prohibit real-time co-creation, as singing in synchrony was not seen as possible with the current technology used by choirs.

‘It’s nice to make a sound together and obviously on Zoom, unless it’s all managed and recorded, you can’t make a sound together. It sounds diabolical.’

‘that’s the problem with online stuff that you can’t recreate the sound, the interaction into reaction between the various parts of those singers. And that’s what singing is, among other things, it’s teamwork’

Despite these drawbacks, the VC experience was seen to hold potential in terms of facilitating inclusion in co-creation, with the suggestion of a hybridised choir format going forward, which would give attendees the option to join IP or virtually.

‘when we go back to proper singing [...] we could have a Zoom situation for our old people who can't come to choir’

Moreover, from a collaborative perspective, co-creation that moves beyond community-level projects to those on an international stage may be a possibility, aided by technological advancements.

‘you can go across the world on Zoom, you know. Which opens up more opportunity for us as a choir’

Wellbeing

Recognition that IP group singing contributed to improved wellbeing was undisputed, with interviewees perceiving holistic benefits.

‘I'm sure that that singing is good for me, not just mentally as I've said, but physically [...] singing is good for your lungs and your heart and your general physique’

During the current COVID-19 pandemic, singing became a valuable resource for sustaining wellbeing, in terms of providing routine, positivity and some degree of normality.

‘[VC] was a regular thing that we would take part in and look forward to.’
‘I suppose it's like I said it's the fact that it's something positive in a negative environment. Maybe it feels like a bit of normality.’

Furthermore, in light of COVID-19-related lockdowns and social distancing measures, VC was felt to foster connection, and therefore enhance social wellbeing.

‘there was a lot of isolation included in it [the pandemic] and this [VC] was a saving grace really’
‘I think it's all about people, it's having the people, whether they're there on the Zoom or here beside you.’

However, while acknowledging positive wellbeing benefits, interviewees also implied that VC did not deliver the usual enhanced sense of wellbeing that accompanied IP rehearsals, perhaps because VC lacks the nuances that enable deeper absorption in the activity.

‘A pleasure to a degree, but not as much as it would have been if I were to go into an in-person rehearsal’
‘I gather there are people that think that online choirs are as good as in-person choirs, and if they do, they are dreaming.’

7. Discussion

Do Online Singing Practices Contribute to an Increase in Overall Wellbeing?

First, it was hypothesised that participants would demonstrate significantly higher levels of wellbeing after engaging in the online singing intervention. Partially supporting this, there was an overall trend for PA, NA and flourishing scores, pointing toward wellbeing improvements post-intervention; although flourishing and NA failed to improve in the solo and group conditions respectively, favourable

baseline scores were reasonably well sustained. This general trend is consistent with Philip et al.'s (2020) quantitative findings reviewed earlier, indicating that participants derived some benefit to wellbeing from VC engagement. However, post-test scores did not differ significantly from baseline, as main effects for time were non-significant for all three ANOVAs. While a single thirty-minute session may have been too brief to result in any significant changes in wellbeing scores, this finding suggests that virtual engagement failed to deliver the same sense of enhanced wellbeing to participants as IP rehearsals, which reflects observations made in previous studies already reviewed (Draper and Dingle, 2021; Philip et al., 2020). Qualitative reports align with this interpretation of quantitative findings, suggesting that VC was felt to be pleasurable and beneficial to wellbeing, but not to the same extent as IP rehearsals.

Second, it was hypothesised that participants in the group condition would demonstrate a significantly greater increase in wellbeing than participants in the solo condition. This hypothesis was partially supported by findings, as a general trend in scores indicates greater wellbeing improvements in the group condition, except for NA. While this study is the first to compare experiences of singing together and alone for individuals rehearsing virtually, this trend echoes findings reviewed earlier indicating that when rehearsing IP members derived greater wellbeing enhancement from group rather than solo singing (Stewart and Lonsdale, 2014). Contrary to expectation, differences in mean scores failed to reach significance, as main effects for condition were non-significant across all three ANOVAs. Consistent with previous analyses (Daffern et al., 2021; Theorell et al., 2020), qualitative findings indicated that singing in VC was aurally a solo activity, which some found to be missing the group feeling they valued in IP rehearsals. Presumably, for these people, rehearsing by themselves or with others made little difference to their VC experience, if both felt to a large degree like individual pursuits, offering a potential explanation for this finding. Nonetheless, explored within the framework of social prescribing (Clements-Cortés and Yip, 2020), data trends and sustained scores are noteworthy considering the significant burden placed on people's wellbeing by the pandemic, suggesting that in the context of COVID-19 shielding recommendations, VCs represent a valuable resource for maintaining and possibly enhancing wellbeing.

Does Singing Online as a Group Produce More Flow than Singing Online Solo?

As hypothesised, the *t*-test showed that the group condition elicited significantly higher levels of flow than the solo condition. Pertinent to this finding is work on social flow. Findings reported by Walker (2010) suggested that athletes experienced social flow with more enjoyment than solitary flow. The present finding supports Walker's resulting proposition that flow may be enhanced by the group setting, as it appeared that participants experienced flow with greater intensity in the group condition. As Csikszentmihalyi (1975) conceptualised flow as a form of enjoyment, emotional contagion theory (ECT; Totterdell, 2000) may help to explain this finding. According to ECT, spontaneous mimicry of facial expressions provides afferent feedback to oneself, which elicits emotional convergence. One possible interpretation of the present finding is that in keeping cameras off and rehearsing the songs by oneself, emotional contagion was prevented in the solo condition, reducing the spread of enjoyment and thereby reducing levels of flow for participants rehearsing individually. This study's qualitative output suggested that the presence of others on Zoom was felt to enhance social wellbeing, a facet of which is enjoyment (Haworth, 2016), reinforcing this line of theorising.

The finding that group contexts may enhance flow experiences is of potential importance for research on cognitive optimisation and translation into clinical recommendations for healthy ageing. Being deep in concentration is an attribute of flow that has been shown to facilitate improvement of attention for people with attention-deficit disorder following a traumatic brain injury (TBI; Yoshida, Sawamura, Ogawa, Ikoma, Asakawa et al., 2014). While the study's generalisability was limited by the case study design ($N = 2$), this implicates flow in the process of attention training, which shows the potential therapeutic value of flow enhancement in optimising cognitive functioning. Like TBI, research on neurological disorders has linked the different forms of dementia with low attention span and decreased concentration (Mitran, Catalin, Sfredel, and Balseanu, 2013). Given the cognitive-related

consequences of flow, it is possible that engaging in group activities such as a choir may serve as a means of symptom reduction for people living with dementia, or as a protective factor against dementia-related cognitive impairment. With dementia rates predicted to increase threefold by 2050 (Prince, Guerchet, and Prina, 2015), future research for this line of theorising may generate valuable findings.

Does Flow Mediate the Relationship between Online Singing Practices and Overall Wellbeing?

As hypothesised, mediation analyses showed that flow served as a mediator for the effects of the online singing intervention on PA, NA and flourishing; although, the output indicated that flow alone did not account for the entire variance in scores across the three measures. In charting the mediation pathway, the intervention session had a significant influence on levels of flow, while flow ratings in turn had a significant effect on perceived wellbeing. This suggests that participants who were more absorbed in the activity, and therefore experienced higher levels of flow, rated their wellbeing more favourably. This may help to explain the trend in scoring that indicates the group condition elicited greater wellbeing improvements than the solo condition, as higher levels of flow recorded for the group condition may have led to higher ratings for wellbeing. In terms of wellbeing, results suggested that levels of flow were positively related to ratings for flourishing and PA and inversely related to NA. This echoes Rogatko's (2009) findings suggesting that flow leads participants to experience an increase in positive emotions and decreases in negative emotions. However, a limitation of this study is that participants were aware of their assignment to the high or low flow condition, such that activities may have been rated to match the researchers' expectations. Importantly, the finding that flow mediated the impact of the online singing intervention on wellbeing suggests that integration of the flow concept into research on VCs can promote understanding of the processes through which VC engagement impacts participants' wellbeing.

The findings in this study are subject to certain limitations. First, the study was based on convenience samples of individuals who self-selected to participate from a pool of those who had access to the Internet. This omitted those without Internet access, who as a cohort may be at greater risk of isolation and therefore lower levels of wellbeing. Second, age, gender and ethnicity distributions of the samples were disproportionately biased toward participants who were older, female and White. While this demographic profile may reflect engagement in community choirs across the UK (Daffern et al., 2021; Daykin et al., 2018), the experience of this sub-group may not generalise to other populations. This includes people from marginalised communities who are at greater risk of experiencing lower levels of wellbeing (McNamara, Stevenson, and Muldoon, 2013), translating to the omission of a clinically vulnerable group from research on wellbeing. Moreover, younger people may have different experiences online, with findings suggesting that younger adults adapt more quickly to new technologies than older adults (Czaja, Charness, Fisk, Hertzog, Nair et al., 2006). Third, as the target sample size estimate was not met for the *t*-test and violations of assumptions were observed, findings need to be interpreted cautiously and confirmatory data is crucial. Fourth, in the absence of a control group, there is no way to determine whether wellbeing improvements were uniquely associated with online singing, as confounds such as expectancy for change may have presented. Fifth, like most literature on musical engagement and flow, this study was limited by the cross-sectional design, which prohibits exploration of a causal relationship. Future longitudinal studies with controls as well as large samples incorporating diversity are needed to comprehensively establish the determinants of flow and the effects of VC engagement on cognitive health and wellbeing.

8. Conclusion

This study was framed by a question posed at the beginning which asked whether the well-established benefits for wellbeing associated with IP choir rehearsals translate to virtual rehearsals. The present study's findings suggest that while the wellbeing benefits of group singing are not limited to IP

rehearsals, there is a cavity between the two experiences, with a general preference expressed for IP engagement. However, in the context of the pandemic, VCs were highly valued for their role in maintaining and possibly enhancing wellbeing, which the present findings suggest could be partly attributed to choir-related flow experiences. For choirs, the group nature of rehearsals may be a part of what makes the activity well-suited to inducing flow, suggesting that group settings may constitute a means of flow enhancement that warrants future research for its potential clinical implications.

References

- Agler, R. and De Boeck, P. 2017. 'On the interpretation and use of mediation: multiple perspectives on mediation analysis' in *Frontiers in Psychology* 8. [available online: <https://doi.org/10.3389/fpsyg.2017.01984>] Last Accessed: 8 August 2021.
- Bailey, B.A. and Davidson, J.W. 2002. 'Adaptive characteristics of group singing: Perceptions from members of a choir for homeless men' in *Musicae Scientiae* 6(2) pp.221-256. [available online: <https://doi.org/10.1177/102986490200600206>] Last Accessed: 8 August 2021.
- Baker, F.A. and MacDonald, R.A. 2013. 'Flow, identity, achievement, satisfaction and ownership during therapeutic song writing experiences with university students and retirees' in *Musicae Scientiae* 17(2) pp.131-146. [available online: <https://doi.org/10.1177/1029864913476287>] Last Accessed: 8 August 2021.
- Baker, F.A., Rickard, N., Tamplin, J. and Roddy, C. 2015. 'Flow and meaningfulness as mechanisms of change in self-concept and well-being following a songwriting intervention for people in the early phase of neurorehabilitation' in *Frontiers in Human Neuroscience* 9. [available online: <https://doi.org/10.3389/fnhum.2015.00299>] Last Accessed: 8 August 2021.
- Bakker, A.B., Oerlemans, W., Demerouti, E., Slot, B.B. and Ali, D.K. 2011. 'Flow and performance: A study among talented Dutch soccer players' in *Psychology of Sport and Exercise* 12(4) pp.442-450. [available online: <https://doi.org/10.1016/j.psychsport.2011.02.003>] Last Accessed: 8 August 2021.
- Baron, R.M. and Kenny, D.A. 1986. 'The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations' in *Journal of Personality and Social Psychology* 51(6).
- Baumeister, R.F., Vohs, K.D. and Funder, D.C. 2007. 'Psychology as the science of self-reports and finger movements: Whatever happened to actual behavior?' in *Perspectives on Psychological Science* 2(4) pp.396-403. [available online: <https://doi.org/10.1111/j.1745-6916.2007.00051.x>] Last Accessed: 8 August 2021.
- Blanca Mena, M.J., Alarcón Postigo, R., Arnau Gras, J., Bono Cabré, R. and Bendayan, R. 2017. 'Non-normal data: Is ANOVA still a valid option?' in *Psicothema* 29(4) pp.552-557. [available online: <https://doi.org/10.7334/psicothema2016.383>] Last Accessed: 8 August 2021.
- Bradburn, N.M. 1969. *The structure of psychological well-being*. Aldine.
- Braun, V. and Clarke, V. 2006. 'Using thematic analysis in psychology' in *Qualitative Research in Psychology* 3(2) pp.77-101. [available online: <https://doi.org/10.1191/1478088706qp063oa>] Last Accessed: 8 August 2021.
- Braun, V. and Clarke, V. 2021. 'One size fits all? What counts as quality practice in (reflexive) thematic analysis?' in *Qualitative Research in Psychology* 18(3) pp.328-352. [available online: <https://doi.org/10.1080/14780887.2020.1769238>] Last Accessed: 8 August 2021.
- Carvalho, H.W.D., Andreoli, S.B., Lara, D.R., Patrick, C.J., Quintana, M.I., Bressan, R.A., Melo, M.F.D., Mari, J.D.J. and Jorge, M.R. 2013. 'Structural validity and reliability of the Positive and Negative Affect Schedule (PANAS): evidence from a large Brazilian community sample' in *Brazilian Journal of Psychiatry* 35 pp.169-172. [available online: <https://doi.org/10.1590/1516-4446-2012-0957>] Last Accessed: 8 August 2021.
- Chen, J., 2007. 'Flow in games (and everything else)' in *Communications of the ACM* 50(4) pp.31-34.
- Clements-Cortés, A. and Yip, J. 2020. 'Social Prescribing for an aging population' in *Activities, Adaptation & Aging* 44(4) pp.327-340. [available online: <https://doi.org/10.1080/01924788.2019.1692467>] Last Accessed: 8 August 2021.

- Clift, S., Hancox, G., Staricoff, R. and Whitmore, C. 2008. *'Singing and health: A systematic mapping and review of non-clinical research.'* Canterbury Christ Church University.
- Clift, S., Nicol, J., Raisbeck, M., Whitmore, C. and Morrison, I. 2010. 'Group singing, wellbeing and health: A systematic mapping of research evidence' in *Unesco Observatory* 2(1).
- Cohen, J. 1988. *Statistical power analysis for the behavioral sciences*. Lawrence Erlbaum Associates. pp.20-26.
- Cruea, M.D. 2020. 'Gaming the mind and minding the game: Mindfulness and flow in video Games' in *Video games and well-being*. Edited by R. Kowert. Palgrave Pivot.[available online: https://doi.org/10.1007/978-3-030-32770-5_7] Last Accessed: 8 August 2021.
- Csikszentmihalyi, M. 1975. *Beyond boredom and anxiety*. Jossey-Bass.
- Csikszentmihalyi, M. 1997. *Flow and the psychology of discovery and invention*. Harper Perennial.
- Czaja, S.J., Charness, N., Fisk, A.D., Hertzog, C., Nair, S.N., Rogers, W.A. and Sharit, J. 2006. 'Factors predicting the use of technology: findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE)' in *Psychology and Aging* 21(2) pp.333-352. [available online: <https://doi.org/10.1037/0882-7974.21.2.333>] Last Accessed: 8 August 2021.
- Daffern, H., Balmer, K. and Brereton, J. 2021. 'Singing together, yet apart: the experience of UK choir members and facilitators during the Covid-19 pandemic' in *Frontiers in Psychology* 12. [available online: <https://doi.org/10.3389/fpsyg.2021.624474>] Last Accessed: 8 August 2021.
- Daykin, N., Mansfield, L., Meads, C., Julier, G., Tomlinson, A., Payne, A., Grigsby Duffy, L., Lane, J., D'Innocenzo, G., Burnett, A. and Kay, T. 2018. 'What works for wellbeing? A systematic review of wellbeing outcomes for music and singing in adults' in *Perspectives in Public Health* 138(1) pp.39-46. [available online: <https://doi.org/10.1177/1757913917740391>] Last Accessed: 8 August 2021.
- Department of Health. 2009. *Departmental Report*. The Health and Personal Social Services Programmes. [available online: www.officialdocuments.gov.uk/document/cm75/7593/7593.pdf] 95] Last Accessed: 8 August 2021.
- Diaz, F.M. 2013. 'Mindfulness, attention, and flow during music listening: An empirical Investigation' in *Psychology of Music* 41(1) pp.42-58. [available online: <https://doi.org/10.1177/0305735611415144>] Last Accessed: 8 August 2021.
- Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D.W., Oishi, S. and Biswas-Diener, R. 2010. 'New well-being measures: Short scales to assess flourishing and positive and negative feelings' in *Social Indicators Research* 97(2) pp.143-156. [available online: <https://doi.org/10.1007/s11205-009-9493-y>] Last Accessed: 8 August 2021.
- Dingle, G.A., Clift, S., Finn, S., Gilbert, R., Groarke, J.M., Irons, J.Y., Bartoli, A.J., Lamont, A., Launay, J., Martin, E.S., Moss, H., Sanfilippo, K.R., Shipton, M., Stewart, L., Talbot, S., Tarrant, M., Tip, L. and Williams, E. J. 2019. 'An agenda for best practice research on group singing, health, and well-being' in *Music & Science* 2. [available online: <https://doi.org/10.1177/2059204319861719>] Last Accessed: 8 August 2021.
- Draper, G. and Dingle, G.A. 2021. "'It's Not the Same": A comparison of the psychological needs satisfied by musical group activities in face to face and virtual modes' in *Frontiers in Psychology* 12. [available online: <https://doi.org/10.3389/fpsyg.2021.646292>] Last Accessed: 8 August 2021.
- Faul, F., Erdfelder, E., Lang, A.G. and Buchner, A. 2007. 'G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences' in *Behavior Research Methods* 39(2) pp.175-191. [available online: <https://doi.org/10.3758/BF03193146>] Last Accessed: 8 August 2021.
- Haworth, J.T. 2006. *Work, Leisure and Well-being*. Routledge.
- Hayes, A.F. 2017. *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford publications.
- Hone, L., Jarden, A. and Schofield, G. 2014. 'Psychometric properties of the Flourishing Scale in a New Zealand sample' in *Social Indicators Research* 119(2) pp.1031-1045. [available online: <https://doi.org/10.1007/s11205-013-0501-x>] Last Accessed: 8 August 2021.
- Howell, A.J. and Buro, K. 2015. 'Measuring and predicting student well-being: Further evidence in support of the flourishing scale and the scale of positive and negative experiences' in *Social Indicators Research* 121(3) pp.903-915. [available online: <https://doi.org/10.1007/s11205-014-0663-1>] Last Accessed: 8 August 2021.
- Humboldt, S.V., Monteiro, A. and Leal, I. 2017. 'Validation of the PANAS: A measure of positive and negative affect for use with cross-national older adults' in *European Studies Review* 9 pp.10-20. [available online: <https://doi.org/10.5539/res.v9n2p10>] Last Accessed: 8 August 2021.

- Irons, J.Y., Petocz, P., Kenny, D.T. and Chang, A.B. 2019. 'Singing as an adjunct therapy for children and adults with cystic fibrosis' in *Cochrane Database of Systematic Reviews* (7). [available online: <https://doi.org/10.1002/14651858.CD008036.pub5>] Last Accessed: 8 August 2021.
- Jackson, S.A. and Kimiecik, J.C. 2008. 'The flow perspective of optimal experience in sport and physical activity' in *Advances in Sport Psychology*. Edited by T. S. Horn, 377–399. Human Kinetics.
- Keeler, J.R., Roth, E.A., Neuser, B.L., Spitsbergen, J.M., Waters, D.J.M. and Vianney, J.M. 2015. 'The neurochemistry and social flow of singing: bonding and oxytocin' in *Frontiers in Human Neuroscience*. [available online: <https://doi.org/10.3389/fnhum.2015.00518>] Last Accessed: 8 August 2021.
- Laerd Statistics. 2015. *Statistical Tutorials and Software Guides*. [available online: <https://statistics.laerd.com/>] Last Accessed: 8 August 2021.
- Livesey, L., Morrison, I., Clift, S. and Camic, P. 2012. 'Benefits of choral singing for social and mental wellbeing: qualitative findings from a cross-national survey of choir members' in *Journal of Public Mental Health* 11(1) pp.10-26. [available online: <https://doi.org/10.1108/17465721211207275>] Last Accessed: 8 August 2021.
- Magyaródi, T., Nagy, H., Soltész, P., Mózes, T. and Oláh, A. 2013. 'Psychometric properties of a newly established flow state questionnaire' in *The Journal of Happiness & Well-Being* 1(2) pp.85-96.
- McNamara, N., Stevenson, C. and Muldoon, O.T. 2013. 'Community identity as resource and context: A mixed method investigation of coping and collective action in a disadvantaged community' in *European Journal of Social Psychology* 43(5) pp.393-403. [available online: <https://doi.org/10.1002/ejsp.1953>] Last Accessed: 8 August 2021.
- Mitran, S.I., Catalin, B., Sfredel, V. and Balseanu, T.A. 2013. 'Neuroregeneration and dementia: new treatment options' in *Journal of Molecular Psychiatry* 1(1) pp.1-6. [available online: <https://doi.org/10.1186/2049-9256-1-12>] Last Accessed: 8 August 2021.
- Nakamura, J. and Csikszentmihalyi, M. 2002. 'The concept of flow' in *Handbook of positive psychology*. Edited by C. R. Snyder and S. J. Lopez, 89-105. Oxford University Press.
- Philip, K.E., Lewis, A., Jeffery, E., Buttery, S., Cave, P., Cristiano, D., Lound, A., Taylor, K., Man, W.D., Fancourt, D., Polkey, M.I. and Hopkinson, N.S. 2020. 'Moving singing for lung health online in response to COVID- 19: experience from a randomised controlled trial' in *BMJ Open Respiratory Research* 7(1). [available online: <https://doi.org/10.1136/bmjresp-2020-000737>] Last Accessed: 8 August 2021.
- Prince, M., Guerchet, M. and Prina, M. 2015. *The global impact of dementia 2013-2050*. Alzheimer's Disease International.
- Rogatko, T.P. 2009. 'The influence of flow on positive affect in college students' in *Journal of Happiness Studies* 10(2) pp.133-148. [available online: <https://doi.org/10.1007/s10902-007-9069-y>] Last Accessed: 8 August 2021.
- Salanova, M., Rodríguez-Sánchez, A.M., Schaufeli, W.B. and Cifre, E. 2014. 'Flowing together: A longitudinal study of collective efficacy and collective flow among workgroups' in *The Journal of Psychology* 148(4) pp.435-455. [available online: <https://doi.org/10.1080/00223980.2013.806290>] Last Accessed: 8 August 2021.
- Schminder, E., Ziegler, M., Danay, E., Beyer, L. and Bühner, M. 2010. 'Is it really robust? Reinvestigating the robustness of ANOVA against violations of the normal Distribution' in *European Research Journal of Methods for the Behavioral and Social Sciences* 6(4) pp.147-151. [available online: <https://doi.org/10.1027/1614-2241/a000016>] Last Accessed: 8 August 2021.
- Seligman, M.E. 2011. *Flourish: A new understanding of happiness and well-being-and how to achieve them*. Nicholas Brealey.
- Stewart, N.A.J. and Lonsdale, A.J. 2016. 'It's better together: The psychological benefits of singing in a choir' in *Psychology of Music* 44(6) pp.1240-1254. [available online: <https://doi.org/10.1177/0305735615624976>] Last Accessed: 8 August 2021.
- Thatcher, A., Wretschko, G. and Fridjhon, P. 2008. 'Online flow experiences, problematic Internet use and Internet procrastination' in *Computers in Human Behavior* 24(5) pp.2236-2254. [available online: <https://doi.org/10.1016/j.chb.2007.10.008>] Last Accessed: 8 August 2021.
- Theorell, T., Kowalski, J., Theorell, A.M.L. and Horwitz, E.B. 2020. 'Choir singers without rehearsals and concerts? A questionnaire study on perceived losses from restricting choral singing during the Covid-19 Pandemic' in *Journal of Voice*. [available online: <https://doi.org/10.1016/j.jvoice.2020.11.006>] Last Accessed: 8 August 2021.
- Totterdell, P. 2000. 'Catching moods and hitting runs: mood linkage and subjective performance in professional sport teams' in *Journal of Applied Psychology* 85(6) pp.848-859. [available online: <https://doi.org/10.1037/0021-9010.85.6.848>] Last Accessed: 8 August 2021.

- Walker, C.J. 2010. 'Experiencing flow: Is doing it together better than doing it alone?' in *The Journal of Positive Psychology* 5(1) pp.3-11. [available online: <https://doi.org/10.1080/17439760903271116>] Last Accessed: 8 August 2021.
- Watson, D., Clark, L.A. and Tellegen, A. 1988. 'Development and validation of brief measures of positive and negative affect: the PANAS scales' in *Journal of Personality and Social Psychology* 54(6). [available online: <http://doi.org/10.1037/0022-3514.54.6.1063>] Last Accessed: 8 August 2021.
- Williams, E., Dingle, G.A. and Clift, S. 2018. 'A systematic review of mental health and wellbeing outcomes of group singing for adults with a mental health condition' in *European Journal of Public Health* 28(6) pp.1035-1042. [available online: <https://doi.org/10.1093/eurpub/cky115>] Last Accessed: 8 August 2021.
- Williams, K. and Underhill, J. 2020. *ISM Global literature review: Music performance, education and COVID-19*. Incorporated Society of Musicians.
- Wrigley, W.J. and Emmerson, S.B. 2013. 'The experience of the flow state in live music Performance' in *Psychology of Music* 41(3) pp.292-305. [available online: <https://doi.org/10.1177/0305735611425903>] Last Accessed: 8 August 2021.
- Yoshida, K., Sawamura, D., Ogawa, K., Ikoma, K., Asakawa, K., Yamauchi, T. and Sakai, S. 2014. 'Flow experience during attentional training improves cognitive functions in patients with traumatic brain injury: an exploratory case study' in *Hong Kong Journal of Occupational Therapy* 24(2) pp.81-87. [available online: <https://doi.org/10.1016/j.hkjot.2015.01.001>] Last Accessed: 8 August 2021.

Appendix A: Ethical approval

CONCLUSION TO ETHICAL REVIEW (if required)	
The applicant's response to our request for further clarification or amendments has now satisfied the requirements for ethical practice and the application therefore has favourable opinion from the Clinical Psychology Ethics Committee.	
Signature:	
Position: Ethics and Integrity Lead	
Date: 12.5.21	

Appendix B: Sponsorship letter



University of Edinburgh
College of Arts, Humanities and Social Sciences
Research Governance Office
55 George Square
Edinburgh
EH8 9JU

22nd March 2021

c/o School of Social and Political Science
University of Edinburgh

Study Title: The experience of singing in an online choir and its impact

Sponsor number: CAHSS2103/01

Under the requirements of the UK policy framework for health and social care research, the University of Edinburgh agrees in principle to act as Sponsor for this project. Sponsorship is subject to you obtaining institutional ethics for the project.

As Chief Investigator, you must ensure that the study does not commence until all applicable approvals have been obtained. Following receipt of all relevant approvals, you should ensure that any amendments to the project are notified to the Sponsor.

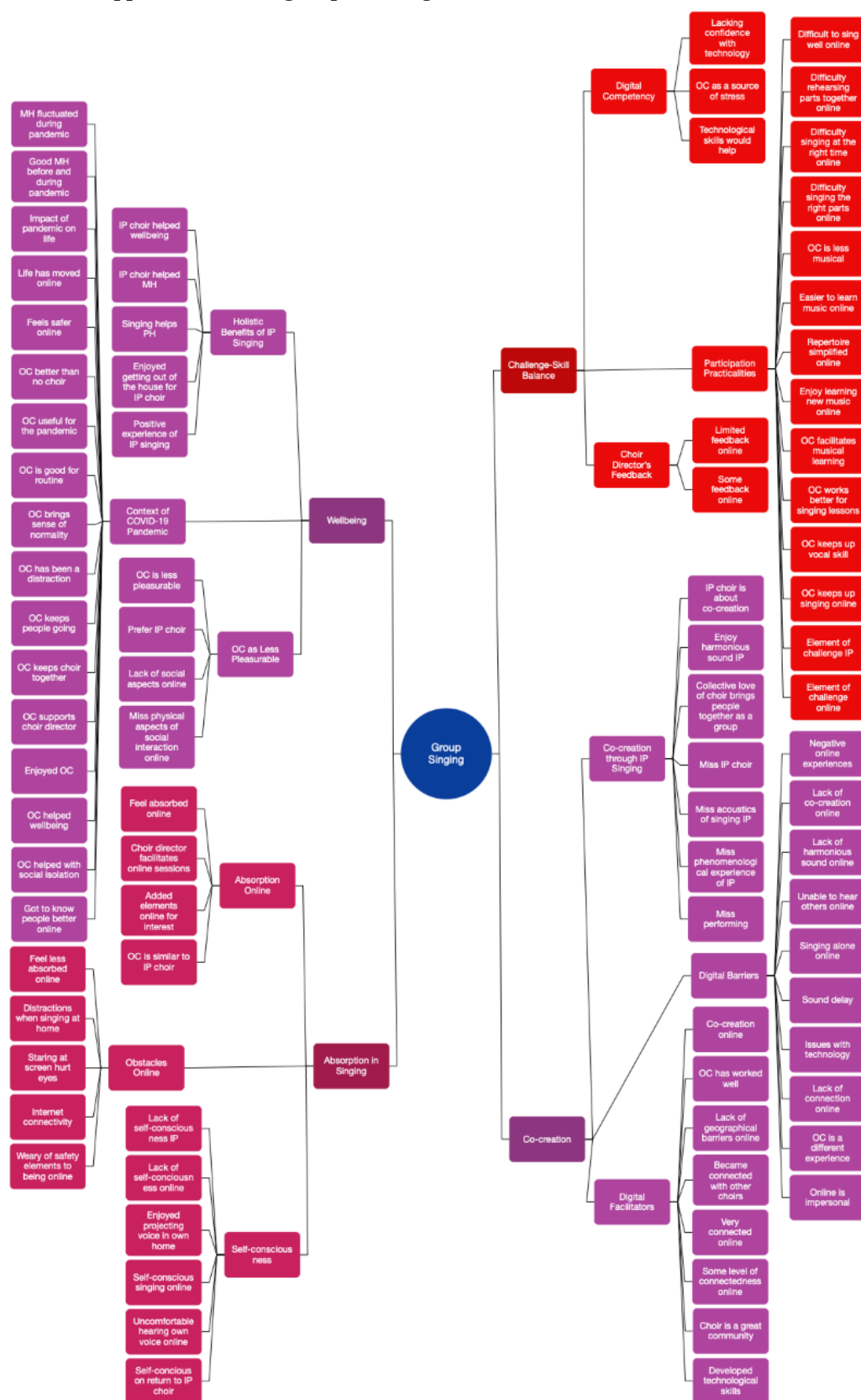
Yours sincerely

A handwritten signature in black ink, appearing to read 'Charlotte Smith'.

Charlotte Smith

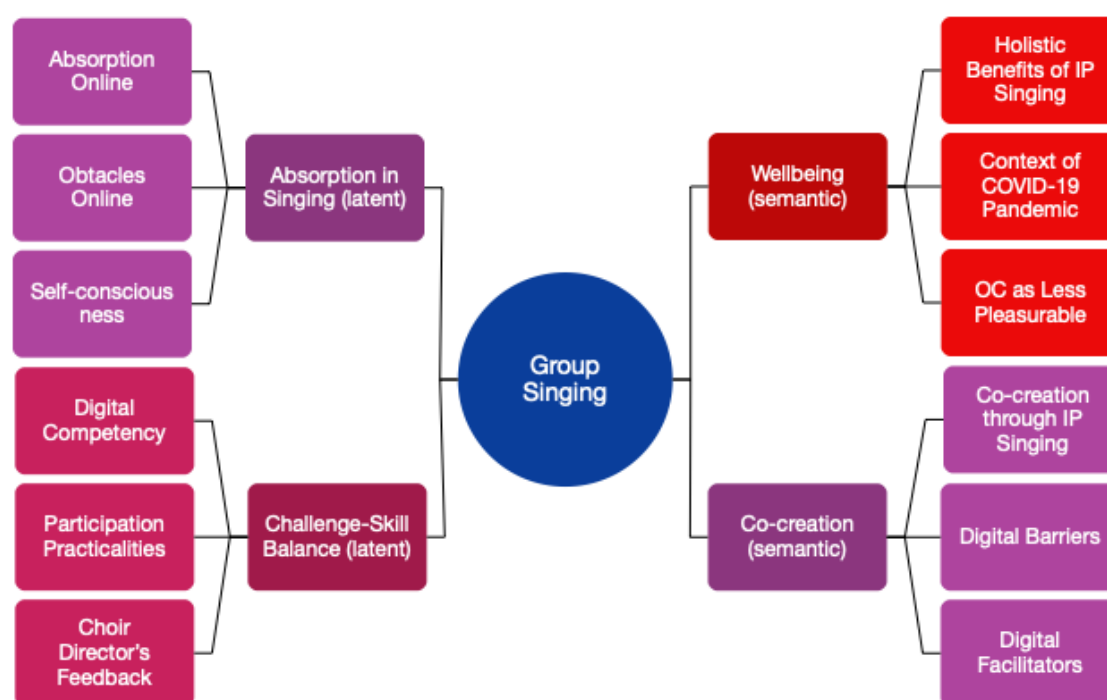
Research Governance Manager

Appendix C: Coding map, showing main themes, sub-themes and codes



Note. Zoom in on the screen to enlarge text if viewing online. Abbreviations: OC = online choir; IP = in-person; MH = mental health; PH = physical health

Appendix D: Thematic map, showing main themes and sub-themes



Note. Abbreviations: OC = online choir; IP = in-person