Singing with Strangers: A Feasibility Study Examining the Effect of Interpersonal Familiarity on Social Bonding during Group Singing

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SINGING WITH STRANGERS: A FEASIBILITY STUDY EXAMINING THE EFFECT OF INTERPERSONAL FAMILIARITY ON SOCIAL BONDING DURING GROUP SINGING

by

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A thesis submitted to the Graduate College in partial fulfillment of the requirements for the degree of Master of Music
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SINGING WITH STRANGERS: A FEASIBILITY STUDY EXAMINING THE EFFECT OF INTERPERSONAL FAMILIARITY ON SOCIAL BONDING DURING GROUP SINGING

Molly Grettenberger, M.M.
Western Michigan University, 2020

Social isolation and loneliness have become major health concerns in today’s world, and the healthcare field needs effective approaches to ameliorating the effects of social isolation and loneliness and increasing opportunities for social bonding. Group singing may be one such approach. This feasibility study focused specifically on interpersonal familiarity during short-term, small-group singing and its effect on the subjective experience of social bonding. A between-groups design and group interviews were used to examine the subjective experience of social bonding resulting from singing. Two groups of four, including one familiar group and one group of strangers, engaged in a brief group singing task and were then asked to reflect on their experience of social bonding, or lack thereof, during a group interview. Results of this study indicate the methodology was feasible overall. Interview results reveal that short-term, small-group singing can have an effect on the subjective experience of social bonding for people in both familiar and unfamiliar groups. While the social closeness effect of singing may be stronger for individuals who are already familiar with one another, singing can also kickstart social bonding amongst strangers. Components of singing together that influenced participants’ experiences included Individual Personalities and Background, Musical Elements, and Social Elements. Results of this study may have implications for future research focused on singing as a therapeutic approach for increasing social bonding.
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### TABLE OF CONTENTS

ACKNOWLEDGEMENTS .................................................................................................................. ii

LIST OF FIGURES ........................................................................................................................ vi

INTRODUCTION ............................................................................................................................... 1

  *Research Objectives* ...................................................................................................................... 4

REVIEW OF LITERATURE ................................................................................................................. 6

  *Singing and Attachment* ............................................................................................................... 7

  *Evolutionary Perspective on Music and Social Bonding* .............................................................. 7

  *Social Functions of Music* ........................................................................................................... 8

  *Music Engagement and Self-Other Merging* ............................................................................... 9

  *Oxytocin, Music, and Social Bonding* ....................................................................................... 9

  *Brain-Opioid Theory of Social Attachment* ............................................................................... 10

  *Group Singing and Social Bonding* ........................................................................................... 12

  *Clinical Studies on the Health Benefits of Group Singing* ....................................................... 15

  *Summary* ................................................................................................................................... 17

METHODS ....................................................................................................................................... 19

  *Study Design* ............................................................................................................................... 19

  *Participants* ................................................................................................................................ 19

  *Procedure* .................................................................................................................................. 20

  *Instrumentation* ......................................................................................................................... 22

  *Analysis* .................................................................................................................................... 23
RESULTS ................................................................................................................................................. 25

Feasibility Results ........................................................................................................................................ 25

Recruitment, Enrollment, and Group Assignment ..................................................................................... 25

Music Intervention Acceptability and Participant Adherence ................................................................. 26

Feasibility of Study Protocols, Logistics, and Outcome Assessment ....................................................... 29

Interview Results ......................................................................................................................................... 30

Major Themes ............................................................................................................................................. 31

DISCUSSION .................................................................................................................................................. 48

Feasibility Discussion ................................................................................................................................ 48

Recruitment, Enrollment, and Group Assignment ..................................................................................... 48

Music Intervention Acceptability and Participant Adherence ................................................................. 49

Feasibility of Study Protocols, Logistics, and Outcome Assessment ....................................................... 50

Social Bonding Discussion ......................................................................................................................... 51

Differences Between Groups ..................................................................................................................... 55

Conclusion ................................................................................................................................................... 58

REFERENCES ................................................................................................................................................. 60

APPENDICES ................................................................................................................................................. 70

A. Recruitment Flyer ..................................................................................................................................... 70

B. Interview Script .......................................................................................................................................... 72

C. Log Trail ..................................................................................................................................................... 74

D. Codebook ............................................................................................................................................... 78
Table of Contents—Continued

APPENDICES

E. HSIRB Approval Letter........................................................................................................... 83
F. Informed Consent .................................................................................................................. 85
G. Lyric Sheets......................................................................................................................... 89
LIST OF FIGURES

1. Study design............................................................................................................ 19

2. Major themes, second-level subthemes, and third-level subthemes .......................... 30
INTRODUCTION

In an era when social media often takes the place of person-to-person interactions, and social isolation is becoming a major health concern, society is urgently in need of innovative approaches to alleviate the effects of social isolation and loneliness (Holt-Lunstad et al., 2015; Holt-Lunstad, 2017; Primack et al., 2017). This is especially true as the world navigates the current COVID-19 pandemic and grapples with the physical health outcomes as well as the mental health implications of social isolation. Studies increasingly demonstrate the dangers of social isolation in relation to mortality as well as psychological, physiological, and behavioral health (Holt-Lunstad et al., 2015; Nicholson, 2012; Primack et al., 2017). Social isolation is marked by limited social contact and social network size (Holt-Lunstad et al., 2015), while loneliness is the “distressing feeling arising from the perception that one’s social needs are not currently being met” (Eglit et al., 2018, p. 2). A wealth of research has examined the prevalence and effects of loneliness and social isolation on the well-being of older adults, but people of all ages can be negatively impacted by social isolation and loneliness (Umberson & Montez, 2010).

According to the American Association of Retired Persons (AARP) (n.d.), over eight million adults, ages 50 or older, are affected by isolation in the United States. In 2010, a survey conducted by AARP reported that over 45% of adults over the age of 45 have experienced chronic loneliness (Wilson & Moulton), and older adults are not alone in this experience. In a 2017 study including over 1000 participants, Child and Lawton found that young adults reported twice as many lonely and isolated days than their late middle-aged (50-70 years old) counterparts. In fact, a recent survey of adults ages 18 or older in Japan, the United Kingdom, and the United States, showed that the majority of people reporting loneliness in all three countries were actually under the age of 50 (DiJulio et al., 2018). Children and adolescents have
also reported experiencing loneliness and social isolation (Jose & Lim, 2014; Masi et al., 2011).

As a whole, these studies demonstrate that loneliness and social isolation are increasingly experienced across the lifespan. These experiences are additionally prevalent amongst diagnosed populations such as persons with autism spectrum disorder, depression, anxiety, psychotic disorders such as schizophrenia, and dementia and Alzheimer’s disease (Cacioppo et al., 2006; Eglit et al., 2018; Jackson et al., 2018).

The financial burden of social isolation, specifically for older adults, is comparable to that of chronic medical conditions such as high blood pressure and arthritis. Medicare spends approximately 6.7 billion dollars in additional expenditures each year to address social isolation in older adults alone (Flowers et al., 2017). Research also demonstrates that loneliness and social isolation are significantly correlated with depression (Cacioppo et al., 2006; Jose & Lim, 2014).

According to Greenberg et al. (2015), in the United States alone, the incremental economic burden of individuals with Major Depressive Disorder (MDD) was 210.5 billion dollars in 2010, and this number represented a 21.5% increase from 173.2 billion dollars in 2005.

Despite these substantive numbers, the research continues to lack robust, generalizable evidence for therapeutic approaches focused on increasing experiences of social bonding and decreasing social isolation and loneliness (Nicholson, 2012; Poscia et al., 2018). One recent meta-analysis identified four primary treatment strategies for reducing loneliness, including improving social skills, enhancing social support, increasing opportunities for social interaction, and addressing maladaptive social cognitions (Masi et al., 2011). Based on these findings, the researchers recommended group activities or group-based interventions as successful settings in which to address loneliness; however, simply placing lonely people together may not in and of itself decrease loneliness. The experience of closeness with other people, or social bonding, may
be the key to reducing loneliness (Martino et al., 2017). For the purposes of this study, social bonding is defined as “the psychological experience of increased social closeness, reflected in prosocial behaviors” (Tarr et al., 2014, p. 1).

Singing is one group activity that has been shown to increase feelings of social bonding and could serve as an effective intervention for targeting the alleviation of social isolation and loneliness (Kreutz, 2014; Pearce et al., 2015; Pearce et al., 2016; Weinstein et al., 2016). The feelings of social bonding associated with group singing may result from a variety of factors, including neurohormonal and endorphin release, self-other merging as a result of interpersonal synchrony, and activation of neural regions associated with socio-affective information and attachment (Koelsch, 2014; Tarr et al., 2014). Research has demonstrated that singing can facilitate social bonding amongst small groups of individuals who are familiar with one another as well as amongst large groups of individuals who are unfamiliar with one another (Weinstein et al., 2016). The current study explored whether singing with strangers can facilitate social bonding in a small-group context and sought to gain a deeper understanding of individuals’ experiences of social bonding through interview data, as interviews have not been commonly used in past music-focused social bonding studies. Focusing on a small group of strangers also allows for a clearer transition to clinical research, as therapy groups are often made up of small groups of individuals who are relatively unfamiliar with one another.

In addition to the small body of research that has focused on strangers’ experience of social bonding in a musical context (Tarr et al., 2016; Wiltermuth & Heath, 2009), many researchers have reported that synchronized movement facilitates feelings of social bonding and prosocial behavior amongst strangers (Cirelli, Einarson, & Trainor, 2014; Cirelli et al., 2017; Cirelli, Wan, & Trainor, 2014; Cirelli et al., 2016; Reddish et al., 2013; Tarr et al., 2016;
Valdesolo & Desteno, 2011; Valdesolo et al., 2010; Wiltermuth & Heath, 2009). Interpersonal synchrony may also play a role in the effect singing has on social bonding. Research demonstrates that singing allows for interpersonal synchrony of physiological systems such as heart rate and respiration (Muller, 2018), but the current study explored whether this physiological synchrony extends to movement synchrony while singing. Movement synchrony data was analyzed and reported separately.

The objectives of this feasibility study were as follows:

**Research Objectives**

1. To determine the feasibility of the methodology
2. To explore the effect of short-term, small-group singing on the subjective experience of social bonding
3. To explore the effect of interpersonal familiarity during short-term, small-group singing on social bonding

Interpersonal familiarity and social bonding were examined using group interviews. The researcher hypothesized that individuals in both the group of strangers and the group of people who were familiar with one another would have an experience of social bonding as a result of singing together, but the intensity and reasons cited for this experience would vary. Feasibility and viability of protocols were examined through group interviews and researcher reflections.

In summary, society is desperately in need of therapeutic approaches that ameliorate the effects of social isolation and loneliness and increase social bonding. Group singing may serve as one cost-effective, evidence-based solution to this problem, facilitated by neurological and neurohormonal mechanisms and interpersonal synchrony resulting in self-other merging. In clinical settings, group therapy often occurs amongst groups of people who are unfamiliar with
one another. If group singing can facilitate the subjective experience of social bonding amongst a small group of strangers, it may be a particularly effective treatment method. This study sought to explore the feasibility and viability of the methods used and the effect of singing with strangers on social bonding.
Music has historically and cross-culturally been used in social contexts and plays a significant role in creating social bonds (Tarr et al., 2014). Indeed, researchers have proposed that music, and specifically singing, may have evolved as a mechanism of social bonding (Huron, 2001). Creating positive social bonds is essential for humans’ physical and mental health (Holt-Lunstad et al., 2015; Holt-Lunstad, 2017; Jose & Lim, 2014). If singing can quickly facilitate social bonding amongst small groups of people, it may be an advantageous tool in mental health and group therapy for encouraging trust, group cohesion, and social closeness.

Singing together has been shown to promote social bonding in a variety of contexts. Singing creates emotional closeness between mothers and infants and can facilitate social closeness amongst small and large groups of people (Fancourt & Perkins, 2018; Weinstein et al., 2016). The mechanisms by which singing influences social bonding may be related to neurohormonal release and self-other merging as a result of synchrony (Tarr et al., 2014). Singing’s effect on social bonding has been explored through a range of lenses, including evolutionary, developmental, behavioral and sociological, hormonal, and neurological. Researchers have theorized about the evolutionary origins of singing, examined the social purposes and effects of group singing, and begun to understand the neural substrates and hormonal effects of singing. However, few researchers have explored the fullness of the individual’s subjective experience of social bonding resulting from group singing—specifically singing with strangers. This study aimed to focus on the individual’s experience after a short-term singing condition, as the subjective experience of a group therapy member is imperative to facilitating individual therapeutic change.
Singing and Attachment

Singing is involved in attachment and the creation of social bonds from before birth (Fancourt & Perkins, 2018; Persico et al., 2017). Singing increases mothers’ pleasure in proximity to their infants and can increase flow of positive mental and emotional states between mother and baby (Creighton et al., 2013). Although mother-infant social bonding in humans is a complex process that takes place over time, researchers have demonstrated increases in mothers’ perceptions of emotional closeness with their infants after only a short-term, thirty-five-minute singing session (Fancourt & Perkins, 2018). The question remains as to whether such increases in emotional closeness after short-term singing can occur between dyads and small groups other than mother-infant pairs.

Evolutionary Perspective on Music and Social Bonding

Creating and sustaining social bonds with multiple people can be time-consuming and requires mechanisms that can facilitate such bonding within a finite time budget. In non-human primates, social bonds are created and sustained through one-on-one grooming behaviors that stimulate endorphin release in the brain and promote emotional closeness (Machin & Dunbar, 2011). Since humans live in much larger groups than other primates, creating social bonds within groups requires mechanisms that can facilitate bonds between several people simultaneously. Early hunter-gatherers needed to engage in behaviors that would have equivalent social-bonding effects to one-on-one grooming behaviors but could be performed with several individuals at the same time, in order to facilitate the creation and maintenance of large social networks. These networks were essential for economic reasons, mating, and safety, among other reasons (Whallon, 2006). When individual bands of hunter-gatherers periodically joined together to form short-term “mega-bands,” large-group rituals often included singing and dancing. These
behaviors have frequently been interpreted as a means to generate social bonds between people while bypassing the need for one-to-one interactions between individuals (Weinstein et al., 2016). Some researchers have argued that active music-making is an evolutionary adaptation, designed with the purpose of enhancing social closeness and providing a sense of group identity (Dunbar, 2012).

Social Functions of Music

The social functions of music are manifold. In a 2014 review of functional neuroimaging studies, Koelsch described seven social functions of music engagement. These functions included social contact, social cognition, co-pathy, communication, coordination of actions, cooperation, and social cohesion. Social contact occurs naturally when engaging in music-making with others. Social cognition in music involves attempting to understand the composer’s or other players’ intentions, and co-pathy refers to the process of inter-individual emotions becoming more homogenous as a result of the empathic effects of music engagement. As for communication, neuroscientific studies have demonstrated overlap between the neural substrates of music perception and production and those of language and communication (Donnay et al., 2014; Limb & Braun, 2008). Music engagement also requires individuals to coordinate or synchronize to a beat, and in order to perform as a group, individuals engaging in music with one another must cooperate to achieve a shared goal. Finally, music can lead to social cohesion, or a sense of belonging with others in a group, akin to social bonding. Additionally, research has shown that active music engagement can foster prosocial behavior after music engagement has concluded, which is often a reflection of an internal experience of social bonding (Kirschner, & Tomasello, 2009; Kokal et al., 2011; Tarr et al., 2014).
Music Engagement and Self-Other Merging

While music has long functioned socially, researchers have only recently begun studying the specific mechanisms by which people experience feelings of social closeness, or bonding, through music engagement. Tarr et al. (2014) proposed that social bonding through music may be a result of self-other merging and neurohormonal mechanisms. Self-other merging refers to the idea that when a person moves in synchrony with another person, they experience the simultaneous activation of neural networks that code for both action and perception of the self and the other. “Mirror neurons,” first discovered in macaques, fire both when an action is performed and when that same action is observed. In other words, when one’s actions match those of another person, such as during exertive music or movement activities, neural systems in humans that are similar to those discovered in macaques make it difficult to perceive the difference between the self and the other. This then serves to create a short-term sense of social bonding between two people (Overy & Molnar-Szakacs, 2009; Tarr et al., 2014). Since music activities are often performed with more than two individuals, synchrony with all participating individuals, and the resulting experience of “self-other” merging, may seem less likely. However, music is a unique facilitator of synchrony, because it allows people to experience shared rhythms and synchronize with one other through an external target of synchrony—the predictable rhythms of the music itself (Tarr et al., 2014). Since many group music-making activities involve non-identical movements, however, “self-other” merging most likely does not provide a complete understanding of the mechanisms facilitating social bonding through music.

Oxytocin, Music, and Social Bonding

Researchers have often turned to neurohormones to provide an understanding of the mechanisms of social bonding, and oxytocin has frequently been described as “the social
neurohormone” (Tarr et al., 2014, p. 3). Because of this, multiple researchers have linked increases in oxytocin while listening to or engaging in music to social bonding (Keeler et al., 2005; Kreutz, 2014; Ooishi et al., 2017). Initially, oxytocin and social bonding were explored through studies of mother-infant pair bonding, and later through studies examining other types of social bonds (Atzil et al., 2011; Bartz et al., 2011). However, more recent research indicates that the positive social bonding effects of oxytocin may be context- and diagnosis-specific (Bartz et al., 2011). Oxytocin has been shown to increase pro-social, trusting behavior in healthy adults, but for adults with Bipolar Disorder, the administration of exogenous oxytocin actually impeded trust and pro-social behavior (Bartz et al., 2011). These findings suggest that oxytocin may be more appropriately described as increasing the salience of social cues, which can trigger either positive or negative emotions depending on context. This indicates that while oxytocin may play a role in social bonding, it cannot be promoted as the sole cause of social bonding.

**Brain-Opioid Theory of Social Attachment**

Machin & Dunbar (2011), in their review of evidence for the Brain-Opioid Theory of Social Attachment (BOTSA), laid the foundation for an expanded understanding of the biochemical foundations of social attachment. BOTSA is based on the behavioral and emotional similarities exhibited by those involved in close, attached relationships and those addicted to narcotics. In both cases, endorphins are linked to the initial feelings of pleasure and gratification that occur in response to an object of reward. The release of endogenous opioids is associated with a feeling of euphoria or contentment with added analgesic effects. Since levels of endogenous opioids decrease relatively quickly after contact with the object of reward, tolerance is not built up, which means that an individual must continue to interact with the object of reward in order to prevent withdrawal. BOTSA posits that social isolation results in lower levels of
endogenous opioids, and social contact results in the release of endogenous opioids, indicating that social closeness may be experienced by the brain as a reward.

BOTSA is, in part, derived from research that demonstrates how endorphins have been implicated in social bonding in non-human primates, which may translate to human social bonding. For example, Schino and Troisi (1992) exhibited a role for endogenous opioid peptides as a common substrate for social attachments between both juvenile macaques and their mothers and between juveniles and group companions. Other researchers demonstrated that monkeys’ central nervous system levels of β-endorphin, an endorphin involved in pain regulation and social reward, increased after monkeys were exposed to bouts of grooming (Keverne et al., 1989). This primate research provides a strong predictor for the ways in which the EOS is implicated in human social bonding and reward.

Since endogenous opioids are expensive and invasive to directly measure in humans, pain threshold has commonly been used as a proxy measure of endorphin release (Dunbar, Kaskatis et al., 2012; Tarr et al., 2014). In humans, experimental evidence suggests that pain tolerance, and endorphin titres by proxy, is higher when humans are actively involved in a supportive or romantic relationship, further supporting the role of endogenous opioids in social attachment (Master et al., 2009; Younger et al., 2010). Master et al. (2009) demonstrated this by administering thermal stimulations to women under a variety of different conditions. Results showed that participants rated pain significantly lower when holding their male partner’s hand than when holding an object or a male stranger’s hand and when looking at a picture of their partner as opposed to looking at an object or picture of a stranger. This research indicates that feelings of social closeness may be related to endogenous opioid release.
Because much of the research basis for BOTSA focuses on dyadic bonds, BOTSA describes three possible mechanisms for group social bonding in humans which may be linked to the EOS. These mechanisms include laughter, group-based exercise including dance, and music (Dunbar, Baron et al., 2012; Tarr et al., 2014). Dunbar, Baron, et al. (2012) demonstrated that social laughter is associated with an increase in pain threshold. Studies have also explored the role of the EOS in relation to synchronized movement, such as rowing and dance, demonstrating increased pain thresholds after participation in these actions (Cohen et al., 2010; Tarr et al., 2015). Finally, music listening and music engagement have both been implicated in increasing pain thresholds, although active music engagement may be the more effective facilitator for creating and maintaining group-level social bonds (Machin & Dunbar, 2011; Weinstein et al., 2016).

In summary, the mechanisms by which music influences social bonding between individuals may include a combination of neurohormonal mechanisms, self-other merging as a result of synchrony, and activation of neural regions associated with socio-affective information and attachment (Koelsch et al., 2014; Tarr et al., 2014).

*Group Singing and Social Bonding*

Researchers have studied group singing and social bonding using a variety of methods, including pain tolerance, self-report measures like the Inclusion of the Other in the Self (IOS) Scale, and behavioral observations of pro-sociality (Good & Russo, 2016; Kreutz, 2014; Pearce et al., 2015; Pearce et al., 2016; Weinstein et al., 2016). Naturalistic studies and surveys of participants in pre-existing choirs have shown that singing can increase feelings of social connectedness, decrease feelings of social isolation and loneliness, increase pain thresholds, and increase oxytocin levels (Hancox & Clift, 2010; Kreutz, 2014). Kreutz (2014) demonstrated
significantly increased oxytocin titres after only 30 minutes of choir participation and an average of 10 minutes of active singing. Other studies have shown that singing may “kickstart” group social bonding, as compared to other social interactions (Pearce et al., 2015; Pearce et al., 2016). Very few studies, however, have explored this “kickstarting” effect in small groups of individuals.

Pearce et al. (2016) did explore social bonding and singing in small groups and specifically focused on the differences in social closeness experienced after singing with one’s own group as opposed to singing with a less socially-familiar but related group. This study focused on pre-existing subgroups of a university fraternity comprising four individuals each. Participants were asked to sing competitively and cooperatively with their own subgroup, and each subgroup was then asked to sing competitively and cooperatively with another subgroup. Results found that closeness, as measured by the IOS Scale, was significantly greater after singing in all conditions, except for the condition in which participants sang competitively within their own subgroup. Closeness increased significantly more in cooperative conditions as opposed to competitive conditions overall. However, singing competitively against another subgroup significantly increased closeness with one’s own subgroup while also increasing closeness, albeit less drastically, with the opposing subgroup.

These findings demonstrate that singing may have an “ice-breaker” effect on social bonding—increasing feelings of closeness while bypassing the need for prior social interaction over an extended period. The social closeness effect, however, was still stronger for groups that already knew one another, perhaps because more intense emotional relationships require a prolonged social history. The findings of this study are particularly pertinent to the proposed study as they examined socially close groups compared to groups of less familiar individuals.
Also pertinent is that Pearce and colleagues cited their inability to control for level of familiarity between groups as a limit to their study. They recommended more research to examine if the same effect of social closeness with strangers exists between groups that are more socially distant than fraternity subgroups. The current study randomly recruited subjects for the group of strangers to control for level of familiarity. The current study also attempted to obtain a fuller and more naturalistic understanding of the subjective experience of social bonding by using interviews rather than a visual scale.

Another study that directly relates to the current study focused on small community choirs that periodically met up with other community choirs to form one “mega-choir.” The study measured pain threshold and self-reported levels of social bonding after singing in two conditions—before and after singing with the community choir and before and after singing with the mega-choir (Weinstein et al., 2016). The study found that after 90 minutes of singing, pain threshold increases were comparable between the small community choir and the mega-choir. Results also found that feelings of social closeness increased from pre- to post-test in the small choir, but that the increase was greater after participation in the mega-choir. These findings suggest that singing can foster social closeness, even in large contexts where individuals are not previously known to one another. The current study sought to determine whether feelings of social connection with strangers may be fostered even in a small-group setting.

The rationale for exploring social bonding amongst small groups is that small groups may be more clinically-relevant, considering that therapy groups are generally made up of small groups of individuals. This study used small groups of four. Although proponents of group therapy have generally recommended that therapy groups be between five and eight participants, groups are often naturally smaller due to setting constraints and attendance issues (Bond, 1984).
The current study was also limited by the use of motion-capture data, which was more feasibly measured amongst a smaller group of participants.

Clinical Studies on the Health Benefits of Group Singing

Research with clinical populations on the benefits of singing have focused on a variety of health outcomes but have rarely concentrated solely on social bonding. One study used descriptive survey data to explore the individual experiences of persons with chronic mental illness after maintaining membership in a therapeutic choir (Eyre, 2011). Participants reported that being a part of a group was particularly significant to their experience and described feelings of friendship, belonging, and feeling valued. Many participants reported that the best part of being in choir was being a part of a group, feeling accepted by other members of the group, and making friends. Participants also identified higher comfort levels in the choir group as opposed to groups outside of choir, indicating that some of the specific characteristics of the singing group contributed to greater feelings of social ease. In a different study, Sun and Buys (2013) found that after participation in a weekly, two-hour choir group over the course of twelve months, Aboriginal and Torres Strait Islander Australians with depression reported significant increases in quality of life, including physical, psychological, spiritual, and social health. Both of these studies looked at long-term membership in a singing group as opposed to the short-term singing condition used in the present study.

A 2018 clinical study (Grebosz-Haring & Thun-Hohenstein) determined that participation in short-term singing had general health benefits for individuals. The study found that after participating in a 45-minute singing condition every day for five days, hospitalized children and adolescents with mental disorders demonstrated decreased cortisol levels and increased quality of life, as measured by salivary swabs and survey data, respectively. Fancourt
et al. (2016) found that one hour of group singing increased positive affect, decreased negative affect, and decreased cortisol, beta-endorphin, and oxytocin levels for cancer patients, caregivers, and bereaved caregivers. The study demonstrated that singing can improve mood state and modulate components of the immune system. Despite reporting a variety of health benefits of singing, however, none of the aforementioned studies specifically focused on the social bonding effects of singing. Likewise, none of the studies used interviews, as did the present study, to gain a deeper understanding of the individual perceptions of participants.

One study in 2005 (Silber) used interview data with a clinical population, but the data was collected at the end of a long-term, eight-month study. Silber, a music educator, reported on the observed effects of a weekly choir for women prison inmates that met over a period of eight months. Through observation and year-end interviews with choir members, Silber reported that participation in the choir generated positive effects on participants’ self-esteem and empowerment, self-control, trust, and support of one another. Silber recommended future research on the effects of such a choir with other populations and on the differential benefits of a choir being conducted by a music therapist versus a music educator. While Silber’s study used interviews to gain an understanding of participants’ subjective experiences of choir, it did not focus on the short-term, potential “ice-breaker” effects of group singing that the present study sought to explore.

Although none of these studies focused specifically on social bonding, they demonstrate that singing may be a helpful treatment method for a variety of clinical populations, including people with depression and other chronic mental illnesses, marginalized individuals, including prison inmates, and hospitalized individuals and their caregivers. These studies also show that singing has potential social health benefits, including friendship, belongingness, feeling valued,
increased trust, and feeling supported, all concepts that are closely related to social bonding. If singing can also be shown to kickstart social bonding for small groups of individuals, it may have important implications as a short-term treatment method for these populations, especially for situations in which short-term treatment methods are the only options available.

Summary

Isolation and loneliness are major health concerns in today’s world, and singing may be one therapeutic method for reducing the negative effects of isolation and increasing social bonding. There are myriad health benefits to group singing, and social bonding has been shown to be one such benefit. The mechanisms by which singing influences social bonding may be a combination of neurohormonal elements, self-other merging as a result of synchrony, and activation of brain regions associated with socio-affective information and attachment (Koelsch, 2014; Tarr et al., 2015). Much of the research examining the effect of singing on social bonding has focused on large groups of individuals and/or has used neurohormonal and simple self-report measures (Good & Russo, 2016; Kreutz, 2014; Pearce et al., 2015; Pearce et al., 2016; Weinstein et al., 2016). Because therapy groups are usually composed of smaller groups of unfamiliar individuals, this study focused on singing and social bonding in small groups of familiar and unfamiliar individuals, in order to create a clearer translation to clinical research. This study also sought to gain a fuller understanding of the individual subjective experience of social bonding through interview data because perception and subjective experience are imperative to therapeutic change. This study did not use a clinical population, however, because it is a feasibility study, and a clearer understanding of the methodology, outcome variables, and measures is necessary before proceeding to clinical research.
If short-term singing in a small group can increase the subjective experience of social bonding, even amongst strangers, singing may have critical implications as a cost-effective and meaningful treatment method for a variety of clinical populations. The results of this study may provide meaningful data as to the feasibility of the methods, one possible mechanism by which singing influences social bonding (i.e. movement synchrony), and the potential for singing to induce a subjective experience of social bonding, even amongst a small group of strangers.
METHODS

Study Design

This study used a mixed-methods, between-groups design with one intervention and two outcome variables, as demonstrated in Figure 1. Each group was asked to engage in group singing, during which each subject’s movements were recorded, using a motion-capture sensor attached to the crown of their head, the Vicon Real-Time Motion Capture System, and video recording equipment. The outcome variables included the overall level of movement synchrony between subjects and between groups and the subjective experience of social bonding, as measured through group interview responses. Only the interview data is reported in this document, as the motion capture data is reported separately.

Participants

Eight subjects were enrolled in this feasibility study, in order to form two experimental groups of four. The two groups included a Familiar Group (FG) and an Unfamiliar Group (UG). The FG was composed of individuals who self-identified their level of social connection with...
each of the other members of the group as “acquaintance-level or higher” during enrollment. This was addressed in the recruitment flyer by asking potential subjects to “sign up as individuals or in groups of four” (see Appendix A). This language was used in the hopes that potential subjects who expressed interest in participating with a pre-established group of four would subsequently identify their familiarity with each of the other group members as “acquaintance-level or higher” during enrollment. The FG was randomly recruited and enrolled on a first-come, first-served basis. Participants in the UG were individually randomly recruited, also on a first-come, first served basis and had an unknown relationship to the other group members.

Inclusionary criteria were: the subjects must be WMU students, over the age of 18, and capable of using their voice to sing. Exclusionary criteria were: any physical limitations that would prevent movement of the head and membership in a WMU voice studio, as voice studio members sing together multiple times a week. Additionally, participants in the FG must have had the aforementioned previous social connection with each other member of the group.

Procedure

Upon arrival for their group’s session, participants entered the biomechanics lab and were asked to individually review their informed consent documentation with the researchers to confirm their consent for participation. Participants were given the opportunity to ask questions, and clarification was provided by the researchers. The four participants were then each equipped with one small, sphere-shaped reflective plastic marker to capture the movement of their heads while singing. Each marker was attached to a wide fabric headband and positioned to rest on the crown of the head. Once all participants were equipped with motion sensors, they were asked to stand on one of four “X’s” on the floor, forming a circle and facing one another approximately
one meter apart from the other participants on each side. A researcher joined the circle and asked the participants to introduce themselves to the group by saying their first name, before leading the group in a warm-up and introducing the singing task.

Participants were asked to sing and move as they would naturally during this portion of the study, with the only stipulation being to remain on their marked “X.” Participants were assured that the purpose of the study was not to judge the quality of anyone’s singing but were reminded that it was important for the outcomes of the study that everyone sang. Before any data was recorded, the researcher led the group in singing “Happy Birthday” as a warm-up without accompaniment. “Happy Birthday” was chosen as it is a song that is often sung in groups and without regard for the quality of singing. After singing “Happy Birthday,” the researcher explained that the group would be asked to sing three familiar songs together, unaccompanied, including, “Jingle Bells,” “You Are My Sunshine,” and “Lean on Me.” These songs were chosen for their simple and repetitive forms, ubiquity across age groups, range of genres, and common use in music therapy sessions, based on the researchers’ own clinical experience and an analysis of clinical songs by Silverman (2009).

The procedure then involved two sections: a rehearsal period and a recording period. During the rehearsal period, the researcher disseminated lyric sheets to each participant and sang through each song with the group until the group endorsed confidence in singing each song without the researcher and without the lyric sheets. After the rehearsal period, each group completed the recording period. During the recording period, the group was asked to sing each song without the researcher and without lyric sheets. The groups were not provided with a starting pitch or tempo. The prescribed form for each song, including short lyrical cues, was provided on a large-print poster just outside of the circle and was visible to all participants during
recording. This was the period during which motion-capture data was collected. Motion capture data was recorded for each song separately, for purposes of feasibility. Video was also recorded in order to match the timing and qualitative aspects of movements with the motion capture data. During the recording period, participants were asked to sing as they would naturally, pausing in between songs in order for researchers to put up a new cue card and reset the motion capture equipment.

When finished with the recording period, the participants were asked to remove their motion sensor headbands. The participants then moved to an adjacent area and engaged in a 10-20-minute group interview, during which they were asked a short series of questions about their experience singing in the group. Following the interview, participants were given time to debrief with the researchers, concluding their participation in the study.

Instrumentation

Motion capture data was measured using the Vicon Real-Time Motion Capture System. Small sphere-shaped plastic markers were attached to participants’ heads on wide fabric headbands to capture head movement while singing.

Interview data was collected via a naturalistic group interview process. The participants were asked seven pre-determined questions (See Appendix B for full interview script), each followed by the question, “...and can you tell me more about that?” The interviewer encouraged each participant to respond verbally to each question and used clarifying questions to gain more detailed responses from participants. Interviews were audio- and video-recorded and transcribed and coded using NVivo software.
Analysis

Motion capture data was analyzed using the Kwon3D Motion Analysis Suite by Visol Inc. and MATLAB and is reported separately. An inductive coding process, informed by a hermeneutic phenomenological approach, was used to analyze interview data (Cohen et al., 2000; Porter & Cohen, 2012). While there is overlap between the many different approaches to collecting and analyzing qualitative data, this study’s approach most closely aligned with phenomenology. The analysis in this study borrowed methods from grounded theory and inductive thematic analysis, but as the primary purpose was to gain an understanding of individual experiences and perceptions, a phenomenological approach was the most appropriate (Guest et al., 2013). The first purpose of analysis was to gain an understanding of participants’ subjective experiences of singing together and of social bonding. The second purpose of analysis was to determine differences between groups in regard to their subjective experiences of social bonding and other emergent themes. These differences were explored after all data had been coded to the determined themes. The researcher created codes through an iterative process that unfolded as follows.

The researcher began by reading and re-reading both interviews to get a sense of each interview as a whole. The researcher then used the hermeneutic circle to begin to more fully understand the experience and the meaning of the experience of each group. This means that the researcher attempted to understand parts of the data in order to better understand the whole and vice versa, using reflective awareness throughout the analysis process (Porter & Cohen, 2012). The researcher began by noting initial thoughts, identifying emerging themes, and then searching for connections across themes. Initial open coding resulted in a group of 17 themes that were pulled from both interviews (Decuir-Gunby et al., 2011). Axial coding was then used to
determine connections between these themes. At this level of the coding process, alike themes were combined, and other themes were moved to the subtheme level. This resulted in seven general themes that included 12 second-level subthemes and three third-level subthemes. These themes were then further subjected to axial coding and resulted in a final group of three general themes that included 12 second-level subthemes, and seven third-level subthemes (see Appendix C for log trail). Due to feasibility constraints, only one researcher completed the analysis process. The researcher consulted with a peer researcher during axial coding for purposes of organization and clarity of definitions.

Feasibility and viability of study protocols were examined using insight and themes gathered from group interviews and researcher reflections during and following implementation. Evaluation of methodological issues was guided by the questions and recommendations set forth by Shanyinde et al.’s 2011 review of medical pilot and feasibility trials and LaGasse’s (2013) music therapy-focused recommendations for feasibility studies. These recommendations include questions pertaining to sample size, eligibility, recruitment, consent, randomization, blinding procedures, adherence to the intervention, acceptability of the intervention, and feasibility and appropriateness of study protocols, logistics, and outcome assessments (Donald, 2018; LaGasse, 2013; Shanyinde et al., 2011).
RESULTS

The purpose of this study was (1) to determine the feasibility of the methodology, (2) to explore the effect of short-term, small-group singing on the subjective experience of social bonding, and (3) to explore the effect of interpersonal familiarity during short-term, small-group singing on social bonding. Eight participants were enrolled in this study, and four participants were assigned to each group. All eight participants completed the study. Feasibility results are reported first, followed by interview results. The exception to this is that some interview results are referenced within the feasibility results, as interview responses informed feasibility.

Feasibility Results

Evaluation of methodological feasibility was guided by Shanyinde et al.’s (2011) and LaGasse’s (2013) recommendations for reporting pilot and feasibility trials. As mentioned previously, these recommendations included sample size, eligibility, recruitment, consent, randomization, blinding procedures, adherence to the intervention, acceptability of the intervention, and feasibility and appropriateness of study protocols, logistics, and outcome assessments (Donald, 2018; LaGasse, 2013; Shanyinde et al., 2011).

Recruitment, Enrollment, and Group Assignment

The recruitment period for the study was three weeks. Twenty-four total participants expressed interest in the study, including three pre-existing groups of four and 12 individuals. Of these 24, nine participants were recruited, including one pre-existing group of four, and eight participants were enrolled in the study. The one recruited participant who was not enrolled did not complete the informed consent documentation. The rate of attrition was zero. Participants for both groups were randomly recruited on a first-come, first-served basis. The final groups were equal in size. All participants who expressed interest in the study were eligible to participate. The
only caveat to this was that two individuals expressed interest as part of a group that was smaller than four people. While these participants were ineligible to participate in the FG, they would have been eligible to participate in a UG, had the study included more than one UG.

Determining an appropriately powered sample size for a future study was not one of the primary purposes of this feasibility study. However, there were chance differences between groups in this study that may have had less impact on the results given a larger sample size. As described below by the theme *Musical Background*, there were clear differences between groups related to music experience and therefore comfortability engaging in the musical task. Also, it became apparent during the UG interview that two of the UG participants were previously acquainted due to being in the same academic program. This is reported in the theme *Familiarity with People in the Room*. Due to this study’s small sample size, these differences may have impacted each group’s overall experience and each participant’s perception of social bonding more significantly than they would have had a larger sample size been used.

*Music Intervention Acceptability and Participant Adherence*

The intervention appeared to be acceptable to participants, as evidenced by researcher observations and participants’ verbal feedback during the study and interview. Participants did report some feelings of vulnerability due to the unfamiliar environment, task, and motion-capture headbands, as detailed in *Perceived Social Pressures, Perceived Isolation or Disconnection*, and *Perceived Social Connection*. While a follow-up question regarding acceptability of the intervention and feelings of discomfort or vulnerability was not specifically asked, no participants commented that the task was more uncomfortable than expected based on the information they were provided during the informed consent process. In fact, as discussed in
Perceived Social Connection, participants in both groups identified that the shared sense of vulnerability they experienced actually contributed to feelings of social connectedness.

There were also variations in participants’ familiarity with the three songs used in the music protocol, as identified in Familiarity with the Music. All participants identified some level of familiarity with “Jingle Bells” and “You Are My Sunshine,” but very few participants initially expressed confidence in singing “Lean on Me.” These variations in familiarity between participants and between groups contributed to inconsistencies in the duration of the rehearsal period. Also, during the recording period, the FG asked the researcher to review “Lean on Me” with them one more time in between songs. These inconsistencies created discrepancies between both groups’ overall dose or duration of singing.

As for adherence to the intervention, each group adhered to the singing protocol as closely as possible, although variation existed between groups due to in-the-moment difficulty remembering and/or adhering to the prescribed form of each song during the recording period. These difficulties are described in the themes Structure of the Musical Task and Level of Difficulty of the Musical Task and are summarized in Table 1. The FG group shortened the last chorus of “Jingle Bells” by half, and the UG added a verse and chorus to “Lean on Me.” The UG also unexpectedly had to sing through “Jingle Bells” twice, due to technical difficulties recording the motion-capture data. Since a tempo and accompaniment were not provided, the researchers expected slight differences between groups in the total amount of singing time during the recording period. However, due to the aforementioned inconsistencies in each group’s performance, the differences in total singing time were greater than expected. During the recording period, in total, the FG sang for three minutes and 56 seconds, and the UG sang for six
Table 1. Summary of actual song forms and duration of singing during recording periods.

<table>
<thead>
<tr>
<th>Song</th>
<th>Prescribed Form</th>
<th>FG Actual</th>
<th>UG Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jingle Bells</td>
<td>Jingle... Dashing... Jingle... Dashing... Jingle...</td>
<td>Jingle... Dashing... Jingle...</td>
<td>Jingle... Dashing... Jingle... (ended halfway through this chorus)</td>
</tr>
<tr>
<td>Duration of Singing</td>
<td>1m 14s</td>
<td>1st time: 1m 28s</td>
<td>2nd time: 1m 22s</td>
</tr>
<tr>
<td>You Are My Sunshine</td>
<td>Sing 3 times total</td>
<td>Sung 3 times total</td>
<td>Sung 3 times total</td>
</tr>
<tr>
<td>Duration of Singing</td>
<td>54s</td>
<td>1m 11s</td>
<td></td>
</tr>
<tr>
<td>Lean on Me</td>
<td>Sometimes in our lives... Lean on me... So just call... Lean on me... Lean on me...</td>
<td>Sometimes in our lives... Lean on me... So just call... Lean on me... Lean on me...</td>
<td>Sometimes in our lives... Lean on me... Sometimes in our lives... Lean on me... So just call... Lean on me... Lean on me...</td>
</tr>
<tr>
<td>Duration of Singing</td>
<td>1m 47s</td>
<td>2m 43s</td>
<td></td>
</tr>
<tr>
<td><strong>Total Duration of Singing</strong></td>
<td><strong>3m 56s</strong></td>
<td><strong>6m 44s</strong></td>
<td></td>
</tr>
</tbody>
</table>

minutes and 44 seconds, demonstrating that the UG sang for a duration 1.7 times longer than the FG.

The duration of the study, including the group interview, was less than one hour per group. One hundred percent of participants completed the outcome assessment—the group interview. Costs to participants included only the time, less than one hour, needed to complete the study and any embarrassment or discomfort experienced while singing together or engaging in the group interview.
**Feasibility of Study Protocols, Logistics, and Outcome Assessment**

Some technical difficulties were encountered during the study, but these were almost completely due to motion-capture logistics rather than singing protocols. As mentioned earlier, the researcher did note that the rehearsal period and recording period for each group took different amounts of time due to technical issues and variations in familiarity with the three songs amongst participants and between groups. Because this changed the total amount of time each group sang together, it may have contributed to differences in experiences of social bonding. Also, because the recruitment process required potential participants to express interest as either an individual or as a group, blinding to which group the participants were a part of was not possible. Additionally, participants were not blinded to the outcome variable, due to the title of the study and the transparency of information provided on the consent form. This was reflected by one FG participant’s statement, “Yeah, you were avoiding eye contact. And that’s what, we’re supposed to connect…” (Annie), referenced in the theme *Isolating Actions*.

The group interview, or outcome assessment, was feasible. The researcher was able to draw out responses from each participant to each question during the group interviews using a naturalistic style of inquiry. The researcher reflected that changing the phrasing of some of the questions to be more open-ended may have encouraged more detailed responses. However, the researcher was able to use follow-up questions in order to invite more detail. The interview questions used were able to garner enough information about participants’ subjective experiences to adequately explore the dependent variable—social bonding. Both group interviews were of a feasible length at less than 20 minutes each. The FG interview lasted for 18 minutes and 30 seconds, and the UG interview lasted for 14 minutes and 45 seconds. The researcher reflected that using group interviews over individual interviews was effective, as responses from the more
communicative participants seemed to naturally encourage more reserved participants to engage more fully in the interview process.

**Interview Results**

Three overall themes emerged from the group interviews and captured the major components that influenced participants’ experience of singing together and subsequently their perceptions of social bonding: *Individual Personalities and Background, Musical Elements*, and *Social Elements* of singing together. Each overall theme was divided into second-level subthemes, and three of the second-level subthemes were further divided into third-level subthemes (see Figure 2). Definitions, sample quotations, and a discussion of the differences

![Figure 2. Major themes, second-level subthemes, and third-level subthemes.](image-url)
between group responses are provided for each theme (Steeves, 2000). Each theme, when appropriate, includes exemplary quotations from both the FG and the UG, allowing comments to be compared between groups.

The researcher determined that including filler words and colloquialisms in quotations was the most accurate and naturalistic way to portray the personality and emotion of participants’ reflections; therefore, all quotations are transcribed as closely as possible to the way in which they were spoken (Oliver et al., 2005). Pseudonyms are used to protect the identity of participants; the FG includes Annie, Bekah, Cassie, and Daisy, while the UG includes Emma, Frank, Gina, and Holly. The codebook, which can be found in Appendix D, supplies a succinct overview of the interview data, including a definition of each theme and a sample quotation from each group.

**Major Themes**

**Individual personalities and background.** Pre-existing personality traits and experiences with which participants entered into the study influenced participants’ level of comfort, participation, and subjective experiences of singing together.

**Personality traits.** Self-identified personality traits influenced participants’ subjective experiences of singing together. FG participants commented on how individual personalities and the dynamics or personality of their group as a whole affected their experience. For example, a FG participant stated, “I’m just an awkward being” (Bekah). Another FG participant described the personality of their group, saying, “We’re very good at books” (Annie), to which another participant responded, “Yeah, if there’s like one direct answer, we’re good at finding it, but at least me personally, I’m not creative at all. So, like, this setting, I’m kind of just a little
uncomfortable, to begin with” (Cassie). In contrast, only one UG participant commented on their personality, and this comment was in response to the question about their familiarity with other members of the group. “I’m very, like, stick to my office or do what I have to do. But I don’t, I don’t, I wouldn’t know like a lot from other people at [the university] besides like the grad assistants that I know and like my professors” (Frank).

Musical background. Previous musical experience or background prior to the study influenced participants’ level of comfort, participation, and subjective experiences of singing together. In the FG, participants came in with differing levels of music experience.

I did have a background singing, like, in high school. So I did like, uh, singing competition. And it’s so different being in front of people completely by yourself rather than being in a choir, like, with a group…Like I put a lot of pressure on myself. So for solos and stuff, I would practice…nonstop, because I don’t want to mess up. But like this was like, “Eh.” I felt more comfortable because it was with, well—people I knew. And you guys said no pressure. It wasn’t for like a competition. (Daisy)

Bekah reported, “I used to sing all the time. Like, musicals and show choir and such, so it wasn’t like a huge deal to me. It’s not like I’ve never sang in a group before.” Meanwhile, in response to a follow-up question about musical background, Annie replied, “I don’t have any experience if that’s what you’re asking” and Cassie said, “Only in my car or in my shower.”

In the UG group, all participants reported having formal music experience. “I’m definitely a soprano” (Gina). “I played in orchestra this semester” (Frank). When asked a follow-up question, all four reported being music majors. This was one major difference between groups, as no FG participants were music majors.
Musical elements. Different elements of the music, including the structure of the musical task, participant familiarity with the music, level of difficulty of the music, and emotional responses to the music, influenced participants’ level of comfort, participation, and subjective experiences of singing together.

Structure of the musical task. The way the musical task was structured influenced participants’ experiences of singing together. The FG commented on the lack of accompaniment, having to remember lyrics, and the repetitive forms of the songs. “When there’s no music, it’s very stressful” (Cassie) and “It’s harder, yeah. I feel like there’s—with music, there’s like cues to pick up on, and you can like remember lyrics a little bit easier, and it kind of muffles if you don’t start right away” (Daisy). In reference to having to remember lyrics, Daisy also reflected:

So, I’ve never been great with remembering lyrics, and especially with like the hundred thousand other things going on in my head. Like, even short term memory like this, like, it’s definitely not as easy as, like, I wish it was (Daisy).

In response to a question about moments when they felt disconnected from the group, the FG participants had a back-and-forth about the correct form of “Jingle Bells.” They discussed the sense of confusion they felt while singing it, since they accidentally cut the last chorus in half, ending the song earlier than directed (Table 1). This exchange references how the repetitive forms and lyrics of the songs may have created confusion.

During "Jingle Bells." (Daisy)

Yeah. That one threw me for a loop. (Cassie)

I know! I was just like, "This is the easiest one!" (Daisy)

I’m like, "We can do a lot of hard things, but this is…” (Cassie)

So what were we—we were just like repeating the “jingle bells, jingle bells”? (Annie)
Yeah, what did we do wrong? (Cassie)

I think we did "Jingle bells" twice. Instead of like, we were supposed to have went on to the "dashing" piece, and we did "Jingle Bells" an extra time. (Bekah)

Similarly, the UG commented on the lack of accompaniment—specifically in relation to starting pitches and figuring out how to start together, difficulty remembering lyrics, and difficulty or confusion with the form.

I felt like we were all on the spot when it came to like a starting pitch…from any experiences I’ve had singing, you know, that’s something that, like, at least you know beforehand. And so I was kind of like, "Alright, I’m gonna rely on someone else to start it…so that I don’t, like, come in wrong. Especially if I’m going to be like an octave lower than everyone.” I’m like, “Let’s see if I can actually sing this or if I have to jump.”

(Frank)

Holly seconded Frank’s thoughts, saying, “At the beginning of the songs, it was like, ‘Who’s gonna be the one to… call it. And like, ‘Where are we going?’”

In reference to having to remember lyrics, Emma remarked, “I didn’t know any of the words to ‘Lean on Me,’” to which Frank responded, “Yeah, it made me realize, quite a bit, that I don’t know those lyrics as well as I thought.” Gina talked about the form of “Lean on Me,” saying, “I thought it was funny that like when we all messed up, and we just all collectively decided that we’re going to sing it again.” This comment was in regard to the group accidentally adding an extra verse and chorus to “Lean on Me,” beyond the prescribed form (see Table 1).

Familiarity with the music. Familiarity with the music or lack thereof influenced participants’ experiences of singing together. Both groups commented on which songs felt familiar and which were unfamiliar. The FG made comments about each of the three songs and
how their familiarity with each song affected their experience. “We were singing [‘Jingle Bells’], and I’m like, ‘I don’t know if this is right’…Like, you know those moments when you start to question everything?” (Cassie). In reference to “Lean on Me,” Cassie reflected, “I think, I kind of picked up that like not everybody was as comfortable with [Lean on Me]. So then I felt like this like, like I had to be like mother hen, and be like, ‘Come on kids!”’ She also said to Bekah, “I feel like you carried us during ‘You Are My Sunshine,’” referencing her own lack of familiarity with that song.

The majority of UG members, like the FG, commented on a lack of familiarity with “Lean on Me” but endorsed familiarity with both “Jingle Bells” and “You Are My Sunshine.” “Like when we were singing, ‘Jingle Bells,’ I was like, ‘Oh it’s like we’re Christmas…caroling’” (Emma). Meanwhile, Gina commented, “My parents used to sing [‘You Are My Sunshine’] to me.”

*Level of difficulty of the music.* The level of difficulty of the songs and the musical task itself affected participants’ experiences of singing together. For the FG, the lack of accompaniment, having to remember lyrics, and the form of “Jingle Bells” were identified as difficult elements of the music, as mentioned earlier. However, at least one participant in the FG commented that the musical task was less difficult than anticipated. “I felt like it was easier than it was gonna be, like, I thought I was gonna be more nervous or something” (Bekah).

As for the UG, participants mainly remarked that “Lean on Me” was significantly more difficult than the other two songs.

Well, I also think that "Lean on Me" was like a more challenging song to sing. Like, just, just because like the rhythms are a little different. You kind of have like some offbeat stuff…And so, it felt like with the other songs it was maybe easier to kind of like stay in
with everybody else, in terms of like when, when we’re singing, when we’re not, whatever. And that entrances were maybe a little—it was like you had to try a little bit harder. And listen a little bit more to get it right… And then I think, like, particularly in "Lean on Me," when we go into the "just call on me brother" part, it’s like the whole feel is really different. And so trying to, like, stay together there was more challenging.

(Holly)

*Emotional responses to the music.* Emotional responses to the music or emotional significance of the music affected participants’ experiences of singing together during certain songs. For the FG, “Lean on Me” and “You Are My Sunshine” held emotional significance due to connections that group members drew between the lyrics and the pre-existing relationships they held within the group. In response to a question about recalling specific moments of connection with another group member, Annie responded, “Definitely, like, for like the last song, again, like with [Daisy]. ‘Lean on Me’…Cause we definitely have had some rough times this semester.” Cassie also commented on “Lean on Me,” saying, “Oh, yeah. I think too, like during the last one [‘Lean on Me’]…I think, like, that’d be the most that I felt like connected to [the other group members]…‘cause it was more applicable than like ‘Jingle Bells.’” Daisy, meanwhile, identified with “You Are My Sunshine.”

I felt like actually during the “Sunshine” song, for me, was more applicable. Like, I—don’t like reach out a whole lot for—like "Lean on Me" is not as applicable. But, like, these girls, I sit next to them every day, and they always make me laugh. And, like, it’s true. Like you guys are…usually little rays of sunshine. You brighten it up a little bit. Make it a little lighter. (Daisy)
For the UG group, emotional responses to the music were related to pre-existing relationships with the music, rather than relationships with other group members. This was one of the most prominent differences between groups, other than differences in musical experience.

I think this might be personal preference, but during "You Are My Sunshine," like, that always hits me really hard because my parents used to sing it to me. So like whenever, like, I listen to it or I sing it with anybody, I’m always like, "Uh!" goosebumps everywhere…It was a little bit different [to sing it in this group], but, like, even—I feel like that was the most out of tune out of all of them—but it was still the most pleasant for me to sing and participate in. It was nice. (Gina)

Frank also commented on “You Are My Sunshine,” saying, “I kind of, recollect like times of hearing it before…and was like, ‘Hmm. This is a very, very different feeling than singing ‘Jingle Bells’ or the other one.’”

**Social Elements.** Different social elements, including perceived social pressures, familiarity with other people in the room, social roles that emerged during the task, spontaneous group decision-making, moments or feelings of social isolation or disconnectedness, and moments or feelings of social bonding or connectedness, all occurred naturally while singing together and influenced participants’ subjective experiences.

**Perceived social pressures.** Many participants thought about or perceived pressure to act or respond a certain way based on their perceptions of the other people in the room and/or the setting. Subcategories of Perceived Social Pressures include Judgements or Perceptions of Others, Study Design, and perceptions about Task Performance.

**Judgements or perceptions of others.** Participants’ thoughts about the judgements or perceptions of the other people in the room influenced level of comfort, participation, and
subjective experience. This applied to both the researchers and the other group members.

When asked about what elements of the study stood out to them, a FG participant commented, “Singing in front of strangers [referring to the researchers]” (Daisy). Cassie said, “I didn’t look at you [gesturing toward Bekah], ‘cause you were too close to the words, and I’m like, ‘I don’t want them [the researchers] to think I’m looking at the words.’” The FG participants did reflect on how their participation might have differed had they been a part of the UG. “Oh, it would’ve been way different if I didn’t know anyone in the group. I would have done it, but I would have been a lot more quiet” (Daisy). “Yeah, I don’t think I would have done it” (Annie).

The UG also made comments that indicated they were thinking about the perceptions or judgements of the other people in the room, but their responses tended to focus on other group members rather than just the researchers.

If I had to like jump up the octave. And I was like, “Oh no. I’m going to have to do this, and it’s gonna be weird. Cause I can’t sing down there…And are they all going to stare at me? Cause I just can’t sing these notes.” (Frank)

**Study design.** Elements of the study design and setting affected participants’ level of comfort, participation, and subjective experience. For example, a FG participant identified that one of the things that stood out to her the most about the study was “Being recorded, because then there’s a—a record of messing up” (Daisy). FG members also discussed how the simple act of participating in a study together felt less comfortable than how they would naturally be together.

I think it was just different. Because like, yeah, we all know each other, and we all hang out and do things, but we’ve never sat down and sung a song together. (Annie)

Like yeah, this is something more formal. (Daisy)
I think if it was like going out on a Friday night and doing karaoke, like, that’d be like a lot of different, I think, than this setting. But I came in with this like, "Alright, let’s do this." And then when we got up there, I’m like, "Oh no, I actually have to do this!"

(Cassie)

UG participants also mentioned the setting and study design.

I mean it’s weird to be singing in a lab. (Holly)

Yeah. Yeah. Like when we were singing "Jingle Bells," I was like, "Oh it’s like we’re Christmas carol—caroling. But like not outside, in front of… (Emma)

And not to other people. (Frank)

And we all had these headbands on our heads. (Holly)

I kinda felt like we were like an alien caroling group a little bit. (Gina)

*Task performance.* Thoughts about how well they were performing the singing task or following the directions given by the researchers affected participants’ subjective experiences.

FG participants specifically discussed how well they normally perform “tasks” compared to how well they completed the study task.

Normally we perform in our tasks a lot better, I feel like. (Cassie)

I know! I was going to say too, like we are definitely all like high achievers. Like, you pretty much have to be to get in [to the academic program of which each FG participant reported being a part]… (Daisy)

I was like, "I found my weakness…This is it." (Cassie)

The UG discussed the concept of “making mistakes” repeatedly, although this phrase was never brought up by the researchers. “We’ve all made mistakes now, and we’re all in this together” (Holly). “And we all know how it feels to, you know, have made a mistake, and we’ve
all been there. So it’s kind of like, ‘All right,’ like, assuredly, like, ‘We know what’s going on, but it’s okay’” (Frank).

Familiarity with people in the room. Level of familiarity with the other participants and people in the room affected participants’ level of comfort, participation, and subjective experiences of singing together. As mentioned earlier, FG participants reported that, “It would’ve been way different if I didn’t know anyone in the group” (Daisy) and “I felt more comfortable because it was with, well, people I knew” (Daisy).

While it turned out that two UG participants, Gina and Holly, did have a prior relationship because they were in the same academic program together, each group member was unfamiliar with at least two other group members, making the group as a whole an unfamiliar grouping. Emma and Frank also disclosed recognizing one of the researchers from playing in orchestra with her. Other than comments describing their level of familiarity with one another, however, the UG participants did not expound on how familiarity affected their subjective experience of the study.

Social roles. Different social roles, such as leading, following, and helping, were naturally taken on by participants during the singing task. In both groups, some participants described feeling as though they took on a leadership role at times, while others recounted acting as followers. Participants also explained that these roles shifted based on each person’s level of familiarity with each song. In the FG, the same participant made comments such as, “I think like, if I forgot a word or something, or like when to start, and then I looked at someone who knew it, I felt like, ‘Okay, you’re like leading me. I’m gonna follow you a little’” (Cassie), and “I kind of picked up that, like, not everybody was as comfortable with [‘Lean on Me’]. So then I felt like this like, like I had to be like mother hen, and be like, ‘Come on kids!’” (Cassie). Cassie also
mentioned, “I think we had a good dynamic. I feel like there was always at least one person who could like, kind of help us.”

In the UG, participants also reflected on how they spontaneously took on specific social roles. “I kept kind of feeling like I was, I was like checking in on everybody—as we were, like, going through, just to be like, ‘Where, where are we at? What’s going on?’” (Holly). Another participant remembered, “Especially during ‘Lean on Me’... I was following you [Holly], because I didn’t know any of the words!” (Emma).

Group decision-making. Non-verbal decision-making appeared to spontaneously occur amongst group members during the singing task. This phenomenon was described by members of both the FG and UG. In the familiar group, Annie commented, “And then I think I was looking at [Cassie], like, during the ‘Jingle Bells,’ so I was like, ‘Are we supposed to be repeating this?’...She just kept singing, so I was like, ‘Ok, I’m gonna keep singing.’” In reference to the same moment, Cassie observed, “I think it’s so weird that we all did it though.”

In the UG, participants made similar comments. “It was just like, I thought it was funny that like when we all messed up, and we just all collectively decided that we’re going to sing it again” (Gina). “But then we were just like, ‘Alright, this is what we’re doing now’” (Frank). The group also had a back-and-forth about their decision as to whether or not to say “Hey!” during “Jingle Bells.”

In "Jingle Bells," we (referring to Holly) kept saying "Hey" at the same time. (Emma)

Yes. (Holly)

And then, yeah, but… (Emma)

And then I joined on it, and I was like, "You know, might as well." (Frank)

That’s what we’re doing, is what we’re doing now. We’re "Hey-ing." (Holly)
I eventually did it. I was just like, "Wait, everyone—" (Gina)

That’s what you want. That’s funny. (Holly)

Social isolation or disconnection. Participants described actions that created social isolation or disconnection and feelings or perceptions of isolation or disconnection. Subcategories of Social Isolation or Disconnection include Isolating Actions and Perceived Isolation or Disconnection.

Isolating actions. Participants described specific actions that contributed to feelings of isolation or disconnection including a lack of eye contact, “just standing” versus singing, and confusion about what pitches to sing. In the FG, participants mainly identified a lack of eye contact as an isolating action. “I think I was anxious, so I just stared at the ground” (Bekah). “Yeah, you were avoiding eye contact. And that’s what, we’re supposed to connect…” (Annie).

In the UG, participants identified “just standing” and personal attempts to fit their voices to the key chosen by the group as isolating actions.

When we weren’t singing, there was just, like, the four of us just, like, standing there like waiting for the next one to happen. And then, like, while we were singing, I felt like, something we were doing together instead of just, like, standing. (Emma)

As mentioned earlier, when asked about moments they felt isolated or disconnected from the group, Frank and Gina both described trying to find the right pitches to sing. “They’re all going to stare at me, cause I just can’t sing these notes” (Frank). “For me, there was, like, only personal moments where my own range, cause, like, I’m definitely a soprano. So we’d start kind of low in a lot of the keys, and like, ‘Uh, it’s not coming out’” (Gina).

Perceived isolation or disconnection. Participants described moments or feelings that contributed to perceptions of isolation, disconnection, or feeling out-of-sync with the group.
These included the feeling that others were connecting when they were not, moments of confusion or not knowing the lyrics, and feeling a lack of rhythmic synchrony. FG participants made the following comments:

I think during, like, "You Are My Sunshine," I felt kind of disconnected, ‘cause—where I was staring at the ground and everything—and then I looked up, and everyone’s like making loving eye contact..."Oh, okay, I’ll look back down." (Bekah)

Cassie described feeling out-of-sync when “Jingle Bells” did not go as planned.

Once one person felt kind of off during "Jingle Bells," I think that spread so quick, and we were like, "Oh wait." I don’t know who the first person was, but I know I wasn’t. I was like the last. And like, "Everyone seems confused." (Cassie)

Cassie also recounted the complicated experience of feeling simultaneously isolated and connected during “Lean on Me.”

I think like during the "Lean on Me" when I noticed like no one else was very familiar with the lyrics, I think I kind of was like, "Help." I was like, I don’t know, like, like I felt connected, cause I went, "Okay, I can help you," but then I was also like, "Why am I the one helping?"

In the UG group, participants identified moments of disconnection or being “out-of-sync” at the beginning of songs while trying to find a group pulse, at times when some participants felt less familiar with the words than others, and, again, at times when participants had difficulty with the pitch range of a song.

I think that like starting each song was always disjointed or whatever. And then I think, like, particularly in "Lean on Me," when we go into the "just call on me brother" part. It’s like the whole feel is really different. And so trying to, like, stay together there was more
challenging…[but] I don’t know if it felt more disconnected. It was just like noticing that we weren’t together. Just kind of thing. (Holly)

Emma talked about not knowing the words to one of the songs as being isolating. “For ‘Lean on Me,’ I didn’t know, like, any of the words except for like ‘Lean on me’…And, so, it just, for like the whole time, I was like, ‘La, la, la.’ I don’t know the words!”

_Social bonding or connectedness._ Participants described actions that created social bonding or connectedness and feelings or perceptions of social bonding or connectedness. Subcategories of _Social Bonding or Connectedness_ include _Social Actions_ and _Perceived Social Connection._

_Social actions._ Participants described specific actions that contributed to feelings of social bonding or connectedness, including singing versus not singing, eye contact or paying attention to others, laughter, and being in time or in tune with the group. When asked whether they experienced a sense of connection more during the singing portion or while not singing, both groups unanimously agreed that they felt more connected while singing. In the FG, participants mainly identified eye contact as a social or connecting action. “I think, like, to feel comfortable, I stared at you guys a lot” (Cassie). “During parts we knew well, I feel like we’d look at each other. It was more fun then, I guess” (Cassie). When asked about moments she felt connected to the group, one participant responded:

I feel like I looked up when we were messing up “Jingle Bells.” We all made like confused eye contact at that point. And then, yeah, I looked at [another participant] pretty much the whole last song because she knew what she was doing, and I did not, so she kind of carried me through that (Bekah).
The UG identified multiple actions that contributed to feelings of social bonding or connectedness, including eye contact or paying attention to other group members, laughter, being in time or in tune with one another, and singing over not singing. When asked about moments they experienced social connectedness, one participant said, “I mean, we, I feel like we [referring to Emma] made eye contact a lot” (Holly), to which Emma replied, “Yeah. Especially during ‘Lean on Me,’ because I was following you, because I didn’t know any of the words!” Holly also reflected, “I mean, I think that like all of us singing together and having to do all of this stuff, in time with each other, and in tune with each other, it, like, just means, we’ve gotta be paying attention to everybody else” (Holly). Another UG participant observed:

But like once there was definitely, and each time we sang, like a for-sure point where everyone was like, "Alright, we’re all on the same page." And then from, from kinda then on, we were kind of more in tuned to what’s going on around us. And then…kind of felt more like a group. (Frank)

One participant also commented about feeling connected through laughter, saying:

I kind of feel like every time we—were laughing. Because, like, whatever happens, like, you know, someone made a mistake, or it wasn’t—it was awkward or whatever. Every time you were laughing, that was like, that was just the bonding moment for me. (Holly)

This participant also agreed that the laughter occurred most often while singing, because “That’s when all the mistakes were made!” (Holly).

**Perceived social connection.** Participants described moments and feelings that contributed to the perception of social bonding or connection with the group, including moments of confusion that were remedied by help from another group member, shared emotional
responses to the music, a shared sense of vulnerability, and a shared sense of humor. FG participants identified moments of connection as times when they were confused and felt like they could rely on other participants for leadership or help, moments when the lyrics of each song helped them connect with other group members, and moments when they felt vulnerable and experienced a sense of solidarity with the group.

As mentioned earlier, multiple participants pointed out moments where they felt confused and then made eye contact with another participant as moments of connection. “I think like, if I forgot a word or something or like when to start and then I looked at someone who knew it, I felt like, okay, you’re like leading me” (Cassie). They also described times when a connection with the lyrics increased their sense of connection or bonding with the other group members. When asked about moments of connection with another individual in the group, as mentioned earlier, one participant responded, “Definitely, like, for like the last song, again, like with [Daisy] um, ‘Lean on me’…Cause we definitely have had some rough times this semester “ (Annie). Also, as stated earlier, in response to a question about connection to the group, Daisy said:

I felt like actually during the “Sunshine” song, for me, was more applicable…like, these girls, I sit next to them every day, and they always make me laugh…Like you guys are…usually little rays of sunshine. You brighten it up a little bit. Make it a little lighter. (Daisy)

Finally, FG members recalled feeling connected over a shared sense of vulnerability. I think too, cause we were all kind of like, I mean, I’m not comfortable singing in front of people. So I think like, we were just kind of vulnerable too, in that like moment, so I think that helped me feel connected, ‘cause then we go, ‘I’m singing, but they are too, so it’s fine.’ (Cassie)
UG participants also identified times when they needed to rely on each other for help and times when they experienced solidarity with the group in response to feeling weird or making mistakes as moments of connection. The UG group additionally characterized moments of laughter as moments of connection or bonding. When asked about moments of connection with another individual, Emma and Holly talked about making frequent eye contact, as mentioned earlier. “Especially during ‘Lean on Me,’ because I was following you, because I didn’t know any of the words!” (Emma). Emma also detailed how connection sometimes emerged from disconnection or confusion, “Like at the beginning of the songs, like, when we would start, we wouldn’t be together at first. But then when we all would get together, I feel like that was a good point.”

Frank discussed connecting over a shared sense of vulnerability.

I don’t know, I personally kind of felt like during those moments, it was like, "Okay, this is kind of a weird situation to sing in, but like at least I’m like, you know, we’re definitely singing as a group,” and that’s def—that’s something that I feel like, "Oh, I’m not alone doing this.” (Frank)

Holly’s comments echoed this sentiment. “We’ve all come, we’ve all made mistakes now, and we’re all in this together. And like, we’re only going to make it through if we can like have a sense of humor about it.” Again, Holly also observed that laughter allowed her to feel more connected to the group. “Every time you were laughing, that was like, that was just the bonding moment for me” (Holly).
DISCUSSION

The purpose of this study was threefold: (1) to determine the feasibility of the methodology, (2) to explore the effect of short-term, small-group singing on the subjective experience of social bonding, and (3) to explore the effect of interpersonal familiarity during short-term, small-group singing on social bonding. The results of this study reveal that while many aspects of the methodology were feasible, changes to some elements might increase fidelity and validity in future studies. The study also found that all participants, regardless of familiarity, endorsed having a subjective experience of social bonding as a result of small-group singing. As hypothesized, the components of this experience and elements of singing that contributed to this experience varied amongst participants and between groups.

Feasibility Discussion

Recruitment, Enrollment, and Group Assignment

Recruitment, enrollment, and group assignment procedures for this study were viable. The main concern that arose in regard to group assignment was the feasibility of controlling for familiarity in the UG, as evidenced by the theme *Familiarity with People in the Room*. If using the same recruitment and enrollment procedures in a future study, a larger sample size would likely diminish the impact of this chance occurrence on the results of the study. Asking UG participants to rate their level of familiarity with the other participants upon arrival for the study and excluding participants from the study who already know each other, could also solve this problem. However, when approaching this issue with an eye toward a transition to clinical research, difficulty controlling entirely for familiarity perhaps becomes less problematic, as having mixed groups of familiar and unfamiliar individuals may increase ecological validity. Although two participants in this study’s UG previously knew each other, each participant in the
group was still unfamiliar with at least two other participants, making for an overall unfamiliar grouping.

Additionally, there were clear differences in musical experience between the groups in this study, which were only inadvertently revealed during group interviews. The researcher may not have been made aware of these differences had they not organically come up in conversation. In the future, collecting preliminary background and demographic information may help researchers better understand participants’ perceptions of social bonding within the context of their pre-existing musical and cultural experiences.

In this study, participants were not blinded to the outcome variable or to the group of which they were a part. Since this study involved a naturalistic form of inquiry, and its analysis was informed by phenomenology, total blinding to the outcome variable and group assignment was not of primary concern. As discussed later, however, asking more open-ended questions at the beginning of the interview about participants’ overall reflections on their experience may have provided a better understanding of participants’ initial take-aways from singing together, before asking more pointed questions regarding social connection and disconnection.

*Music Intervention Acceptability and Participant Adherence*

The music intervention and duration appeared to be generally acceptable to participants, although this was not directly measured. Including an interview question specifically addressing the acceptability of the intervention may help future researchers better evaluate this component of the methodology. Participants did report varying degrees of familiarity with the three songs chosen for this study. This contributed to inconsistencies in the duration of the rehearsal and recording periods between groups, which meant that each group received a different dose or duration of singing time. Testing familiarity of these songs with the sample population in
advance might give future researchers a better idea of the average rehearsal time necessary to introduce and rehearse each song. Further research into the most commonly known songs amongst the sample population might also provide more insight into the feasibility and appropriateness of song choices. Future researchers might also consider that researcher-chosen music versus participant-chosen music may influence outcomes and participants’ intrinsic experiences resulting from music engagement. Based on this study, “Jingle Bells” and “You Are My Sunshine” were both appropriate and generally familiar choices for this population. “Lean on Me” was less familiar to the sample population. Future researchers could either choose to plan for additional rehearsal time for “Lean on Me” or simply use a different song. For this study, “Lean on Me” was specifically chosen for its more rhythmic and upbeat style, in order to include at least one song that might naturally encourage movement.

Due to in-the-moment confusion about song forms and lyrics, there were inconsistencies in the sung forms of songs during the recording period, which created differences in recording period duration between groups. Technological difficulties also affected differences in the recording period. These inconsistencies might be remedied in future studies by providing more than one poster board to cue the form during the recording period, in order to increase visibility for all participants. Other potential solutions might be to improve clarity of instruction regarding the lyrics and form during the rehearsal period and to increase the length of the rehearsal period. Thorough advance rehearsal with motion capture equipment might also diminish unexpected technical difficulties.

*Feasibility of Study Protocols, Logistics, and Outcome Assessment*

The group interviews were of an acceptable duration, and the naturalistic style of inquiry allowed the researcher to ask follow-up questions in order to gain a more detailed description of
participants’ experiences. The researcher reflected that not blinding participants to the purpose of the study may have influenced participants’ experiences of the study and responses to interview questions. However, since the purpose of this study was to understand the details of the singing and social bonding experience, it may have been important for participants to have at least some awareness of the outcome variable. Regardless, future researchers may want to begin with questions focused on general feelings that came up during the experience, before asking more specific questions about connection and disconnection. This may garner a more organic description of overall initial take-aways. If social bonding naturally comes up in this initial discussion, this may help researchers understand the level of significance of social bonding in participants’ overall perceptions of singing together.

Social Bonding Discussion

The results of group interviews revealed that all participants in both groups endorsed feelings of connection or social bonding with other group members as a result of singing together. These results align with earlier research that supports a role for singing in increasing social bonding amongst both unfamiliar and familiar groups (Pearce et al., 2015; Pearce et al., 2016; Weinstein et al., 2016). Both groups identified multiple elements of the study that contributed to their overall experience as well as specific actions and feelings that influenced their perceptions of social bonding. There were some differences between groups in regard to the components of singing together that led to a social bonding experience. The most distinctive of these differences was their emotional responses to the music.

Elements of the study as a whole that influenced participants’ experiences will be briefly discussed first, followed by actions and feelings that participants associated with social bonding.
The discussion of social bonding will conclude with the ways in which interpersonal familiarity impacted social bonding.

All of the themes that arose from the group interviews described different elements of the study that influenced participants’ singing experience, and subsequently their experience of social bonding. The participants’ Individual Personalities and Background and the Musical Elements of the prescribed singing task all influenced participants’ experiences in different ways. Participants’ internal experiences were also affected by Perceived Social Pressures and Familiarity with People in the Room, as was one of the hypotheses of this study. Each of these elements may be important for future researchers to consider when constructing a study examining singing and social bonding. Additionally, participants discussed how Social Roles and Group Decision-Making naturally resulted from singing together and thus affected their experiences of social bonding.

All participants endorsed feeling more connected while singing as opposed to times when they were not singing. Participants identified three primary Social Actions, or components of singing, that contributed to feelings of Social Bonding or Connectedness. These included eye contact or shared attention, laughter, and being in time and in tune with one another. All three of these concepts align with prior research on the mechanisms that facilitate social bonding during music engagement. For example, Koelsch (2014) identified social contact, synchronizing to a beat, and cooperating to achieve a shared goal as three of the social functions of music engagement. Shared attention, eye contact, and laughter, as identified by the participants in this study, all fall under the umbrella of social contact. While these were important elements of participants’ social bonding experience, they may not be exclusive to singing activities.
Being in time and in tune with one another, on the other hand, are inherently musical concepts. These ideas also coincide with Koelsch’s (2014) concepts of synchrony and cooperation. As discussed earlier, Tarr et al. (2014) determined that self-other merging as a result of synchrony may be one of the key mechanisms by which music influences social bonding (Muller, 2018; Overy & Molnar-Szakacs, 2009). Being in time with one another can certainly be understood as a form of synchrony, and, as Tarr et al. (2014) predicted, the participants in this study reflected that moments of temporal synchrony contributed to their experiences of social connection.

Additionally, researchers have identified laughter, separately from music, as a mechanism of social bonding related to the EOS (Dunbar, Baron et al., 2012; Machin & Dunbar, 2011; Tarr et al., 2014). When music and laughter occur simultaneously, as they did in this study, perhaps the potential for social bonding or the intensity of the social bonding experience increases. Future researchers may find this an intriguing area of inquiry.

Conversely, participants pinpointed *Isolating Actions* that contributed to feelings of *Social Isolation or Disconnection*. These included a lack of eye contact or shared attention, “just standing” versus singing, and attempting to find appropriate pitches to sing. Interestingly, these actions are almost exact opposites of the *Social Actions* that contributed to a sense of connection. In this study, the researchers attempted to increase potential for eye contact and shared attention by taking away lyric sheets and having the participants stand facing one another in the circle. These strategies appeared to be effective for the majority of the time in both groups. Some moments without eye contact naturally occurred however, because it would be impossible to force continuous eye contact amongst a group of people for the length of time required by the intervention in this study. The issue participants had with finding a pitch center for each song
would easily be addressed in a future study by providing accompaniment or determining keys in advance. The researchers in this study chose not to provide an accompaniment or starting pitches to try to encourage natural movement and cooperation amongst group members while they attempted to find a pitch center and tempo collaboratively. Also, since participants often depicted moments of disconnection eventually transforming into moments of connection, it may be unnecessary to change any of the aforementioned elements in future studies, as a mild level of discomfort may actually have played a part in facilitating social bonding in this study.

As for feelings and internal experiences that contributed to social bonding or Perceived Social Connection, participants identified times when they felt either helped or supported by other group members or could provide help to others; shared emotional responses to the music; a shared sense of vulnerability or discomfort; and a shared sense of humor. Feeling helped or supported can naturally contribute to feelings of social closeness or social cohesion, and like many of the social actions described by participants, social cohesion has been identified by researchers as a natural social function of music engagement (Koelsch, 2014). The other three internal experiences described by participants involved perceptions of shared emotion. As mentioned earlier, Koelsch (2014) identified co-pathy as a function of shared musical engagement. Co-pathy, or the idea of inter-individual emotions becoming more homogenous as a result of shared experience, seems to correlate with the phenomenon of shared emotions described by participants in this study. It also aligns with the concept of self-other merging, or the idea that the boundaries between the self and the other may become blurred as a result of music engagement (Overy & Molnar-Szakacs, 2009; Tarr et al., 2014).

Participants identified that Perceived Isolation or Disconnection occurred when one participant felt that others were connecting when they were not; during moments of confusion;
and when feeling a lack of rhythmic synchrony. The FG participant who identified feeling like the rest of the group was connecting and she was not, noted that this was during a time when she was looking down and not making eye contact with others. She also self-identified that moments of connection she experienced may have been related to increased eye contact. Many participants noted moments of confusion and times when they had difficulty with the lyrics. However, participants also reflected that when they could look to another participant for help or support, these moments of confusion often transformed into moments of connection. Similarly, participants talked about how moments of asynchrony at the beginning of songs transformed into moments of cohesion once the group was able to find a shared pulse.

Additional social themes that arose from the group interviews included Social Roles and Group Decision-Making. Both of these themes describe other important social functions of music engagement identified by Koelsch (2014), including communication and social cognition. Non-verbal communication occurred in order for groups to make cooperative decisions while singing. Social cognition, the attempt to understand others’ intentions, also most likely contributed to participants’ perceptions of group decision-making and the natural emergence of social roles. Again, while these social themes may not be specific to music engagement, the inherent power of group singing may lie, in part, in its ability to serve a myriad of social functions at once.

Differences Between Groups

Both groups reported elements of singing together that facilitated a social bonding experience, but there were some differences between groups. The UG identified laughter and being in time or in tune with one another as elements of singing that contributed to social bonding, while the FG did not. Perhaps the most significant difference between groups, however,
was the underlying reason for their emotional responses to the music, which subsequently influenced their experience of social closeness with the group. Each of these distinctions between groups can be put in the context of either differences in background or differences in interpersonal familiarity.

Laughter occurred in both groups, but since the UG participants did not know one another, laughing together may have been a more prominent element of the experience for them than it was for the FG. Additionally, the UG had significantly more musical experience than the FG. This may have contributed to the way they noticed and described musical elements of the task, like being in time or in tune with one another, and may explain this difference between groups.

The clearest contrast between groups was in regard to emotional responses to the music and how those responses influenced feelings of social bonding. The FG emotionally responded to lyrics that connected to their pre-existing relationships with the group, while the UG’s emotional responses were connected to pre-existing relationships with the music itself. This is a critical difference, as it demonstrates one of the primary ways in which interpersonal familiarity differentially influenced participants’ experiences of social bonding. This difference was likely due to the fact that the UG, with the exception of the two previously acquainted participants, did not have pre-existing relationships with one another to which they could connect the lyrics. The shared emotional responses to the music experienced by the FG required shared history. This corresponds with the results of Pearce et al.’s (2016) study that found that singing can induce social closeness amongst both familiar groups and unfamiliar groups but that the social closeness effect may be stronger in familiar groups because of shared history.
Pearce et al. (2016) and Kreutz (2014) talked about a role for music in kickstarting social bonding, also described as the “ice-breaker” effect of singing. While the UG did not have the shared emotional response to the music that was discussed by the FG, they did report a shared sense of vulnerability, support, and humor that contributed to an experience of social bonding. Since groups in this study sang together for less than seven minutes each during the recording period, and less than approximately 20 minutes total, including both the rehearsal and recording periods, the singing in this study can be described as a short-term singing task. In light of the short duration of singing, this study’s results support Pearce et al.’s (2016) and Kreutz’ (2014) idea that short-term singing can serve to kickstart social bonding. This means that singing may have the ability to increase feelings of closeness while bypassing the need for prior social interaction over an extended period of time.

In summary, the results of this study align with previous research on interpersonal familiarity, singing, and social bonding and further our understanding of the subjective experience of social bonding resulting from singing through interview data. Additionally, this study demonstrates that it is possible, even with a group as small as four individuals, and after singing together for less than 20 minutes, for individuals who are unfamiliar with one another to have an experience of social bonding. While the data in this study support the idea that the impact of singing on social bonding may be stronger amongst individuals who are already familiar to one another due to shared history, the results also support the potential for singing to kickstart social bonding amongst strangers.

Limitations and Future Research

As addressed in the discussion of feasibility, there were multiple limitations to this study. These included the difficulty in controlling for familiarity in the UG; the clear differences in
musical experience between groups and the lack of preliminary demographic information; difficulty controlling for dose or overall duration of singing, as evidenced by inconsistencies in the duration of the rehearsal time and the recording period due to technical difficulties and familiarity with the music; and difficulty blinding participants to their group and the outcome variable. Recommendations for addressing these limitations are provided in the Feasibility Discussion section of this manuscript.

As this was a feasibility study, and the majority of the methods proved feasible, it is recommended that a future study replicate the methods of this study with a larger sample size, taking into account identified limitations. Future researchers may also want to look at the duration or dose of singing necessary for participants to report a subjective experience of social bonding, as this study used a shorter duration than most previous studies and still found that participants reported experiencing social bonding.

Conclusion

The results of this study imply that short-term, small-group singing can have an effect on the subjective experience of social bonding for people in both familiar and unfamiliar groups. While the social closeness effect of singing may be stronger for individuals who are already familiar with one another, singing can kickstart social bonding amongst strangers. Eye contact, shared attention, laughter, and being in time or in tune with one another were some of the elements of singing in this study that contributed to an internal experience of social bonding. Participants also identified that shared feelings of vulnerability, support, and humor contributed to social bonding. For the FG, shared emotional responses to the music strengthened pre-existing feelings of social closeness. These results suggest that there are multiple components of singing together that may contribute to social bonding, and that regardless of familiarity, singing has the
capacity to accelerate social bonding. Furthermore, with only a few exceptions, the methods of this study were feasible. With a larger sample size, future researchers may use this study’s methods to continue to expand our understanding of singing’s potential to influence social bonding and the complex mechanisms by which this occurs. The icebreaker potential of singing explored in this study may have critical implications for building trust and group cohesion in therapy for persons struggling with social isolation and loneliness across the mental health spectrum.
REFERENCES


APPENDIX A

RECRUITMENT FLYER
SING FOR SCIENCE!
Looking for individuals or groups of four to participate. No formal singing experience necessary!

Interested in a research study involving singing familiar songs in a small group while wearing motion capture sensors?

This study will explore how people move while singing together. Participants will be asked to sing three short songs as a group while wearing motion capture sensors, followed by a brief interview about their experience. No formal singing experience or musical background is necessary to participate!

Interested participants may sign up as individuals or in groups of four. Please let our researchers know if you have a group of four people interested in completing the study together.

Each participant will receive:

- A $40 gift card as compensation for their time
- Information on results of the study at its completion

Location
- Study participation involves one 60-minute session located in the WMU Student Recreation Center

Are you eligible?
- 18 years of age or older
- Currently a WMU student
- Capable of using your voice to sing
- Not a member of a WMU School of Music Voice Studio

If you’re interested in participating or unsure if you meet the requirements, email a member of the study team:

- Student Investigators:
  - Sheridan Brown, MT-BC: sheridan.r.brown@wmich.edu
  - Molly Grettenberger, MT-BC: molly.a.grettenberger@wmich.edu
- Principal Investigator:
  - Edward Roth, MM, MT-BC: edward.roth@wmich.edu

Contact us for more information!
APPENDIX B

INTERVIEW SCRIPT
Interview Script

Scaffolding of questions:
- Naturalistic Inquiry
- Each question followed by “…and can you tell me more about that?”

Interview Questions:
1. What stands out to you the most about this experience?
2. Do you recall moments when you experienced a sense of connection with an individual in the group?
3. Do you recall any moments when you experienced a sense of connection with the whole group?
4. If you felt a sense of bonding or connectedness, did you feel it more strongly when singing or when not singing?
5. Were there moments when you felt particularly “out of sync” or disconnected from the group?
6. Can you describe your level of familiarity with the other participants in the group before beginning this study?
7. Is there anything else we haven’t discussed that you’d like me to know?
**Initial Themes**

1. Familiarity with Other People in the Room
2. Physical Environment and/or Setting
3. Fear of Judgement or Perceptions of Others
4. Musical Structure and Elements
5. Social Interaction or Social Contact
6. Roles within the Group
7. Feelings that Surfaced during Participation
8. Emotional Significance of the Music
9. Task Performance or Proficiency
10. Musical Experience and Background
11. Study Design, Procedure, and Methods
12. Disconnection or Isolation
13. Personality Traits
14. Regrets following Singing
15. Familiarity with the Music
16. Group Decision-Making
17. Social Bonding or Connectedness
**Step 2: Axial Coding - Combining Themes and Creating Subthemes**

<table>
<thead>
<tr>
<th><strong>Themes, Second-Level Subthemes, and Third-Level Subthemes</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Familiarity with other People in the Room</td>
</tr>
<tr>
<td><strong>2.</strong> Study Design</td>
</tr>
<tr>
<td>a. Physical Environment and Setting</td>
</tr>
<tr>
<td>b. Musical Task</td>
</tr>
<tr>
<td>i. Musical Structure and Process</td>
</tr>
<tr>
<td>ii. Familiarity with the Music</td>
</tr>
<tr>
<td>iii. Difficulty of the Music</td>
</tr>
<tr>
<td><strong>3.</strong> Musical Experience or Background</td>
</tr>
<tr>
<td><strong>4.</strong> Feelings that Surfaced During the Study</td>
</tr>
<tr>
<td>a. Fear of Judgement or Perceptions of Others</td>
</tr>
<tr>
<td>b. General Personal Feelings</td>
</tr>
<tr>
<td>c. Feelings of Disconnection or Isolation</td>
</tr>
<tr>
<td>d. Feelings of Connection, Bonding, or Togetherness</td>
</tr>
<tr>
<td>e. Feelings about Task Performance or Proficiency</td>
</tr>
<tr>
<td>f. Emotional Responses to Music</td>
</tr>
<tr>
<td><strong>5.</strong> Social Elements of the Task</td>
</tr>
<tr>
<td>a. Prosocial Actions</td>
</tr>
<tr>
<td>b. Isolating Actions</td>
</tr>
<tr>
<td>c. Group Decision-Making</td>
</tr>
<tr>
<td>d. Social Roles</td>
</tr>
<tr>
<td><strong>6.</strong> Personality Traits</td>
</tr>
<tr>
<td><strong>7.</strong> Regrets following Singing</td>
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Step 3: Further Axial Coding and Final Codes

<table>
<thead>
<tr>
<th>Themes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Individual Personalities and Background</td>
</tr>
<tr>
<td>a. Musical Background</td>
</tr>
<tr>
<td>b. Personality Traits</td>
</tr>
<tr>
<td>2. Social Elements</td>
</tr>
<tr>
<td>a. Familiarity with other People in the Room</td>
</tr>
<tr>
<td>b. Perceived Social Pressures</td>
</tr>
<tr>
<td>i. Judgement or Perceptions of Others</td>
</tr>
<tr>
<td>ii. Task Performance</td>
</tr>
<tr>
<td>iii. Study Design</td>
</tr>
<tr>
<td>c. Social Roles</td>
</tr>
<tr>
<td>d. Group Decision-Making</td>
</tr>
<tr>
<td>e. Social Isolation or Disconnection</td>
</tr>
<tr>
<td>i. Isolating Actions</td>
</tr>
<tr>
<td>ii. Perceived Isolation or Disconnection</td>
</tr>
<tr>
<td>f. Social Bonding or Connectedness</td>
</tr>
<tr>
<td>i. Social Actions</td>
</tr>
<tr>
<td>ii. Perceived Social Connection</td>
</tr>
<tr>
<td>3. Musical Elements</td>
</tr>
<tr>
<td>a. Emotional Responses to the Music</td>
</tr>
<tr>
<td>b. Structure of the Musical Task</td>
</tr>
<tr>
<td>c. Level of Difficulty of Songs and/or the Musical Task</td>
</tr>
<tr>
<td>d. Familiarity with the Music</td>
</tr>
</tbody>
</table>
APPENDIX D

CODEBOOK
<table>
<thead>
<tr>
<th>Theme:</th>
<th>Definition:</th>
<th>Example(s):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Personalities</td>
<td>Pre-existing personality traits and experiences with which participants entered into the study influenced participants’ level of comfort, participation, and subjective experiences of singing together.</td>
<td>FG: “I’m just an awkward being” (Bekah)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UG: “I’m very, like, stick to my office or do what I have to do” (Frank)</td>
</tr>
<tr>
<td>Personality Traits</td>
<td>Self-identified personality traits influenced participants’ subjective experiences of singing together.</td>
<td>FG: “I did have a background singing, like, in high school. So I did like, uh, singing competition” (Daisy)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“I don’t have any experience if that’s what you’re asking” (Annie)</td>
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<td></td>
<td></td>
<td>UG: “I’m definitely a soprano” (Gina)</td>
</tr>
<tr>
<td>Musical Background</td>
<td>Previous musical experience or background prior to the study influenced participants’ level of comfort, participation, and subjective experiences of singing together.</td>
<td>FG: “When there’s no music, it’s very stressful” (Cassie)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UG: “At the beginning of the songs, it was like, ‘Who’s gonna be the one to… call it. And like, ‘Where are we going?’” (Holly)</td>
</tr>
<tr>
<td>Musical Elements</td>
<td>Different elements of the music, including the structure of the musical task, participant familiarity with the music, level of difficulty of the music, and emotional responses to the music, influenced participants’ level of comfort, participation, and subjective experiences of singing together.</td>
<td>FG: “I think, I kind of picked up that like not everybody was as comfortable with [Lean on Me]. So then I felt like this like, like I had to be like mother hen, and be like, ‘Come on kids!’” (Cassie)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UG: “Like when we were singing, ‘Jingle Bells,’ I was like, ‘Oh it’s like we’re Christmas... caroling’” (Emma)</td>
</tr>
<tr>
<td>Structure of the Musical Task</td>
<td>The way the musical task was structured influenced participants’ experiences of singing together.</td>
<td></td>
</tr>
<tr>
<td>Familiarity with the Music</td>
<td>Familiarity with the music or lack thereof influenced participants’ experiences of singing together.</td>
<td>FG: “I felt like it was easier than it was gonna be, like, I thought I was gonna be more nervous or something” (Bekah)</td>
</tr>
<tr>
<td>Level of Difficulty of the Music</td>
<td>The level of difficulty of the songs and the musical task itself affected participants’ experiences of singing together.</td>
<td></td>
</tr>
<tr>
<td>Emotional Responses to the Music</td>
<td>Emotional responses to the music or emotional significance of the music affected participants’ experiences of singing together during certain songs.</td>
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<td>----------------------------------</td>
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<tr>
<td>FG: “Definitely, like, for like the last song, again, like with [Daisy]. ‘Lean on Me’... Cause we definitely have had some rough times this semester.” (Annie)</td>
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<td></td>
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<tr>
<td>UG: “I think this might be personal preference, but during &quot;You Are My Sunshine,&quot; like, that always hits me really hard because my parents used to sing it to me.” (Gina)</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Social Elements</th>
<th>Different social elements, including perceived social pressures, familiarity with other people in the room, social roles that emerged during singing, spontaneous group decision-making, moments or feelings of social isolation or disconnectedness, and moments or feelings of social bonding or connectedness, all occurred naturally while singing together and influenced participants’ subjective experiences.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG: “Oh, it would’ve been way different if I didn’t know anyone in the group... I would have done it, but I would have been a lot more quiet” (Daisy)</td>
<td></td>
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<tr>
<td>UG: “If I had to like jump up the octave. And I was like... ‘Oh no. I’m going to have to do this, and it’s gonna be weird. Cause I can’t sing down there... And are they all going to stare at me?’” (Frank)</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Perceived Social Pressures</th>
<th>Many participants thought about or perceived pressure to act or respond a certain way based on their perceptions of the other people in the room and/or the setting.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Judgements or Perceptions of Others</th>
<th>Participants’ thoughts about the judgements or perceptions of the other people in the room influenced level of comfort, participation, and subjective experience.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG: “I mean it was just different. Because like, yeah, we all know each other, and we all hang out and do things, but we’ve never sat down and sung a song together.” (Annie)</td>
<td></td>
</tr>
<tr>
<td>UG: “I mean it’s weird to be singing in a lab.” (Holly)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study Design</th>
<th>Elements of the study design and setting affected participants’ level of comfort, participation, and subjective experience.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG: “Well, I also think that &quot;Lean on Me&quot; was like a more challenging song to sing. Like, just, just because like the rhythms are a little different. You kind of have like some offbeat stuff...” (Holly)</td>
<td></td>
</tr>
</tbody>
</table>

Emotional Responses to the Music

Emotional responses to the music or emotional significance of the music affected participants’ experiences of singing together during certain songs.

Social Elements

Different social elements, including perceived social pressures, familiarity with other people in the room, social roles that emerged during singing, spontaneous group decision-making, moments or feelings of social isolation or disconnectedness, and moments or feelings of social bonding or connectedness, all occurred naturally while singing together and influenced participants’ subjective experiences.

Perceived Social Pressures

Many participants thought about or perceived pressure to act or respond a certain way based on their perceptions of the other people in the room and/or the setting.

Judgements or Perceptions of Others

Participants’ thoughts about the judgements or perceptions of the other people in the room influenced level of comfort, participation, and subjective experience.

Study Design

Elements of the study design and setting affected participants’ level of comfort, participation, and subjective experience.
| Task Performance | Thoughts about how well they were performing the singing task or following the directions given by the researchers affected participants’ subjective experiences. | FG: “Normally we perform in our tasks a lot better, I feel like.” (Cassie) |
| Familiarity with People in the Room | Level of familiarity with the other participants and people in the room affected participants’ level of comfort, participation, and subjective experiences of singing together. | FG: “I felt more comfortable because it was with, well… people I knew” (Daisy). UG: N/A |
| Social Roles | Different social roles, such as leading, following, and helping, were naturally taken on by participants during the singing task. | FG: “I think we had a good dynamic. I feel like there was always at least one person who could like, kind of help us.” (Cassie) UG: “I kept kind of feeling like I was, I was like checking in on everybody… as we were, like, going through, just to be like, ‘Where, where are we at? What’s going on?’” (Holly) |
| Group Decision-Making | Non-verbal decision-making appeared to spontaneously occur amongst group members during the singing task. | FG: “And then I think I was looking at [Cassie], like, during the ‘Jingle Bells,’ so I was like, ‘Are we supposed to be repeating this?’... She just kept singing, so I was like, ‘Ok, I’m gonna keep singing.’” (Annie) UG: “It was just like, I thought it was funny that like when we all messed up, and we just all collectively decided that we’re going to sing it again” (Gina) |
| Social Isolation or Disconnection | Participants described actions that created social isolation or disconnection and feelings or perceptions of isolation or disconnection. | |
| Isolating Actions | Participants described specific actions that contributed to feelings of isolation or disconnection, including a lack of eye contact, “just standing” versus singing, and confusion about what pitches to sing. | FG: “I think I was anxious, so I just stared at the ground” (Bekah). UG: When we weren’t singing, there was just, like, the four of us just, like, standing there like waiting for the next one to happen. And then, like, while we were singing, I felt like, something we were doing together instead of just, like, standing. (Emma) |
| Perceived Isolation or Disconnection | Participants described moments or feelings that contributed to perceptions of isolation, disconnection, or feeling out-of-sync with the group. These included the feeling that others were connecting when they were not, moments of confusion or not knowing the lyrics, feeling pressure to lead the | FG: “I think during, like, "You Are My Sunshine," I felt kind of disconnected, cause, where I was staring at the ground and everything. And then I looked up, and everyone’s like making loving eye contact… ‘Oh, okay, I’ll look back down.’” (Bekah) |
group, and feeling a lack of rhythmic synchrony.

UG: “I think that like starting each song was always disjointed or whatever. And then I think, like, particularly in "Lean on Me," when we go into the "just call on me brother" part. It’s like the whole feel is really different. And so trying to, like, stay together there was more challenging…” (Holly)

<table>
<thead>
<tr>
<th>Social Bonding or Connectedness</th>
<th>Participants described actions that created social bonding or connectedness and feelings or perceptions of social bonding or connectedness.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Social Actions</th>
<th>Participants described specific actions that contributed to feelings of social bonding or connectedness, including singing versus not singing, eye contact or paying attention to others, laughter, and being in-tune or in-time with the group.</th>
</tr>
</thead>
</table>

FG: “During parts we knew well, I feel like we’d look at each other. It was more fun then, I guess” (Cassie)

UG: “I mean, I think that like all of us singing together and having to do all of this stuff, in time with each other, and in tune with each other, it, like, just means, we’ve gotta be paying attention to everybody else” (Holly)

<table>
<thead>
<tr>
<th>Perceived Social Connection</th>
<th>Participants described moments and feelings that contributed to the perception of social bonding or connection with the group, including moments of confusion that were remedied by help from another group member, shared emotional responses to the music, a shared sense of vulnerability, and a shared sense of humor.</th>
</tr>
</thead>
</table>

FG: “I think too, cause we were all kind of like, I mean, I’m not comfortable singing in front of people. So I think like, we were just kind of vulnerable too, in that like moment, so I think that helped me feel connected, cause then we go, ‘I’m singing, but they are too, so it’s fine.’” (Cassie)

UG: “I don’t know, I personally kind of felt like during those moments, it was like, ‘Okay, this is kind of a weird situation to sing in, but like at least I’m like, you know, we’re definitely singing as a group,’ and that’s def-, that’s something that I feel like, ‘Oh, I’m not alone doing this.’” (Frank)
APPENDIX E

HSIRB APPROVAL LETTER
Date: October 21, 2019

To: Ed Roth, Principal Investigator
    Sangwoo Lee, Co-Principal Investigator
    Sheridan Brown, Molly Grettenberger, Student Investigators for thesis

From: Amy Naugle, Ph.D., Chair

Re: IRB Project Number 19-10-32

This letter will serve as confirmation that your research project titled “Singing with Strangers: The effect of Interpersonal Familiarity on Synchrony and Social Bonding in Group Singing” has been approved under the expedited category of review by the Western Michigan University Institutional Review Board (IRB). The conditions and duration of this approval are specified in the policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may only be conducted exactly in the form it was approved. You must seek specific board approval for any changes to this project (e.g., add an investigator, increase number of subjects beyond the number stated in your application, etc.). Failure to obtain approval for changes will result in a protocol deviation.

In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the IRB for consultation.

The Board wishes you success in the pursuit of your research goals.

A status report is required on or prior to (no more than 30 days) October 20, 2020 and each year thereafter until closing of the study.

When this study closes, submit the required Final Report found at https://wmich.edu/research/forms.

Note: All research data must be kept in a secure location on the WMU campus for at least three (3) years after the study closes.
APPENDIX F

INFORMED CONSENT
Western Michigan University
Music Therapy Department

Principal Investigator: Ed Roth, MM, MT-BC, Professor and Director of Music Therapy
Student Investigators: Sheridan Brown, MT-BC, Molly Grettenger, MT-BC
Title of Study: Singing with Strangers: The Effect of Interpersonal Familiarity on Synchrony and Social Bonding in Group Singing

STUDY SUMMARY: This consent form is part of an informed consent process for a research study, and it will provide information that will help you decide whether you want to take part in this study. Participation in this study is completely voluntary. The purpose of the research is to examine the relationships between singing and synchrony and singing and social bonding. This research will serve as both Sheridan Brown and Molly Grettenger’s theses for the requirements of the Master of Music degree in Music Therapy. If you take part in the research, you will be asked to wear a motion sensor while singing a brief vocal warm-up and three familiar songs in a small group of four participants. After singing, you will participate in a brief 10-20 minute group interview with a student investigator in order to share your experience of singing with the group. Your time in the study will take approximately 60 minutes. Possible risk and costs to you for taking part in the study may be discomfort experienced while singing in a small group and time necessary to complete the study. There are no anticipated benefits of taking part in this study other than a potential positive shift in mood as a result of singing. Your alternative to taking part in the research study is not to take part in it.

You are invited to participate in this research project titled "Singing with Strangers: The Effect of Interpersonal Familiarity on Synchrony and Social Bonding in Group Singing," and the following information in this consent form will provide more detail about the research study. Please ask any questions if you need more clarification to assist you in deciding if you wish to participate in the research study. You are not giving up any of your legal rights by agreeing to take part in this research or by signing this consent form. After all of your questions have been answered and the consent document reviewed, if you decide to participate in this study, you will be asked to sign this consent form.

What are we trying to find out in this study?
The purposes of this study are: (1) to determine the relationship between singing in a small group and movement and (2) to explore the personal experience of singing in a small group.

Who can participate in this study?
Anyone can participate in this study who is a WMU student, over the age of 18, and capable of using their voice to sing.

Exclusionary criteria are any physical limitations that would prevent movement of the head and membership in a WMU voice studio.
Where will this study take place?
This study will take place on Western Michigan University's campus in Room 1061 in the Student Recreation Center at 2000 W. Michigan Ave, Kalamazoo, MI, 49008.

What is the time commitment for participating in this study?
You will be asked to come to Room 1061 of the Student Recreation Center for a single visit. The duration of your time commitment once you arrive will be approximately 60 minutes.

What will you be asked to do if you choose to participate in this study?
After this informed consent has been signed, a student investigator may ask one follow-up question via email to confirm eligibility for participation in this study. After this, a student investigator will contact you via email to schedule a session time for your participation. During your participation in this study, you will be equipped with motion sensors to record the movement of your head. You will then engage in a short vocal warm-up with a student investigator and three other participants. After this, you will sing three familiar songs as a group. At the conclusion of the singing, you will participate in a small group interview with a student investigator regarding the singing experience. You will then have an opportunity to debrief with a student investigator.

What information is being measured during the study?
During this study, your natural head movements will be measured using a motion sensor placed on the top of your head. The singing portion of the study will also be video-recorded, in order to match the timing of the singing tasks with the motion capture data. Interview responses will be audio-recorded and transcribed to be analyzed for themes amongst participants.

What are the risks of participating in this study and how will these risks be minimized?
There are no known risks to participating in this study other than any discomfort experienced while singing in a small group and time necessary to complete the study.

What are the benefits of participating in this study?
There are no anticipated benefits of taking part in this study other than a potential positive shift in mood as a result of singing.

Are there any costs associated with participating in this study?
There are no costs associated with participating in this study.

Is there any compensation for participating in this study?
Compensation for this study will be a $40.00 gift card for completing the study.

Who will have access to the information collected during this study?
Only the principal investigator, student investigators, and research assistants will have access to the information collected in this study. Results of this study may potentially be shared at professional music therapy conferences and in peer-reviewed journals, but all information will be
de-identified when shared. This means that no names or individually identifiable data will be shared during or after your participation in this study.

**What will happen to my information or biospecimens collected for this research after the study is over?**

After information that could identify you has been removed, de-identified information collected for this research may be used by or distributed to investigators for other research without obtaining additional informed consent from you.

**What if you want to stop participating in this study?**

You can choose to stop participating in the study at anytime for any reason. You will not suffer any prejudice or penalty by your decision to stop your participation. You will experience NO consequences either academically or personally if you choose to withdraw from this study.

The investigators can also decide to stop your participation in the study without your consent.

Should you have any questions prior to or during the study, you can contact the following researchers:

- Principal Investigator: Ed Roth, (269) 387-5415, edward.roth@wmich.edu
- Student Investigator: Sheridan Brown, (586) 744-9013, sheridan.r.brown@wmich.edu
- Student Investigator: Molly Grettenberger, (231) 944-4105, molly.a.grettenberger@wmich.edu

You may also contact the Chair, Institutional Review Board at 269-387-8293 or the Vice President for Research at 269-387-8298 if questions arise during the course of the study.

This consent document has been approved for use for one year by the Western Michigan University Institutional Review Board (WMU IRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.

I have read this informed consent document. The risks and benefits have been explained to me. I agree to take part in this study.

---

Please Print Your Name

Participant’s signature  Date
APPENDIX G

LYRIC SHEETS
Jingle Bells

Jingle bells, jingle bells
Jingle all the way
Oh what fun it is to ride
In a one-horse open sleigh
Jingle bells, jingle bells
Jingle all the way
Oh what fun it is to ride
In a one-horse open sleigh

Dashing through the snow
In a one-horse open sleigh
O'er the fields we go
Laughing all the way
Bells on bobtails ring
Making spirits bright
What fun it is to ride and sing
A sleighing song tonight

Form: Jingle, Dashing, Jingle, Dashing, Jingle
You Are My Sunshine

You are my sunshine, my only sunshine
You make me happy when skies are gray
You’ll never know dear, how much I love you
Please don’t take my sunshine away

Form: Repeat 2 times (sing 3 times total)
Lean on Me

Sometimes in our lives
We all have pain
We all have sorrow
But, if we are wise
We know that there’s
Always tomorrow

Lean on me, when you’re not strong
And I’ll be your friend
I’ll help you carry on
For, it won’t be long
‘Til I’m gonna need
Somebody to lean on

So just call on me brother, when you need a hand
We all need somebody to lean on
I just might have a problem that you’ll understand
We all need somebody to lean on

Form: Sometimes in our lives, Lean on me, So just call,
Lean on me, Lean on me