DOES MUSICAL BEHAVIOR PROMOTE AFFILIATION?

A Dissertation

by

CINDY KAY HARMON-JONES

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2011

Major Subject: Psychology

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Approved by:

Co-Chairs of Committee,	Brandon Schmeichel
	Gerianne Alexander
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ABSTRACT

Does Musical Behavior Promote Affiliation? (August 2011)

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Past research suggested that greater rhythmic complexity in musical behavior increases affiliation in small groups. The current research tested the hypothesis that musical behavior including melody would promote affiliation. In the current experiment, a video showed models either singing nonsense syllables in unison or speaking identical syllables in synchrony. Participants were assigned to either imitate, or merely listen to, the videos. Participants perceived both the synchronous speaking condition and singing conditions as musical behavior. In the imitate conditions, synchronous speaking produced more affiliation and ingroup favoritism and less embarrassment than singing, whereas in the listen-only conditions, affiliation, ingroup favoritism, and embarrassment did not differ between singing and speaking. Reported happiness and fun were greater in the imitate conditions.

The successfulness of imitation, coded by judges, was less, and self-reported difficulty was greater, in the singing condition compared to the synchronous speaking condition. Ratings of success at imitation were positively related to affiliation, positive

affect, and ingroup favoritism. Ratings of success were also related to the average trait approach motivation, agreeableness, and emotional stability of the groups.

The results partially supported the hypothesis that musical behavior promotes affiliation. However, performance of the sound-making task was much worse in the singing condition than in the synchronous speaking condition. Because melody was confounded with failure at the sound-making activity, the effect of melody on affiliation is difficult to interpret. Future research should examine the effect of melody on affiliation when melody is not confounded with failure.

DEDICATION

To the members of the Mood Elevators, Brandon Schmeichel, Philip Gable, and Eddie Harmon-Jones, thank you for the many happy hours we spent playing music together in our garage band. You inspired and "field tested" the ideas examined in this research.

ACKNOWLEDGEMENTS

I would like to thank my advisor, Brandon Schmeichel for his support. I appreciate your encouragement to pursue an area of research about which I am passionately interested. Thank you for the many hours we spent discussing the ideas explored in this manuscript. I could not have wished for a kinder or more supportive advisor and friend.

I also thank my husband, Eddie Harmon-Jones. Your expertise in designing experimental tests of hypotheses was invaluable. Thank you for your helpful suggestions for designing and carrying out this research, and for reading and commenting on drafts of the manuscript. I have the deepest appreciation for your unwavering support during our 21 years together.

I greatly appreciate the congregation of the Unitarian Universalist Church of the Brazos Valley, where I served as music director from 2005 to 2011. Your community was a wonderful place to make music along with accomplished musicians in an atmosphere of kindness and love. You allowed me to experience the power of music to bond people together in a practical way.

Brandon, Eddie and Philip Gable also gave me a tremendous gift by playing with me in our garage band, The Mood Elevators. You provided a compelling field test of affiliation through musical behavior, and gave me a whole lot of joy.

I owe a great debt to the research assistants who acted as models in the video stimuli, ran participants, and processed and coded data. Thank you, Kara Polansky, Melanie Felmet, Jessica Edwards, Sarah Eisenbraun, and Sylvia Harmon-Jones.

I also thank my committee, Gerianne Alexander, Jeffrey Winking, and Aaron Taylor for many helpful ideas and suggestions. Dr. Alexander encouraged me to consider the nature of music more deeply. Dr. Winking contributed expertise from the field of Anthropology. Dr. Taylor provided advice on statistics for dependent data. I appreciate the gift of your valuable time to serve on my committee.

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CHAPTER I

INTRODUCTION

> *Neither the enjoyment nor the capacity of producing musical notes are faculties of the least use to man in reference to his daily habits of life; they must be ranked among the most mysterious with which he is endowed (Darwin, 1871, p. 733).*

Although music is universal, its functions are neither uncontroversial nor obvious (Darwin, 1871; McDermott, 2008; Pinker, 1997). However, it has been suggested that music promotes social bonding (Fitch, 2006; Freeman, 2000). Recent research found that assigning people to engage in synchronous behavior increases affiliation (Hove & Risen, 2009; Valdesolo, Ouyang, & DeSteno, 2010; Wiltermuth & Heath, 2009), which suggests that the entrainment found in musical behavior may also lead to affiliation. However, musical behavior is complex and possesses a number of characteristics that differ from simple synchrony. One aspect of some types of music is melody, that is, a sequence of organized tones. The current research tested the idea that melody produces greater affiliation than synchronous verbal behavior that lacks melody.

When examining the functions of music, the possibility that music serves no function must be considered. At least one prominent scientist suggested that the search for a functional explanation of music will prove fruitless (Pinker, 1997). All species

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This dissertation follows the style of the *Journal of Personality and Social Psychology*.

possess some traits which are not adaptive. Indeed, Gould (1997) proposed that the majority of universal human behavioral abilities are "spandrels," that is, non-adaptive by-products of other adaptations.

"I suspect music is auditory cheesecake, an exquisite confection crafted to tickle the sensitive spots of at least six of our mental faculties." (Pinker, 1997, p. 534). According to this view, music most likely evolved as a co-product of adaptive traits such as language, but serves no function of its own. The pleasure music gives to humans may derive from music's similarity to language, its inclusion of frequencies that are harmonic overtones of one another, and the similarity of music to both verbal expressions of emotion and to environmental sounds. Finally, rhythm, which Pinker referred to as "the universal component of music," (p. 538) activates the motor control system. Musical rhythm may create motivational and emotional responses similar to movement, and humans may experience this as pleasurable.

Conversely, music may be functional. Arguments against the hypothesis that music is non-functional are music's universality across cultures, the tremendous amount of energy that making music consumes (sometimes to the point of exhaustion of participants), and the fact that music is loud (potentially attracting enemies; Fitch, 2006). If music had no function, strong selection pressure against it would be expected. According to this line of reasoning, music likely has adaptive aspects to offset these negatives.

CHAPTER II

MUSIC

Although every known human culture includes behavior that can be classified as music, the definition of music versus non-musical sound varies between cultures (Merriam, 1964). Some cultures require sounds to be humanly created in order to qualify as music, while others include natural sounds (e. g., birdsong) in their definitions of music. For example, the Basongye, an African group, define music as humanly created sound that has organization and temporal continuity. According to this view, a single tap on a drum is not music (it lacks temporal continuity) and neither is the sound of wind in the trees (it is not humanly created). Another African group, the Nketia, emphasize intention in determining whether sound is music, so that the sound of dried seeds rattling in a seed pod may be music, but only if the person rattling the pod is doing so with the intention of creating music. In addition, individuals within single cultures sometimes disagree about whether a given sound sequence is music (Merriam, 1964).

Although universal agreement on a definition of music has not been reached, temporal organization (pulse) and frequency-based organization (pitch) are widely considered the fundamental aspects of music (Bispham, 2009; Merker, Madison, & Eckerdal, 2009; Merriam, 1964). Although some music is not pitch-based (some percussive music) and some music does not have an observable pulse (drone chanting, Indian rajas), *entrainment* (based on pulse, pitch, or both pulse and pitch) appears to provide the universal organizing framework for musical behavior (Bispham, 2009). For

the current manuscript, "music" will be defined as intentional human acoustical behavior entrained according to pulse, pitch, or both. Additionally, the definition of music will be assumed to depend on the subjective experience of the perceiver. Examples of music are so widely various that any sequence of sounds experienced as musical by a perceiver will be defined as music.

Hypotheses regarding the origin of music

Since at least Darwin, music has been considered one of the most mysterious human attributes (Darwin, 1871). Today, debate continues about the process by which music evolved, and several selection mechanisms have been suggested (Brown, Merker and Wallin, 2000). Music may have evolved as a courtship device similar to the songs of nonhuman animals such as birds (Darwin, 1871). Music may have promoted selection at the either the individual or group level by promoting group coordination or cohesion (Fitch, 2006; Freeman, 2000). Conversely, music may have evolved to signal group cohesion rather than promote it (Hagen & Bryant, 2003). Furthermore, music may have enhanced individual fitness through improved parent-infant attachment (Dissanayake, 2000). Research areas that might help to identify the evolutionary origins of music include identifying musical abilities that have a genetic basis, identifying musical abilities in young infants, identifying elements of music with universal cross-cultural appeal, and identifying music-related traits in non-human animals (McDermott, 2008).

The origins of music are ancient. The oldest uncontested musical instruments are at least 36,000 years old (Fitch, 2006). However, instruments used in traditional cultures

are often made of materials that quickly decay, and thus instruments may have been produced much earlier but not have survived. Darwin (1871) suggested that an intermediary form of communication may have existed in human evolution that resembled music more than language. This communication system may have been a precursor of both human language and human music. Masataka (2007) reviewed research on the songs of apes and other primates, and concluded that evidence supports this hypothesis.

Animal communication systems (i. e., bird songs, whale songs, ape drumming) possess similarities to human music. According to Fitch (2006), drumming by great apes may be the animal behavior most related to human music. Male chimpanzees, bonobos, and gorillas produce drumming sounds by beating their chests as an aggressive display. They also drum on the ground, on trees, and on other apes. Females and juveniles also drum in playful contexts.

Entrainment, synchronization of behavior to an external signal, is necessary for measured music and dance (Merker, Madison, & Eckerdal, 2009). Although great apes produce drumming sounds, as noted above, they do not entrain their behavior temporally. In fact, humans are unique among mammals in having the capacity to engage in behavioral entrainment. Entrainment is rare in animals, although a few insects, frogs and crabs possess the ability to entrain (Merker, Madison, & Eckerdal, 2009).

Functional theories of the evolution of music

Music may have evolved as a means of enhancing infant survival by promoting affiliation between mother and infant (Dissanayake, 2000). Across cultures, lullabies are universally used to soothe infants, and the extremely early development of musical perceptual abilities in human infants supports the hypothesis that music developed to facilitate parenting (Fitch, 2006). Sexual selection is not the only means by which evolution can select for traits. Parental care can also increase the chances that offspring survive to adulthood, when they can pass on their genes. Human infants have an extended period of dependency, during which they rely on care by their mothers and other humans, so parental care is important to individual selection (Dissanyake, 2000).

Although it has often been hypothesized that music originated as a means for males to attract mates (Fitch, 2006; Darwin, 1871), surprisingly little research tests the idea. Although great musicians sometimes have many sex partners, this is not sufficient to demonstrate that musical skill leads to reproductive success.

Music may have evolved to facilitate mate attraction, but through group processes (Merker, 2000; Merker, Madison, & Eckerdal, 2009). Humans, like chimpanzees and bonobos but unlike other primates, practice female exogamy. In groups of early humans, males may have needed a means to attract females to their group. Group singing among males may have evolved to attract females, as it could signal group resources and cooperativeness. Although group chorusing does not exist among male chimpanzees, it has been reported in bonobos.

Music almost never includes discrete beat-to-beat tempo changes (Merker, 2000). Instead tempo changes are always either gradual or in the form of whole integer ratios. The consistency of tempo allows the beat to be predictable, and the predictable beat allows multiple individuals to synchronize their behavior in a coherent way, as musicians, dancers, or other participants. The predictable beat of music and its ability to organize coherent behavior among groups of people may have allowed music to be used as a signal of group cooperativeness among males, thus attracting females. According to this view, better, more coordinated music would signal a more cohesive group.

Social bonds and music

In contrast to the mate-attraction and parental care hypotheses, music may have evolved as a technology of social bonding (Freeman, 2000). Trust is essential to human culture, and the practice of music may increase trust. When a group of humans make music and dance together, it synchronizes their emotions and associated neurotransmitters. This brings about behavioral coherency in masses of people, which has survival value as complex societies of humans require coordinated human action. Similarly, the group functions of music might be thought of as "vocal grooming" (Fitch, 2006). As groups of humans grew larger, music may have developed as a means of encouraging cooperative interactions within the group and possibly dissuading outside aggression by signaling group strength. The resulting cooperative interactions may have enhanced survival at either the individual or group level.

Music may have evolved not to *enhance* group cohesion, but to *signal* cohesion in order to promote inter-group alliances (Hagen & Bryant, 2003). Humans are unique among primates in forming non-consanguineal alliances and these between group alliances have been essential to human reproductive success. The anthropological literature suggests that humans engage in music and dance when groups come together to organize coalitions. Groups also engage in music and dance prior to battles, perhaps to display group strength and coordination. Because music requires practice, the degree of coordination shown during a musical display could signal the group's longevity, an important indicator of group strength. Music as a signal of group quality may have evolved from animal territorial defense signals. Animals, including pair-bonded birds, female lions, and apes, use group calls to dissuade out-group aggression. However, unlike animal defense calls, musical displays often attract and provide enjoyment to human outgroup members. A group's music may provide the outgroup with a signal of a group's quality, and thus encourage the outgroup to form a coalition with the group (Hagen & Bryant, 2003).

The evolutionary origins of music are not necessarily identical to music's current functions. Music may have originated by any of the mechanisms suggested above, and then later have been either culturally or biologically adapted for different or additional functions. Furthermore, there is no reason to expect musical behavior to serve only one function, as many human behaviors serve multiple functions. *The current research is intended to examine how music may currently affect affiliation, rather than to establish its evolutionary origins.*

Several of the hypotheses about the origins of music involve variations on interpersonal affiliation. The mate attraction, parental care, social bonding and coalition signaling hypotheses all presume that musical behavior has the ability to attract and/or attach individuals to one another. Music, a social, multisensory activity, possesses key elements of imitation, synchronization, and shared affective experience (Molnar-Szakacs & Overy, 2006). Mirror neurons may be involved in musical experiences (Lahav, Saltzman, & Schlaug, 2007; Overy & Molnar-Szakacs, 2009) and other synchronous behaviors (Tognoli, Lagarde, DeGuzman, & Kelso, 2007). An embodiment perspective suggests that the interpersonal attention and coordination required by musical behavior may promote bondedness between the individuals who engage in it together. Experimentally testing the idea that music promotes affiliation is important because the social functions of music, if any, are not well understood.

CHAPTER III

AFFILIATION

The concept of affiliation is closely related to interpersonal bonding, cohesion, and attachment. Group cohesion refers to bonding or attachment among members of a human collective, and is thought to depend on interpersonal attraction and liking, commitment to group tasks, and group pride (Gully, 2000). Research on group bonding has focused on interpersonal attraction as the most important force holding a group together (Lott & Lott, 1965).

According to Dunbar and Shultz (2010) scientists have mostly assumed bondedness between individual social animals based on how much time they spend together, even though this does not describe the nature or strength of the relationship. Dunbar and Shultz (2010) suggested that affiliation is primarily an emotional process, and that affiliation among animals has been poorly researched because we lack adequate language to describe these relationships. Humans find it easy to express cognitions verbally, but social bonds are felt rather than cognized. They suggested several behavioral measures that might provide improved indices of the degree of bondedness of non-human animals. For example, distress responses to separation might provide an index of bondedness, as might the cost an animal is willing to incur in order to be with another individual. Responses to being reunited after a period of separation, or the degree of effective behavioral coordination may provide other possible indices. Finally, even in humans, affiliation is difficult to express in words because it is an emotional,

rather than a cognitive, process (Dunbar & Schultz, 2010). In humans, researchers often measure affiliation in affective terms, via self-reported liking and feelings of closeness toward other individuals (Aron, Melinat, Aron, Vallone, & Bator, 1997).

Primates appear to engage in social grooming to establish and maintain social bonds (Dunbar, 2010). Social grooming is highly rhythmic, and involves plucking or scratching interspersed with stroking movements (Sparks, 1967). Some social species of primates devote 20% of their waking hours to social grooming, far more than would be needed to maintain cleanliness (Dunbar, 2010). According to Dunbar (2010) being groomed by primates can be quite painful at first, but like deep massage, it becomes pleasurable over time. In social primates, the amount of time spent in social grooming is strongly correlated with group size, and grooming partners are consistent and persistent over time. Grooming partnerships form the basis for social alliances, such that time spent grooming a specific group member significantly correlated with the likelihood of being aided by the group member when under attack. Humans engage in less grooming than other social primates, however humans engage in petting, cuddling, and hair care with those with whom they are closely affiliated.

Grooming cannot be thought of as a direct exchange relationship, because the frequency of attack, when an individual might need the aid of a grooming partner, is far less than the frequency of grooming (Dunbar, 2010). Instead, over repeated interactions, grooming may provide an affective psychological basis for mutual aid. These affectively positive relationships may occur because grooming results in the release of endogenous opiates, or endorphins.

Endorphins: Neurotransmitters that promote bonding

Endorphins have analgesic effects, produce feelings of wellbeing and a mild high (Nelson & Panksepp, 1998). Endorphins are released in response to physical stressors, such as vigorous exercise and painful stimuli, and to pleasurable stimulation such as close contact between affiliated individuals. Like other opiates, endorphins have reward properties (Dunbar, 2010). Bonding in humans and primates appears to be related to the release of both endorphins and oxytocin (Dunbar, 2010; Panksepp, 1998), and both of these neurotransmitters are increased by close contact between affiliates. Oxytocin may be important because the central effects of oxytocin inhibit the development of tolerance toward opioids (Panksepp, 1998). Social motivation relies on the ability to feel distress when isolated from affiliates and to experience comfort when social contacts are reestablished (Panksepp, 1998). These distress and comfort responses appear to be mediated by changes in opioids. A decrease in opioids due to separation produces distress, increasing social motivation; whereas reuniting with the individual to whom one is affiliated causes the release of opioids, and relieves the distress. In support of these mechanisms, research has shown that administration of opioids is highly effective at relieving separation distress (Panksepp, 1998).

Other evidence suggesting that social motivation is related to endogenous opiate withdrawal comes from research on autism. One distinguishing characteristic of autism is a deficiency in social motivation, and Panksepp (1998) noted that the behavior of autistic humans is similar to the behavior of young animals that have been given opioids. Approximately half of autistic children produce abnormally high levels of endorphins;

furthermore, administering an opiate blocker relieves symptoms in about half of autistic children (Panksepp, 1998).

It is possible that musical behavior also causes the release of endorphins. Musical behavior involves interpersonal synchrony, and research suggests that synchronous behavior causes endorphin release (Cohen, Ejsmond-Frey, Knight, & Dunbar, 2009). In this study, members of a college rowing crew rowed either alone or in synchrony with their teammates. Pain thresholds were assessed after exercise, as a proxy for endorphin release. Results showed that the athletes' pain thresholds were greater in the synchronous rowing condition.

Research using positron emission tomography also supports the idea that music is related to endorphin release. When individuals listened to music that caused the intensely pleasurable experience of "chills," they evidenced increased blood flow in the regions associated with reward, similar to the patterns observed in other imaging studies of euphoria. Activity in these regions involves dopamine and opioids (Blood & Zattore, 2001). If music causes the release of endorphins, this might provide one mechanism by which musical behavior may strengthen interpersonal bonds.

Studies of human affiliation

In humans, merely categorizing individuals into groups may be sufficient to produce affiliation with one's group (Tajfel, 1982). In studies on "minimal groups," individuals were assigned to groups based on trivial similarities, such as their preference for one abstract artist over another. Participants then awarded points, redeemable for

money, to an ingroup member and an outgroup member. Participants were required to award the money using matrices that assessed various strategies for distributing the points. Participants gave larger rewards to ingroup members, suggesting that mere categorization was sufficient to cause individuals to affiliate more with the ingroup than the out-group.

Several other experimental manipulations have been used to increase affiliation in humans. Assigning individuals to engage in personal self-disclosure, compared to discussion of mundane topics, led to greater feelings of closeness (Aron et al, 1997). Participating in an effortful or embarrassing initiation in order to join a group increased liking for the group (Aronson & Mills, 1959; Gerard & Masterson, 1972; Keating et al., 2005). Laughter has been shown to cause endorphin release, and participating in humorous, compared to a non-humorous, experiences increased feelings of closeness (Dunbar, 2010; Fraley & Aron, 2004).

Affiliation and dissonance reduction

Effort justification may also lead to affiliation (Aronson & Mills, 1959). This dissonance-related process occurs when individuals' liking for a reward increases proportionally to the effort they have expended in order to obtain the reward. Music is an effortful behavior (Fitch, 2006), suggesting that effort justification may be involved in the social effects of music.

In the effort justification paradigm, an individual engages in an unpleasant or effortful activity to obtain a reward. Engaging in the unpleasant activity evokes

dissonance affect, a negative state that results from conflict between cognitions with opposing action tendencies (Harmon-Jones, Schmeichel, Inzlicht, & Harmon-Jones, 2010). The unpleasant state motivates dissonance reduction, and dissonance can be reduced by regarding the reward as more desirable (Harmon-Jones & Mills, 1999). In the first experiment on effort justification, women were assigned to undergo either a severely or a mildly embarrassing initiation to become a member of a group. Afterward, women who had experienced the severe initiation valued the group more than women who had experienced a mild initiation (Aronson & Mills, 1959).

In this original study, participants underwent initiation in order to join a group that turned out to be undesirable. Subsequent researchers assumed that receiving an undesirable reward was a necessary component of effort justification processes (Gerard & Masterson, 1966). However, Harmon-Jones, Schmeichel, and Harmon-Jones (unpublished manuscript) found that effort justification may occur whether the reward is desirable or undesirable. In their study, male participants performed either an easy, congruent Stroop task, or a difficult, incongruent Stroop task in order to see neutral pictures (rocks) or desirable pictures (attractive women). Participants who had performed the difficult Stroop task liked the pictures they viewed more than those who had performed the easy Stroop task. The effortful task increased liking for the desirable and neutral pictures equally, although there was also a main effect for picture type such that women were liked more than rocks.

Animal studies also suggest that effort justification can increase liking for desirable as well as undesirable rewards. Lydall, Gilmour, and Dwyer (2010) assigned

rats to either a high- or low-effort lever pressing task to receive the same, desirable sucrose solution reward. Using lick analysis, they found that rats assigned to the high-effort task liked the solution more than those assigned to low-effort task. The recent results, demonstrating that effort justification occurs in both humans and non-human animals, and increases liking for both desirable and undesirable rewards, suggest that effort justification is a more pervasive process than had previously been assumed.

Over 50 years of research has shown that dissonance reduction occurs under a wide variety of circumstances, however, the underlying processes were not well understood. Harmon-Jones and colleagues proposed the "action-based model" of dissonance to explain *why* dissonant cognitions cause discomfort and *why* changing cognitions relieves this discomfort (Harmon-Jones, Amodio, & Harmon-Jones, 2009; Harmon-Jones & Harmon-Jones, 2003; Harmon-Jones & Harmon-Jones, 2007). The action-based model assumes that cognitions are often associated with specific action tendencies. It further proposes that when cognitions with implications for action conflict with one another, this produces a negative affective state. The reason for the negative state is that conflict between these cognitions may interfere with effective action. According to the model, altering cognitions to reduce dissonance assists individuals to behave effectively with regard to commitments, and thus dissonance reduction is often an adaptive, approach-motivated process aimed at translating a behavioral intention into effective action.

According to the action-based model, dissonance reduction is a functional process (Harmon-Jones et al., 2009) present in a number of species (Egan, Bloom, &

Santos, 2010; Egan, Santos, & Bloom, 2007). The model proposes that dissonance reduction assists the individual in bringing cognitions in line with behavioral intentions, which promotes goal-directed behavior (Harmon-Jones, Gerdjikov, & Harmon-Jones, 2008; Harmon-Jones & Harmon-Jones, 2002; Harmon-Jones, Harmon-Jones, Fearn, Sigelman, & Johnson, 2008).

Based on the action-based model, when effort justification increases affiliation to a social group, the resulting affiliation assists the individual in behaving effectively with regard to the group. Effort justification would be expected to be engaged when group membership is contingent on musical behavior. In this situation, group membership would serve as a reward for the effortful behavior of making music, and dissonance could be reduced by increasing the attractiveness of the group.

Affiliation and costly displays

Aronson and Mills (1959) conducted their original experiment on effort justification in an attempt to understand hazing. Their results suggested that groups haze initiates because hazing produces greater commitment to the group. Hazing bears similarities to costly displays, a category of practices which includes ritual mutilation, scarification, costly sacrifices, and martyrdom (Henrich, 2009). Clearly, costly displays constitute an effortful behavior that would be expected to engage dissonance processes. Costly displays have been found to increase commitment to groups (Henrich, 2009). Costly displays may also enhance the credibility of the displayer by providing proof of the individual's commitment to the group's ideology and values. Groups that require

costly acts extract more solidarity and cooperation from their members. In addition, merely witnessing a costly display by an ingroup member increases commitment to the group from fellow group members (Henrich, 2009).

It may seem surprising to refer to music as a costly display, as the term is commonly used to refer to severe cultural practices such as ritual mutilation and martyrdom (Henrich, 2009). However, music is a costly social behavior (Merker, Madison, Eckerdal, 2009). In fact, any activity is costly to the degree that it takes time and energy away from food production (Dunbar, 2010). It is not unusual for groups to engage in ritual musical behavior that brings participants to the point of exhaustion (Fitch, 2006). More subtly, musical behavior may be viewed as a test of group membership. For example, individuals may feel pressured to sing hymns during a church service or to sing their team's fight song during a football game. These public behaviors, which express group values and transmit group-specific knowledge, allow identification of committed group members.

Experimental evidence supports the hypothesis that the quality of musical displays provides evidence of group commitment (Hagen & Bryant, 2003). Participants listened to a recording of an original song in which the tracks of the four instruments were either synchronized, or offset by 60 ms. Participants then rated the men who had ostensibly played the song on questions intended to measure coalition strength (e. g., how long have they known each other; how much do they like each other; how willing are they to help each other). The men who played the well-synchronized song were rated

as having a stronger coalition compared to the men who played the less well-synchronized song (Hagen & Bryant, 2003).

When an individual performs a costly display, it may convince fellow group members that he or she is committed to the group, and thereby elicit more affiliation from fellow group members. At the same time, costly displays create greater affiliation to the group by both the displayer and in-group observers, probably through dissonance processes. If musical behavior constitutes an effortful behavior, then participating in music could cause individuals to attach to the group. Furthermore, if musical behavior constitutes a costly display, then when an individual engages in music this may convince fellow group members that the individual is a good group member, committed to the group and its values. This may produce greater affiliation toward that individual from fellow group members.

Costly displays reinforce group values

Initiation practices (e. g., hazing, costly displays) likely support group functioning by reinforcing group values, as well as through dissonance processes. In support of the idea that initiations teach group values, college athletes reported initiation experiences that included more physical challenge and pain, in comparison to the initiation experiences of sorority and fraternity members, who reported more social deviance and embarrassment (Keating et al., 2005). Ratings of the amount of social deviance and fun of these initiation activities independently predicted dependence on the group and proximity-seeking toward the group (Keating et al., 2005).

An experimental follow-up to this field study found that participants who were assigned to undergo embarrassing procedures (e.g., act like a dog) rated the procedures as more fun (as well as more embarrassing) compared those who underwent mild procedures (e. g., pretend to brush your teeth). Participants in the embarrassing condition subsequently rated their group as more attractive, engaged in more proximity-seeking toward their group, and yielded more to conformity pressures from group members. (Keating et al., 2005).

Music, like initiation procedures, may also transmit group values (Merriam, 1964). When several thousand folk songs from 233 cultures were coded, analyses showed that specific characteristics of cultures were associated with unique characteristics of their songs (Lomax, 1968). For example, cultures that valued group cohesiveness featured well-blended choral singing with a smooth tone, whereas those cultures that valued individualism featured a high degree of vocal rasp, which prevents vocal blending. Furthermore, closely bonded, egalitarian cultures engaged in participatory singing with large choruses, whereas highly stratified cultures employed long periods of passive attention to solo performances. These data suggest that specific characteristics of a group's music may produce different degrees and types of affiliation.

Affiliation and affect

Harmon-Jones, Schmeichel, and Slator (under review) found that musical rhythmic behavior increased affiliation and happiness more than synchronous behavior, and the increase was mediated by reported happiness. This result converges with

research suggesting positive affect may sometimes increase affiliation. For example, when male participants were induced to experience a positive, compared to a negative, mood, they engaged in more social interaction and self-disclosure with a female confederate (Cunningham, 1988). In other research, state positive mood was positively correlated with self-reported attraction toward a stranger (Gouaux, Lamberth, & Friedrich, 1972).

Positive mood does not always lead to prosocial behavior, however. Participants were induced to feel either happy or sad via false-feedback on a test of cognitive-spatial abilities, and then participated in a dictator game in which they allocated raffle tickets to themselves and another participant. Participants in the happy mood condition behaved more selfishly (Tan & Forgas, 2010). Whether positive affect produces affiliation or not may depend on the cause of the positive affect. If happiness is brought about by enjoyable interpersonal interactions with fellow group members, then affiliation is a likely result. Thus, musical behavior may increase affiliation through increased happiness when the musical behavior constitutes a pleasurable interpersonal experience.

CHAPTER IV

SYNCHRONY, MUSIC, AND AFFILIATION

Musical motivation and affiliation

The research reviewed above suggests several means by which music may influence affiliation. Music, like other rhythmic sensory stimuli such as grooming, may promote the release of endorphins. Music, like other effortful behaviors, may cause bonding to fellow group members through dissonance processes. To the extent that music constitutes a costly display, music may influence fellow group members to affiliate with the individual who engages in musical behavior. When engaging in group musical behavior produces happiness, the positive mood may lead to affiliation. Furthermore, specific characteristics of music may reflect and teach the group's values. Music, in its various forms, is attractive to humans across cultures, and the pleasurable, rewarding aspect of music may also be essential to its social effects. Given the complexity of musical behavior and the importance of affiliation for humans, music is likely to influence affiliation through multiple mechanisms.

Humans are clearly motivated to engage in musical behavior. However, theories of musical motivation are nearly absent from the literature (Bispham, 2009). Shared intentional actions appear to be a broad goal of humans, and the motivation to engage in music may be due to the ability of music to produce intersubjectivity, that is, a convergent psychological state (Bispham, 2009). If musical behavior exerts its effects on affiliation via dissonance processes, interpersonal attention, and/or behavioral

entrainment, the motivation to engage in musical behavior may be necessary to these effects. For example, a recent case study showed that musical interventions were more effective than similar non-musical interventions in improving the social responsiveness of a child with autism (Finnigan & Starr, 2010). The researchers hypothesized that the subject was more motivated in the music condition, and this led to more responsive behavior.

Individuals with autism are often particularly interested in music, and this may be related to their sensitivity to rewards. Both autistic individuals and professional musicians have been found to possess elevated DRD4 mRNA dopamine receptors, compared to healthy controls with no interest in music (Emanuele, Boso, Cassola et al., 2009). The DRD4 receptor may be involved in other reward-related conditions, such as pathological gambling and addiction.

Furthermore, music production involves behavioral synchrony. Research suggesting that simple synchrony promotes affiliation suggests that engaging in musical behavior may also promote affiliation.

Synchronous behavior increases bonding

Synchrony is one of the elements of music, and recent experimental research suggests that synchronous behavior increases interpersonal affiliation. In one of the first tests of this idea, Hove and Risen (2009) asked participants to play an electronic drum that made an audible tap, while sitting alongside an experimenter who also played an electronic drum. The experimenter and participant each synchronized their taps with a

visual metronome, and the metronomes were randomly assigned to be either synchronized or unsynchronized. A screen between the participant and experimenter only allowed each to see his or her own metronome. Participants who were assigned to play in synchrony, compared to those assigned to play out of synchrony, reported that the experimenter was more likeable, and the degree of synchrony was correlated with liking.

Other recent research suggests that synchrony leads to interpersonal cooperation. Participants assigned to synchronous rocking in rocking chairs, compared to asynchronous rocking, showed increased perceptual sensitivity and performed better at a joint-action task (Valdesolo, Ouyang, & DeSteno, 2010). Participants assigned to engage in synchronous, compared to asynchronous, behavior showed increased trusting behavior and increased cooperation in a commons game (Wiltermuth & Heath, 2009). Additionally, pairs of four-year-old children assigned to an activity that involved singing and dancing with the experimenter, compared to a matched activity that did not involve synchrony, engaged in more spontaneous helping (Kirschner & Tomasello, 2010).

The studies reviewed above provide evidence that synchronous behavior increases affiliation. However, musical behavior differs from simple synchrony in several ways, notably by its complexity. Musicians often perform complex interactions wherein the temporal intervals produced by one player are subdivided by another player (Keller and Rieger, 2009). Pulse-based music sometimes requires entrainment to an "external" pulse that is imagined but not played by the musicians. Music often involves entrainment around pitch, in addition to temporal entrainment (Merker, Madison, &

Eckerdal, 2009). Engaging in music requires individuals to monitor auditory and visual feedback from other performers, while coordinating their own actions. Thus, music is a complex activity that requires close attention to others as well as precise control over one's own behavior. Simple synchrony might promote greater affiliation than musical behavior precisely because simple synchrony requires individuals to perform exactly the same behavior at the same time.

Recent research found that when persons experience the same sensation at the same time, it results in the perception of self-other merging and the blurring of self-other distinctions (Paladino, Mazzurega, Pavani, & Schubert, 2010). Similarly, when individuals engage in synchrony, they share a nearly identical experience. During musical behavior, in contrast, individuals often engage in complex, coordinated, but *non-synchronous* behavior. Because of the lesser degree of synchrony in much musical behavior, compared to simple synchrony, musical behavior might be expected to produce less affiliation than simple synchrony. However, other characteristics of music might lead to greater affiliation than simple synchrony. Therefore, it is important to examine which behavior, synchronous or musical, produces greater affiliation.

The above review suggests numerous possibilities for a causal relationship between musical behavior and social bonding. The enjoyableness of musical behavior, the degree of effort required, specific characteristics of music (such as vocal blend versus vocal rasp), and the relationship to endorphin release are all aspects of music which might relate to the degree and character of affiliation produced. However, it is

first necessary to experimentally test the hypothesis that musical behavior affects affiliation.

Rhythmic musical behavior promotes affiliation

Harmon-Jones, Schmeichel and Slator (under review) conducted two studies testing the idea that musical behavior increases affiliation. In the first of these, small groups of participants played simple rhythm instruments along with a confederate. The participants were told to play however they liked. The experiment used a within subjects design, and the confederate played rhythmically on one iteration and arrhythmically on the other iteration (order was counterbalanced). Judges coded videos of the sound-making activity, revealing that musicality was greater in the in-rhythm condition. Participants felt more on the same team with their group and were happier in the in-rhythm condition than out-of-rhythm condition.

In the study described above, musical behavior emerged when participants made sounds together, particularly in the condition in which the confederate played rhythmically. The highest degree of musicality that emerged was coded as playing "consistently well-synchronized with other participants with complex musical elements such as subdivided tempos." The second-highest degree of musicality that emerged was playing "consistently well-synchronized with other participants at a single, matched tempo" (in other words, simple synchrony). In a second study, Harmon-Jones, Schmeichel, and Slator (under review) directly manipulated these categories of behavior

to examine whether more complex musical behavior would produce greater affiliation than simple synchrony.

In this study, musical behavior was manipulated via video instructions. In the simple synchrony condition, small groups of participants played simple pitched rhythm instruments in unison at 100 beats per minute. In the musical behavior condition, the participants with the lower-pitched instruments played at 100 beats per minute, while the participants with the higher-pitched instruments played a more complex, coordinated rhythm (Figure 1). Results showed that participants felt more on the same team with their groups, liked their groups more, rated their groups as more competent, and were happier in the musical condition compared to the simple synchrony condition. In addition, happiness statistically mediated the difference in affiliation between conditions. These results suggested that rhythmic musical behavior produced affiliation via its effects on positive mood.

Effects of singing

Another aspect of music, besides rhythmic complexity, is melody. Melody can be produced by singing or by using instruments (strings, percussion, wind, etc.). Singing is found in all known cultures (Lomax, 1968). Within the US, group singing is common, and most individuals have had the experience of singing at such diverse activities as football games, church services, and in school music classes. Producing melody using musical instruments, in contrast, often requires specialized skills.

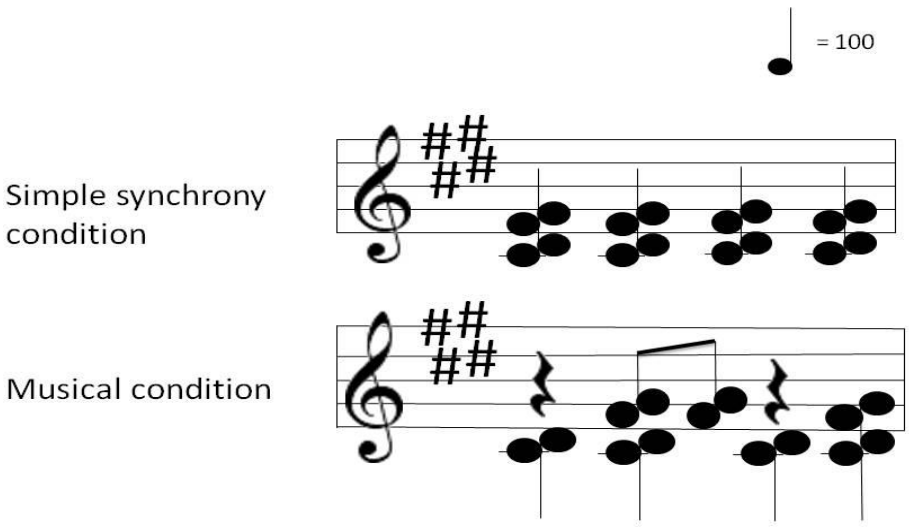

Figure 1.

One measure of the sound-making activity. Participants repeated this rhythm for 3 minutes.

Research in social psychology has rarely examined the effects of singing on unselected individuals, although one survey of Korean university students found that 88.3% of respondents enjoyed singing (Chong, 2010). According to Chorus America, 42.6 million Americans (13.80% of the population) sing in a choir, indicating that this activity, while common, is not engaged in by the majority of individuals in the U.S. (Chorus America, 2010).

Several studies have suggested that singing improves well-being. Members of a choir for homeless and marginalized individuals reported that singing provided cognitive, social and emotional benefits, specifically greater emotional balance, temporary escape from problems, a feeling of purpose in life, belongingness, and mental stimulation (Bailey & Davidson, 2005). In comparison, middle-class choir members reported that singing provided an opportunity to introspect, relaxation, increased energy, "singer's high," and a feeling of closeness to their group. The middle-class singers, unlike the marginalized singers, also expressed anxieties regarding creating a worthwhile musical product and insecurity about the adequacy of their voices (Bailey & Davidson, 2005).

Singing produces physiological benefits in addition to psychological benefits. Amateur singers reported increased joy, elatedness, relaxation and energy following a singing lesson, and had increased serum oxytocin and decreased cortisol. In contrast, professional singers reported only increased relaxation and energy, and had increases in both oxytocin and cortisol (Grape, Sandgren, Lars-Olof, Ericson, & Theorell, 2003). In another study, singing with a choir increased positive affect, decreased negative affect,

and increased secretory immunoglobulin A (a marker of improved immune function), compared to listening to the same music (Kreutz, Bongard, Rohrmann, Hodapp, & Grebe, 2004). These results suggest that the overall effects of singing were positive, although effects differed between groups of singers, with some groups experiencing negative as well as positive effects. Unfortunately, the studies demonstrating positive effects of singing on wellbeing and health were all based on self-selected individuals, that is, individuals who chose singing as a hobby or profession. It is difficult to predict whether the results would generalize to unselected individuals.

Although singing may lead to greater subjective well-being, singing has also been used to manipulate anxiety (Brown & Garland, 1971; Garland & Brown, 1972; Sturm, Ascher, Miller, & Levenson, 2008). The designs of studies using singing to manipulate embarrassment commonly include specific features: 1) preselect self-reported poor singers; 2) provide negative feedback; 3) require participants to sing alone; 4) require participants to sing a difficult song (such as the Star Spangled Banner); 5) require participants to perform for an audience whose purpose is to evaluate (Brown & Garland, 1971; Garland & Brown, 1972; Sturm, Ascher, Miller, & Levenson, 2008). Thus, the studies employing singing to evoke embarrassment manipulate not merely singing, but the experience of *failure* at singing. It seems likely that the effects of singing depend on the context and circumstances under which singing occurs: group singing of a familiar song along with friends likely affects individuals differently from inadequately performing a difficult solo for an audience of judgmental strangers.

Reactions to singing in unselected individuals

Due to the dearth of research on reactions to singing in unselected individuals, preliminary data was collected on reactions to singing. The purpose was to ascertain whether it is feasible to request participants to engage in singing behavior during a study and to assess participants' affective responses to this activity.

In this study, participants listened to six 60 second audio clips. In the singing conditions, the clips were of three women singing phrases about health behaviors, whereas in the synchronous speaking conditions, the clips were of the women speaking identical phrases in unison. Participants were assigned to either imitate the clips or listen quietly to the clips. Participants reported their attitudes toward singing and public speaking in general, and their responses to the listening activity.

At the trait level, participants reported enjoying singing more than public speaking, and mean liking for singing was well above the midpoint of the scale (M = 5.38 on a 7-point scale). Women reported liking singing more than men liked singing, however, women and men did not differ in their liking for public speaking.

Participants found the listening activity more fun and less difficult in the singing-clips compared to speaking-clips condition. Participants also found the activity more fun and liked the clips more in the imitate than listen-only condition. The audio clips were liked least in the speaking-clips/listen-only condition compared to the other three conditions. However, participants also found the activity more embarrassing in the singing-clips and imitate conditions.

Because embarrassment and difficulty are considered negative whereas fun and liking are positive, it was surprising that the same conditions (singing and imitation) that produced increased fun and liking and decreased difficulty also produced increased embarrassment. A dissonance explanation for these results might suggest participants increased their enjoyment of the listening activity to reduce the dissonance generated by having done an embarrassing activity. If this were the case, we would expect fun during the listening exercise and liking for the audio clips to be mediated by embarrassment. However, our results suggested that this was not the case. Embarrassment did not predict fun or liking in regression analyses. Furthermore, the effects of music and imitation on fun and liking were not weakened when controlling for embarrassment.

The results of the preliminary study suggested that it is feasible to study singing behavior in unselected individuals. The results also suggested that participants enjoyed participating actively along with auditory stimuli more than passively listening, and that participants enjoyed musical stimuli more than synchronous stimuli. This was the case even though they found active participation and music somewhat embarrassing.

CHAPTER V

DISSERTATION STUDY

The purpose of this study was to assess the effects of melody on affiliation. We assigned participants to conditions that varied on melody: singing versus matched nonmelodic verbal behavior. In addition, we were interested in whether musical behavior or merely listening to music would produce affiliation. We compared the effects of imitating the above behaviors to merely listening to the behaviors. In the past studies comparing rhythmic musical behavior to simple synchrony (Harmon-Jones, Schmeichel, & Slator, under review), merely listening to the stimuli was not assessed. It is possible that listening to music would have been sufficient to produce the effects on affiliation, without the need for actual musical behavior.

In pretesting, when small groups of participants were asked to produce a simple melody using tuned percussion instruments, the majority were unable to do so. Because singing is a familiar experience for most people, singing was used to manipulate melody in the current research. In the singing condition, the melodies were intended to be simple and easily learned. The aim was for the synchronous speaking and singing to match on all characteristics, including task difficulty, except that the singing condition involved melody and the simple synchrony condition did not.

The current study was intended to compare the effects of musical behavior with nonmusical behavior that is matched on all other characteristics. One hypothesis was that repeated verbal utterances that included melody would be perceived as musical, whereas

similar utterances that did not include melody would be perceived as nonmusical. Participants also completed open-ended responses that requested their personal definitions of music. Judges coded these to improve our understanding of how sound sequences are categorized as musical.

Based on our past results, participating in musical behavior was expected to cause individuals to affiliate more strongly to their group (Harmon-Jones, Schmeichel, & Slator, under review). In addition, the production of higher-quality music was expected to relate to more positive attitudes toward ones' group (Harmon-Jones, Schmeichel, & Slator, under review), and increased perceptions of group cohesiveness by outside observers (Hagen & Bryant, 2003). Thus, participants rated their perceptions of the affiliation of individuals engaging in singing or synchronous speaking. In addition, videotapes of the participants' behaviors during the sound-making activity were coded on their success, to see whether affiliation related to success.

We included a behavioral measure of affiliation in addition to self-report measures. In social animals, affiliation is presumed to be functional because it leads to cooperation and mutual aid. The primary components of affiliation are affective feelings of liking, closeness and connection (Dunbar, 2010). The cooperative behavior that occurs between affiliates is then based on the ongoing positive affective relationship that has been established. Thus, creating an affective feeling of connection through music may influence cooperative behavior.

The methods used by Tajfel (1982) to assess intergroup discrimination were adapted to provide the behavioral measure of affiliation. Participants assigned points,

redeemable for money, to themselves, an ingroup member and an outgroup member using matrices. For the current study, these matrices were adapted to assess selfishness (maximum joint profit versus maximum self profit), ingroup derogation (maximum joint profit versus maximum difference in favor of the self), ingroup favoritism (maximum joint profit versus maximum ingroup profit), and outgroup derogation (maximum joint profit versus maximum difference in favor of the ingroup).

Big 5 personality traits (extraversion, emotional stability, agreeableness, openness to experience, and conscientiousness), self-esteem, and approach motivation were also assessed. Research has suggested that groups are perceived as having higher quality when they produce better music (Hagen & Bryant, 2003; Harmon-Jones, Schmeichel, & Slator, under review). We were interested in whether high quality music is a true signal of group quality. That is, are groups that produce high quality music made up of individuals with more desirable traits?

The affiliation produced by musical behavior may be related to positive affect (Harmon-Jones, Schmeichel, & Slator, under review). Thus, happiness and fun were predicted to be greater in the singing and imitation conditions compared to the synchronous speaking and listen-only conditions.

Based on the results of the pilot study, embarrassment was expected to be greater in the singing and imitation conditions compared to the synchronous speaking and listen-only conditions. However, embarrassment was not expected to increase affiliation through effort justification, because group membership was not contingent on imitation.

CHAPTER VI

METHOD

Participants

Participants were 105 undergraduates (38 female, 67 male) participating in order to partially fulfill a course requirement. They participated in same-sex groups comprising two to four individuals.

Video stimuli

Musicality was manipulated using video-recorded instructions. In the videotapes, three individuals acted as models. In each video, the models repeated nonsense phrases for 75 seconds. In the simple synchrony condition, the models spoke the nonsense phrases in synchrony with one another. In the musical condition, the models sang identical phrases in unison. For the musical condition, the melodies were adapted from sea shanties (Nelson-Burns, 2009). These melodies were intended to be simple and unfamiliar to participants.

Procedure

After giving consent, participants completed the Ten Item Personality Inventory (Gosling, Rentfrow, & Swann, 2003), the Behavioral Inhibition/Behavioral Activation Sensitivity questionnaire (Carver & White, 1994), questions to assess their attitudes toward singing and speaking, and the Self-Esteem Scale (Rosenberg, 1965).

Participants then took seats in front of a projector screen. The experimenter explained that participants would watch videos of musical or nonmusical behavior and do a group activity during these videos. She explained that participants would read the instructions for the group activity from the screen, so that she could remain blind to condition during all interactions with participants. She noted that participants might be asked to make sounds during the activity, and requested that they speak up so that their participation could be recorded. She then started a video camera to record the group activity, and seated herself out of the participants' view.

Next, participants read instructions for the group activity. The instructions assigned them either to imitate the models in the videos or to listen to the videos quietly. Participants then watched three videos of either synchronous speaking or singing, and performed the assigned group activity during the videos.

After the group activity, participants read instructions asking them to move to computers for the next task. They completed ratings of their group and similar ratings of the models in the videos. The questions were: "How much do you feel that you are on the same team with your group?", "How much do you trust your group?", "How much do you like your group?, and "How competent is your group?" Participants also reported their current happiness, how much fun they had during the group activity, and how embarrassing they found the group activity.

Next, participants played a game to assess affiliation to the group. They read instructions explaining that during the game they would give points to themselves and to a member of their group, and to a member of their group and a member of the group that

would participate after theirs. The instructions explained that the group that participated prior to the current group had already assigned points to the their group. Each point would be worth one cent, and at the end of the experiment the experimenter would add up the points and exchange them for money. Participants then assigned points to the self versus a randomly selected member of their group, and a member of their group versus a member of the following group, using four matrices. Each matrix assessed a different strategy—selfishness, ingroup derogation, ingroup favoritism, and outgroup derogation (Tajfel, 1982). Participants then completed the State Self-Esteem Scale (Heatherton & Polivy, 1991).

Participants evaluated the videos by answering the following questions: "Were the people in the videos engaging in musical behavior? Yes No", "How musical was the behavior of the people in the videos you watched?", "How difficult was the activity you did with your group?", and an open-ended question, "What is music? (Please write your personal definition of music.)" Participants completed questions to assess suspicion. Last, the experimenter debriefed participants, gave them course credit, and dismissed them.

Two independent raters who were blind to hypotheses coded the videos for how well participants succeeded at imitating the behavior in the videos. In the synchronous speaking condition, the degree of success was based on whether the syllables were clear, understandable, matched the syllables in the video, and whether the participants were synchronized temporally with the video. In the singing condition, the degree of success was based on these same judgments, and in addition on how well the group matched the

melody demonstrated in the videos. The coding scheme was as follows: 0 = the group did not produce audible sound; 1 = imitation was very poor; 2 = imitation was poor; 3 = imitation was good; 4 = imitation was very good. The judges ratings were highly correlated, $r = .78$. Discrepancies were resolved through review of the relevant videos and discussion.

CHAPTER VII

RESULTS AND DISCUSSION

Preliminary analyses

Responses to the yes/no question, "Were the people in the videos engaging in musical behavior?" were examined. Overall, 81.37% of participants identified the videos as showing musical behavior. There was no significant difference between conditions in identification of the videos as consisting of musical behavior, $X^2 = 3.45$, $df = 3$, $p = .33$. This result was contrary to hypotheses, as the singing condition was intended to present musical behavior whereas the synchronous speaking condition was intended to present matched, nonmusical behavior.

Because the manipulations were predicted to affect behavior at the group level, responses were averaged within each group. For responses to the question, "How musical was the behavior of the people in the videos that you watched?" there was a main effect of melody, F (1, 28) = 45.29, $p < .001$. There was a marginal effect of imitation, F (1, 28) = 3.07, $p = .09$, and no interaction, $p > .44$. Participants rated the singing videos as more musical ($M = 3.43$, $SD = 0.45$) compared to the synchronous speaking videos ($M = 2.23$, $SD = 0.56$). Participants did not rate the videos as significantly different in musicality in the listen-only condition ($M = 3.00$, $SD = 0.84$) compared to the imitate condition ($M = 2.63$, $SD = 0.73$. These results supported the hypothesis that the singing condition would be perceived as more musical than the synchronous speaking condition.

For responses to the question, “How difficult was the group activity?” there was no main effect of melody, $p < .20$, but there was a significant main effect of imitation, $F(1, 28) = 7.04$, $p = .01$, and a significant interaction, $F(1, 28) = 5.69$, $p = .02$. Within the imitate condition, self-reported difficulty was greater for singing ($M = 1.82$, $SD = 0.56$) than synchronous speaking, ($M = 1.30$, $SD = 0.36$), $t(16) = 2.42$, $p = .03$. Within the listen-only condition, the difficulty for singing ($M = 1.11$, $SD = 0.20$) did not differ from speaking ($M = 1.26$, $SD = 0.38$), $p = .36$. This result was contrary to hypotheses, as the singing and synchronous speaking conditions were not intended to differ in difficulty.

Success at imitation, as rated by judges, was examined within the imitate condition. Success at imitation was greater in the synchronous speaking condition ($M = 3.13$, $SD = 1.24$) than in the singing condition ($M = 0.67$, $SD = 0.59$). In the singing condition, performance at the sound-making task was poor overall. This result, along with the results for self-reported difficulty, suggested that task difficulty and melody were confounded in the current experiment.

Male and female groups did not differ on affiliation, success at imitation, happiness, fun, or embarrassment, all ps $> .42$. Sex of the groups also did not interact with melody or fun in predicting any of the above variables, all ps $> .15$. Thus, sex will not be discussed further.

Group level tests of hypotheses

An index of affiliation was created by averaging responses to the questions, "How much do you feel on the same team with your group?"; "How much do you trust

your group?"; "How much do you like your group?"; and "How competent is your group?", Cronbach's coefficient $\alpha = .87$. A similar index of affiliation was also created for perceptions of the models in the video, Cronbach's coefficient $\alpha = .91$.

The effect of melody and imitation on affiliation were examined using an analysis of variance (ANOVA). Results showed a main effect of melody, F (1, 28) = 2.27, $p = .01$, and a main effect of imitation, F (1, 28) = 5.54, $p = .03$. There was also a marginal interaction, F (1, 28) = 3.23, $p = .08$ (Figure 2). Affiliation was greater in the synchronous speaking ($M = 4.46$, $SD = 0.81$) compared to the singing condition (M = 3.79, $SD = 0.55$. Affiliation was also greater in the imitate ($M = 4.40$, $SD = 0.91$) compared to listen-only condition ($M = 3.81$, $SD = 0.36$). Regarding the marginal interaction, in the imitate condition, affiliation was greater for synchronous speaking (M = 4.84, $SD = 0.82$) than for singing ($M = 3.85$, $SD = 0.70$). In the listen-only condition, affiliation did not differ between synchronous speaking ($M = 3.91$, $SD = 0.37$) and singing ($M = 3.72$, $SD = 0.36$). These results partially supported the hypotheses. As predicted, synchronous behavior increased affiliation. However, contrary to predictions, melody did not increase affiliation.

The effects of melody and imitation on perceptions of affiliation of the models in the videos were examined using ANOVA. There were no main effects or interactions, all ps > .22. These results failed to support the hypothesis that the models would be perceived as more affiliated in the singing condition.

The effects of melody and imitation on self-reported happiness were examined using ANOVA. Results showed a main effect of imitation, F (1, 28) = 4.32, $p = .05$.

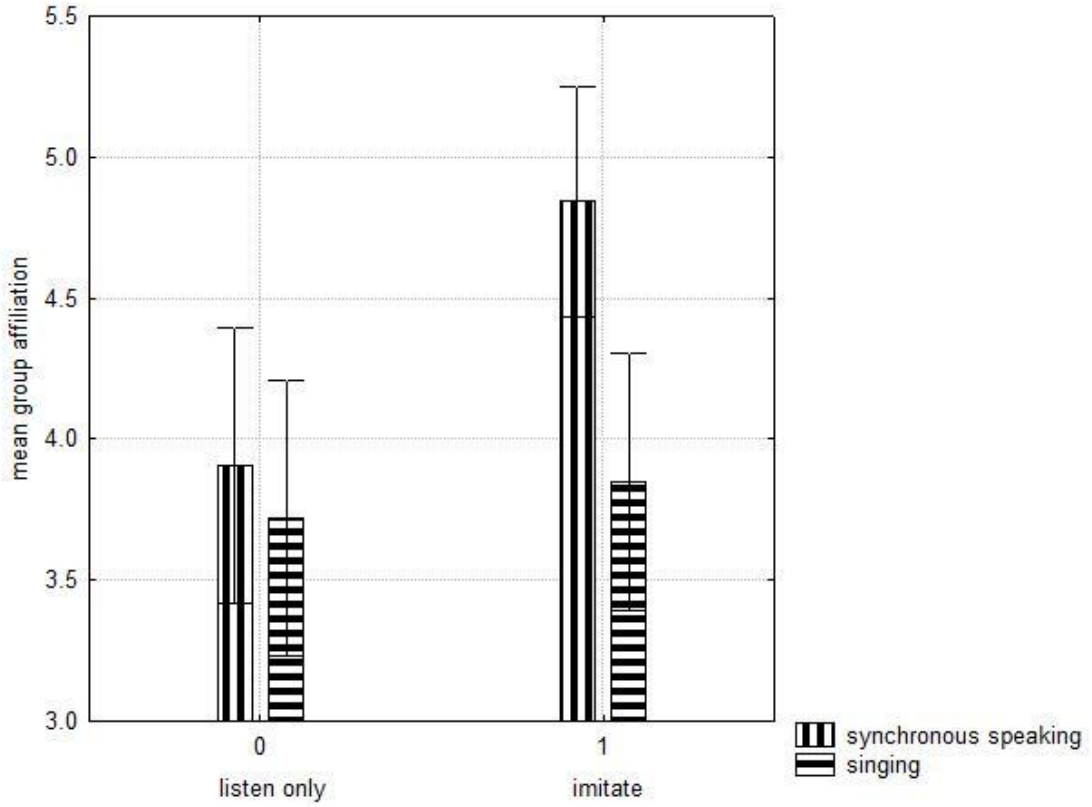

Figure 2: Effect of imitation and melody on mean reported affiliation. Main effect of melody, F (1, 28) = 2.27, p = .01, and main effect of imitation, F (1, 28) = 5.54, p = .03.

There was no main effect of melody and no interaction, *p*s > .16. Happiness was greater in the imitate condition (*M* = 4.61, *SD* = .84) compared to the listen-only condition (*M* = 4.01, *SD* = 0.69). These results supported the hypothesis that synchronous behavior increases happiness, but failed to support the hypothesis that melody increases happiness.

The effects of melody and imitation on self-reported fun during the group activity were examined using ANOVA. Results showed a main effect of imitation, *F* (1, 28) = 6.65, *p* = .02. There was no effect of melody and no interaction, *p*s > .23. Participants reported more fun in the imitate condition (*M* = 3.67, *SD* = 1.31) compared to the listen-only condition (*M* = 2.58, *SD* = 0.87). These results supported the hypothesis that engaging in synchronous behavior is more fun than observing synchronous behavior, but failed to support the hypothesis that singing is more fun than simple synchrony.

The effects of melody and imitation on self-reported embarrassment during the group activity were examined using ANOVA. The results showed a main effect of imitation, *F* (1, 28) = 10.39, *p* = .003, no main effect of melody, *p* > .40, and a significant interaction, *F* (1, 28) = 8.08, *p* = .008. Within the imitate condition, singing (*M* = 3.17, *SD* = 0.91) produced greater embarrassment than synchronous speaking (*M* = 2.22, *SD* = 0.72). Within the listen-only condition, embarrassment did not differ between singing (*M* = 1.61, *SD* = 0.56) and synchronous speaking (*M* = 2.12, *SD* = 0.60). These results supported the hypothesis that singing behavior is experienced as more embarrassing than speaking.

The effects of melody and imitation on behavior in the game were examined using ANOVA. There were no significant differences for selfishness, in-group derogation or out-group derogation, all *p*s > .20. For in-group favoritism, there were no main effects of imitation or melody, but there was a significant interaction, F (1, 28) = 7.58, p = .01. In the imitate condition, ingroup favoritism was greater in the synchronous speaking (M = 6.93, SD = 1.40) compared to the singing condition (M = 4.81, SD = 1.39). In the listen-only condition, ingroup favoritism did not differ between the singing (M = 5.93, SD = 1.47) and synchronous speaking conditions (M = 6.92, SD = 2.08). These results did not support the prediction that melody would increase ingroup favoritism.

Relationships between task success, group traits, and responses to musical behavior

Because the majority of participants reported that both synchronous speaking and singing constituted musical behavior, these conditions were combined. Correlational analyses were used to explore relationships between affiliation, success at the imitation task, and subjective responses to the activity (Appendix, Table 1), and between success at the imitation task and mean individual differences (Appendix, Table 2).

Imitation success was positively related to average group affiliation (Figure 3), happiness, fun, and ingroup favoritism. Average group affiliation was positively related to imitation success, average group happiness, and average reported fun. These results suggested that a higher quality performance of a musical activity relates to greater affiliation toward the group and increased positive affect.

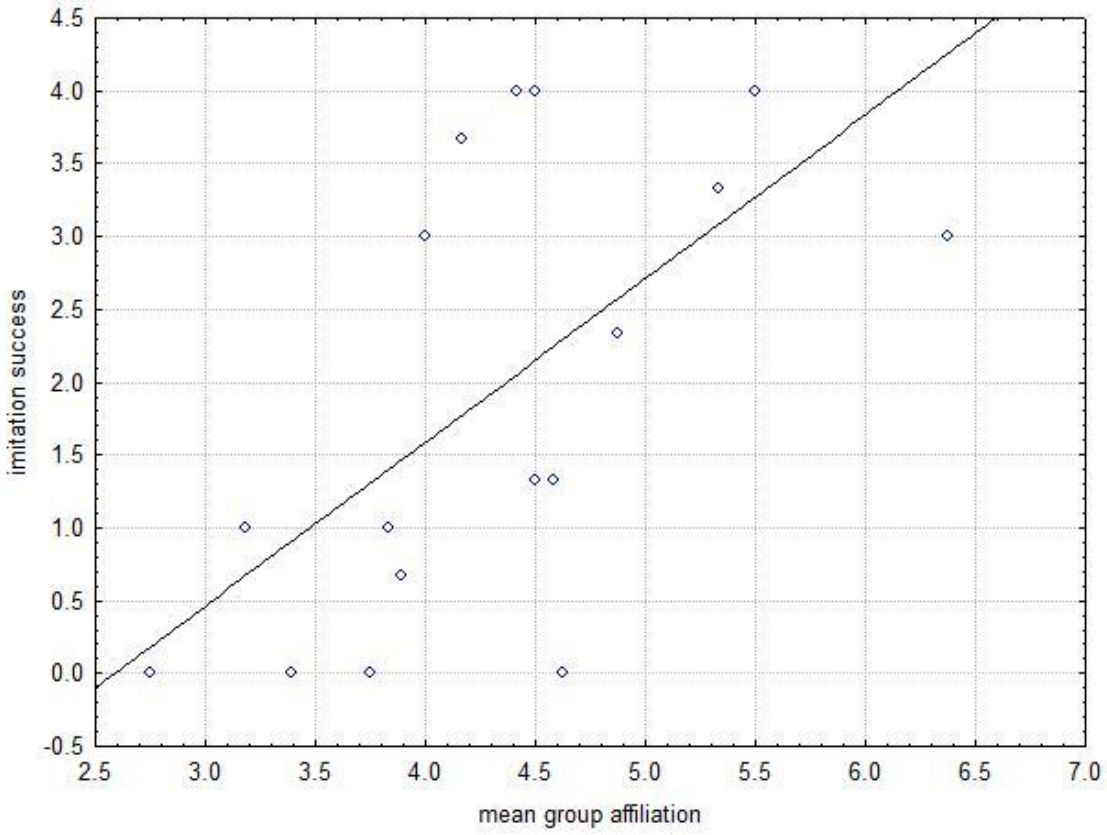

Figure 3: Affiliation and sound-making success. Relationship between affiliation and judges' ratings of success at imitation in the imitation conditions, r (16) = 0.64, p = .004.

At the trait level, imitation success was positively related to average group BAS reward responsiveness, BAS fun-seeking, emotional stability, agreeableness, liking for singing solos, and liking for public speaking. These results suggest that higher quality musical behavior may reflect trait characteristics of the group. Not surprisingly, groups in which the members had greater liking for solo singing and public speaking performed better at imitation. More interestingly, groups in which the members possessed greater emotional stability and agreeableness also performed better. Furthermore, groups in which the members were higher in approach motivation performed better. These results support the hypothesis that the quality of music produced by a group may provide a truthful signal regarding group quality, specifically the average agreeableness, conscientiousness, and approach motivational traits of the group.

Individual level tests of hypotheses

To examine the effects of imitation and melody at the individual level, multilevel models were conducted using imitation and melody as fixed factors and including a random intercept for group. For affiliation, results revealed a main effect for imitation, F (1, 21.17) = 11.02, p = .003, no main effect for melody, p > .61, and a significant interaction, F (1, 23.40) = 5.27, p = .03. Within the imitation condition, the estimated marginal mean for affiliation was greater in the synchronous speaking condition (M = 4.85, SD = 1.94) compared to the singing condition (M = 3.76, SD = 2.07). In the listen-only condition, affiliation did not differ between synchronous speaking (M = 3.90, SD = 2.20) and singing (M = 3.74, SD = 2.08). These results converged with the group-level

analyses in suggesting that synchronous speaking behavior increased affiliation, and in failing to support the hypothesis that melody would increase affiliation.

For perceptions of the affiliation of the models in the video, a multilevel model was conducted using imitation and melody as fixed factors and including a random intercept for group. Results revealed no main effect of singing, F (1, 26.19) = 0.46, p = .50, a marginal effect of imitation, F (1, 30.67) = 3.71, p = .06, and no interaction, F (1, 28.31) = 1.97, p = .17. These results converged with the group level analyses in finding no significant effects of melody on perceptions of affiliation among the models.

For reported happiness, a multilevel model was conducted with imitation and melody as fixed factors and including a random intercept for group. Results revealed a main effect of imitation, F (1, 28.17) = 7.85, p = .009, no main effect of singing, F (1, 23.17) = 0.39, p = .54, and no interaction, F (1, 25.56) = 2.82, p = .11. Happiness was greater in the imitation condition (M = 4.59, SD = 1.25) compared to the listen-only condition (M = 4.00, SD = 1.05). These results converged with the group-level analyses in suggesting that imitation of the stimuli increased happiness.

For reported fun during the group activity, a multilevel model was conducted with imitation and melody as fixed factors and including a random intercept for group. Results revealed a main effect of imitation, F (1, 27.08) = 4.57, p = .04, with no main effect of singing, F (1, 24.07) = 0.42, p = .52, and no interaction, F (1, 25.48) = 0.10, p = .75. Fun was greater in imitation condition (M = 3.65, SD = 1.59) compared to the listen-only condition (M = 2.58, SD = 1.34). These results converged with the group level

analyses in suggesting that participants experienced imitation of the stimuli as more fun than merely observing the stimuli.

For reported embarrassment during the group activity, a multilevel model was conducted with imitation and melody as fixed factors and including a random intercept for group. Results revealed no main effects of singing, F (1, 100) = 1.31, p = .26, or imitation, F (1, 100) = 0.28, p = .60, and a significant interaction, F (1, 100.00) = 6.51, p = .01. In the imitate condition, embarrassment was greater with singing (M = 3.19, SD = 2.77) compared to synchronous speaking (M = 2.25, SD = 2.67). In the listen-only condition, embarrassment did not differ between singing (M = 1.59, SD = 2.91) and speaking (M = 2.04, SD = 2.94). Similar to the group level analyses, these results suggested that participants are more embarrassed when they sing than when they engage in synchronous speaking.

For ingroup favoritism, a multilevel model was conducted using imitation and melody as fixed factors and including a random intercept for group. There was no main effect of singing, F (1, 26.08) = 1.25, p = .27, or of imitation, F (1, 30.46) = .51, p = .48. However, results revealed a significant interaction, F (1, 28.16) = 7.46, p = .01. In the imitation condition, ingroup favoritism was greater in the synchronous speaking condition (M = 6.95, SD = 5.18) compared to the singing condition (M = 4.86, SD = 5.54). In the listen-only condition, ingroup favoritism did not differ between the synchronous speaking (M = 5.85, SD = 5.91) and singing (M = 6.75, SD = 5.64). These results, similar to the group-level analyses, did not support the hypothesis that melody would increase ingroup favoritism.

Definitions of music

Participants answered the question, "What is music? (Please write your personal definition of music.)" Two independent raters coded the open-ended responses by sorting the responses into six non-exclusive categories. Their responses matched on 93% of judgments, and disagreements were resolved through review and discussion. Of the responses, 40.38% referred to emotion (e. g., expresses emotion, makes me happy, affects people's feelings), 35.58% referred to pitch coordination (e. g., has melody, harmony, tone), 25.00% referred to pulse coordination (e. g., has rhythm, keeps a beat), 22.12% referred to aesthetic appeal (e. g., is beautiful, sounds good, pleasant sounding), 11.54% referred to communicating meaning (e. g., communicates ideas, transmits thoughts), 9.62% referred to creativity (e. g., is artistic, creative), and 10.58% could not be classified into any of these categories. According to X^2 tests, none of these responses were significantly different by condition, all ps > .34. These results suggested that definitions of music were idiosyncratic, as no single category of responses was generated by more than 41% of participants.

CHAPTER VIII

GENERAL DISCUSSION

The results of the current study provide some support for the idea that musical behavior promotes affiliation. When participants engaged in synchronous speaking, affiliation was greater compared to when participants merely listened to synchronous speaking. The majority of participants perceived the synchronous speaking as musical behavior. Furthermore, the increase in affiliation due to musical behavior may be related to affect. Imitation produced more self-reported happiness and was experienced as more fun than merely listening, and affiliation was correlated with happiness and fun.

The current research was intended to examine differences in affiliation produced by musical and matched nonmusical behavior. Because synchronous speaking lacks melody and singing includes melody, synchronous speaking was expected to be experienced by participants as nonmusical whereas singing was expected to be experienced as musical. However, the majority of participants classified both synchronous speaking and singing as musical behavior. The proportion of participants classifying the stimuli as musical did not differ by condition, although the singing condition was rated as more musical than the synchronous speaking condition on a continuous measure.

In addition, success at the imitation task (rated by judges) was much lower in the singing condition than in the synchronous speaking condition. Thus, melody was confounded with poor performance. While it is possible that synchronous speaking

behavior produced greater affiliation compared to singing behavior due to differences in musicality, it is also possible that the difference in affiliation was due to poorer musical performance in the synchronous speaking condition. Correlational analyses provide some support for the idea that greater success at musical behavior is related to affiliation: Judges' ratings of success at the sound-making task were positively related to affiliation, happiness, fun, and ingroup favoritism.

Another hypothesis for the current study was that observers would perceive a group engaged in melody as more affiliated than a group engaged in synchronous speaking. This hypothesis was not supported by participants ratings of the degree of affiliation of the models in the videos, as the degree of perceived affiliation did not differ by condition. However, these results are difficult to interpret because the majority of participants rated both the synchronous speaking and singing conditions as musical behavior.

Based on past research, poor performance at a musical activity would be expected to produce less affiliation than good performance. Individuals affiliate more when their group plays with more coordination (Harmon-Jones, Schmeichel, & Slator, under review), and observers infer greater group cohesiveness when a group plays well-coordinated music (Hagen & Bryant, 2003). Hagen and Bryant noted that when a group produces cohesive music, this signals high group quality to observers. The current results build on the past work by suggesting that better music performance may provide a *true* signal of group quality. Average group agreeableness, emotional stability and approach motivation were related to judges' ratings of success at the sound-making task.

Our past research examining affiliation and musical behavior operationalized musical behavior in terms of rhythmic complexity (Harmon-Jones, Schmeichel, & Slator, under review). When participants played two different, coordinated rhythms they reported more affiliation compared to when they played a single, synchronous rhythm. These results differ from the results of the current study, in which participants who engaged in melody affiliated less than participants who engaged in synchronous speaking. However, in the past studies, the rhythms were easy to perform and task success was high in both the simple synchrony and coordinated rhythm conditions.

The current results also differ from the results of the preliminary study on singing behavior. In the preliminary study, participants reported more fun and less difficulty in the singing compared to the synchronous speaking condition. The preliminary study differed from the current study in that it was conducted online, so it is likely that participants completed the study alone. In addition, the stimuli differed from the stimuli used in the current study (the preliminary study used phrases regarding health behaviors; the current study used nonsense syllables). These differences in the designs of the studies may have contributed to the different pattern of results. In particular, failure at imitation in the singing/imitation condition may have been more common in the current study, in which participants imitated as a group, because poor performance by even one group member would make the entire group sound bad. In addition, participating as a group may have made the quality of performance at the sound-making task more salient.

Because musical behavior is effortful, it is possible that one means by which music could produce affiliation through effort justification. This would be consistent

with research on dissonance (Aronson & Mills, 1959), hazing (Keating et al., 2005), and costly displays (Henrich, 2009). The current results do not support a dissonance explanation, as affiliation was not positively related to either embarrassment or the self-reported difficulty of the musical behavior. However, in order to test whether musical behavior can produce affiliation through effort justification, it would be important to make group membership contingent on performing the musical behavior. In the current study, group membership was assigned prior to the musical behavior, so effort justification would not be expected. However, in real-life groups in which group memberships is perceived to be contingent on participating in musical behavior (e. g., religious groups), so dissonance processes may be involved. Future research should examine the contribution of effort justification to affiliation during musical behavior when group membership is implicitly or explicitly contingent on musical behavior.

The current results suggest that participants defined music very broadly. The majority of participants classified our simple stimuli as examples of musical behavior. Participants also answered an open-ended question regarding their personal definitions of music. The most common responses were that music affects or communicates emotion, is coordinated by pitch, is coordinated by pulse, and/or is aesthetically appealing. Responses to this question varied widely; each of the above categories of responses was mentioned by fewer than 41% of participants. These results converge with research suggesting that examples of music and definitions of music vary considerably across cultures and within cultures (Bispham, 2009; Merker, 2000; Merriam, 1964).

Future research in which melody is not confounded with task success should examine whether melodic behavior produces affiliation. To test this question, it would be important to create a matched control condition in which the behavior is not perceived as musical by the participants. The current study suggests the difficulty of designing such a condition, as participants defined music quite broadly: The majority of participants perceived non-melodic repetition of nonsense syllables in unison as musical.

Furthermore, designing a melody condition that participants can perform with a high degree of success may be difficult. In the current study, although the melodies in the singing condition were intended to be simple, coding by judges revealed that most groups were unable to imitate the melodies successfully. One option for increasing task success in the melody condition would be to provide more extensive training in singing the melodies, perhaps by having a live instructor teach the melodies instead of using video instruction. Unfortunately, this might increase experimental demand. Participants could create the melodies using musical instruments, although pretesting suggested that playing melodies on instruments is at least as difficult for participants as singing. Musicians or singers could be selected as participants, but this would limit the generalizability of the results.

Another possible solution would be to use simple melodies that are already familiar to participants, such as nursery rhymes. In the current research, the use of familiar melodies was avoided because participants would have prior associations with the familiar melodies that might influence their responses to the group. However, given the difficulty participants experienced in learning new melodies, the advantages of

familiar melodies might outweigh the drawbacks. Because so little previous research in social psychology has examined musical behavior, extensive work needs to be done in developing and testing stimuli.

The current results converge with past research in suggesting that affiliation during musical behavior is related to positive emotion. Theorists have suggested that affiliation during music is caused by producing a similar psychological state among group members (Bispham, 2009; Freeman, 2000). However, perhaps it is not necessary that this state be positive affect. For example, when individuals play angry music together, this might be expected to increase subjective anger, but still might increase affiliation with the group. Similarly, when individuals play sad music together, this might increase both sadness and affiliation. Future research should examine the relationship of musical behavior, specific positive and negative affective states evoked by music, and affiliation.

CHAPTER IX

CONCLUSIONS

Fitch (2006) noted that music is costly. Music consumes a tremendous amount of energy, sometimes to the point of exhaustion of participants. However, if music functions as a technology of interpersonal bonding (Freeman, 2006) this benefit might outweigh the costs. The current studies provide some evidence that musical behavior does increase affiliation, at least when individuals perform the behavior successfully. In addition, the results suggest that the quality of music may provide information about group traits.

Research suggests that mirror neurons may be involved in music (Lahav et al., 2007; Overy & Molnar-Szakacs, 2009) and other synchronous activities (Tognoli et al., 2007). Research also suggests that endorphins, hormones that are involved in human interpersonal bonding, are produced during synchronous behavior (Cohen, Ejsmond-Frey, Knight, & Dunbar, 2009; Panksepp, 1998) and during highly pleasurable music listening experiences (Blood & Zattore, 2001). Thus, a number of behavioral, neuronal, and hormonal mechanisms may be involved in the relationship between music and affiliation. The current study focused on melody as one dimension of musical behavior. However, music is a multidimensional activity. Future research should examine the social effects of other aspects of music, including but not limited to aesthetic appeal, tempo, evoked emotion, and lyrical content. In addition, future research should examine whether musical behavior results in the release of endorphins.

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APPENDIX

Table 1

Correlations within the imitate condition: Responses to group activity averaged within groups

	Affiliation	Imit Success	Happy	Fun	Embr	Perf SE	Social SE	Appr SE	Selfish	Ingrp dero	Ingrp fav
Imitation Success	0.64**										
Happiness	0.76***	0.52*									
Fun	0.60**	0.46*	0.86***								
Embarrassment	-0.35	-0.40	-0.28	-0.43							
Performance SE	0.32	0.45	0.46*	0.47*	-0.19						
Social SE	0.27	0.23	0.17	0.26	-0.29	0.50*					
Appearance SE	0.40	0.38	0.45	0.58**	-0.41	0.62**	0.63**				
Selfishness	0.07	0.03	0.15	0.01	-0.09	-0.19	-0.23	-0.01			
Ingroup derogation	-0.07	0.14	-0.16	-0.05	-0.32	-0.12	0.13	0.29	-0.03		
Ingroup favoritism	0.41	0.62**	0.35	0.16	-0.27	0.12	0.20	-0.06	0.26	-0.15	
Outgroup derogation	0.14	-0.08	0.18	0.24	-0.61**	0.01	0.10	0.40	-0.22	0.46*	-0.19

Note. $df = 16$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 2

Correlations within the imitate condition: Relationships between ratings of success at imitation and averaged group traits

	Imitate Success	BAS RR	BAS Dr	BAS Fun	BIS	Extra	Emo Stabil	Agree	Consc	Open	Self Est	Like Sing
BAS Reward Resp	0.69**											
BAS Drive	0.41	0.58*										
BAS Fun-Seeking	0.47*	0.59**	0.51*									
BIS	-0.23	-0.22	-0.05	-0.26								
Extraversion	0.18	0.39	0.30	0.55*	-0.45							
Emotional Stability	0.58*	0.29	0.04	0.17	-0.07	-0.02						
Aggreeableness	0.48*	0.23	0.27	0.06	-0.18	0.09	0.01					
Conscientiousness	-0.07	-0.01	0.18	-0.41	0.38	-0.39	-0.01	-0.08				
Openness to Exp	0.37	0.20	0.39	0.28	-0.37	0.46	0.35	-0.11	0.22			
Self Esteem	0.37	0.68**	0.45	0.25	-0.09	0.16	0.21	0.06	0.46*	0.27		
Like Sing Solo	0.36*	0.30	0.14	0.16	-0.27	0.25	0.15	0.31	-0.07	0.44**	0.25	
Like Public Speech	0.55**	0.40*	0.53**	0.35*	-0.12	0.53**	0.15	0.29	0.02	0.34	0.41*	0.14

Note. $df = 16$, *$p < .05$, **$p < .01$, ***$p < .001$

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