2021

To Sing Or To Speak: Closeness Between Mother-Infant Dyads In Different Contexts

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TO SING OR TO SPEAK: CLOSENESS BETWEEN MOTHER-INFANT DYADS IN DIFFERENT CONTEXTS

by

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Submitted in Partial Fulfillment

of the requirements for the degree of

Bachelor of Arts

in

Honours Psychology

Faculty of Arts and Social Science

Huron University College

London, Canada

April 30th, 2021

HURON UNIVERSITY COLLEGE

CERTIFICATE OF EXAMINATION

Advisor: Dr. Tsang

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The thesis by:

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entitled:

To Sing or To Speak: Closeness Between Mother-Infant Dyads in Different Contexts

Is accepted in partial fulfilment of the requirements for the degree of

Bachelor of Arts

in

Huron Psychology

__April 30th, 2021___ ___Dr. Tsang __

Date Chair of Department

Abstract

Past research has demonstrated the influence of a mother on her child's development. This research has highlighted the importance of closeness in relationships and the abundance of positive outcomes that result from high closeness in early relations, long after infancy. This study used recordings from a previous study on mother-infant dyads to examine observable behaviours indicating closeness in infant-mother dyads, during speech and song episodes. It was hypothesized that the dyads total closeness would be higher in the song condition than the speech condition, which was validated by the results. Further analysis showed a difference in closeness scores within the dyad, with mothers displaying significantly higher scores than her infant. There was no significant effect of closeness score per episode when the closeness scores within the dyad were broken down to compare a mother versus her infant, though after removing control variables such as gender and the episode order, the results indicated near significance. Correlations indicated a relationship between mothers and their infants when engaging in touch, even across episodes. Several limitations were present in the study and future directions for this line of research were identified.

Keywords: mother-infant dyads, closeness, speech, song

Acknowledgements

I am sincerely grateful and would like to offer many thanks to my thesis advisor Dr. Christine Tsang. Your continued feedback and support allowed me to consistently improve the study design and the final written project. Your guidance and expertise on the subject and developmental psychology allowed me to better understand my interests and find something specific that I am passionate about, I am grateful for your mentorship.

I would like to thank my second reader Dr. Irene Cheung who offered many suggestions throughout the compilation of the final written thesis. You helped me understand the passion I currently hold for psychology after being my lab instructor in first year and have helped me develop confidence in my abilities over the last few years.

To all the professors I have had the pleasure to be taught by at Huron University, you have created a positive and rewarding experience for me here and allowed me to always continue to learn.

To my family and friends, I am indebted to you for your endless support. Thank you for allowing me to run my ideas by you and to help me overcome my frustrations and doubt within myself. Thank you for always having faith in me.

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Introduction

From conception, a mother plays an important role in the life of her child. The infant grows within their mother and relies on her for viability. Even after birth, a mother's role in her child's life continues to be important, especially as an infant, since they are vulnerable and relatively ignorant to the world around them. Over time, rewards of mother-infant exchanges have evolved to increase interaction between a mother and her infant, in order for the infant to get the attention required to develop until they can fend for themselves. Depending on the nature of these interactions, infants learn different competencies that help them grow into an independent individual.

In the beginning of an infant's life, crying is a method to express oneself, but overtime crying becomes a measure of communication (Bell & Ainsworth, 1972). Maternal responsiveness to the early signals of their infant, like crying, influences the development of other modes of communication and behaviours between a mother and her infant (Bell & Ainsworth, 1972), impacting their future relationship.

The significance of this early communication is evident as mother-infant relationships are enduring and play a role in many developmental outcomes of the infant. This study endeavored to investigate the relationship between a mother and her infant by examining the factors and contexts which play a role in the facilitation of closeness. To cognize closeness, one must understand the influences which create connections between individuals and the lasting importance of the mother-infant relationship. This research focuses on the difference between singing and speech contexts in which closeness may be facilitated, to further understand the influences of different interaction types on the relationship between a mother and her infant.

Development of Bonding and Affiliation

Haley and colleagues (2003) found that infants of more responsive parents show better regulation than those of less responsive parents, including when it comes to stress sensitivity, self-soothing and self-regulation. In rodents, the leptin in maternal milk reduces the response to stress in infants and enhances hippocampal development (Walker, 2004) showing the importance of mother-infant interactions and that the effects of maternal responsiveness on an infant's mental development are specific and direct (Bornstein & Tarmis-Lemonda, 1997). Interactions with caregivers also play a role in developing societal expectations and an infants' self-efficacy (Mequaid et al., 2010). Feldman (2012) was able to link the release of oxytocin, a bonding hormone, to a parent and their infant's readiness for engagement in social behaviours, and synchrony demonstrating the importance of early bonds on relationships later in life.

In a similar way to oxytocin, touch influences early socialization, development of memories and impacts future behaviours (Gallace & Spence, 2010), showing how many variables, both internally and externally, play a role in the development of early bonds. Interpersonal touch also provides effective means for influencing people's social behaviours, including the creation of bonds (Gallace & Spence, 2010). Touching and other micro-level social behaviours such as vocals, gaze and affect, paired with the rise of certain psychological processes in an infant, and hormonal responses, create dyadic specific affiliations (Feldman, 2012). Freeman (1992) defines affiliation as the stable interpersonal relationships that involve both frequent interaction and positive sentiment, the result of bonding. These affiliative bonds are selective and enduring attachments that provide a foundation for infants' capacity to function competently, grow to form intimate bonds with non-genetically related others, and nurture the next generation (Feldman, 2012). Bonding is viewed as the progressive development of emotional involvement between two individuals (Figueiredo et al., 2007). In the case of a mother

and her child, a mother begins to develop the necessary psychological means to create this bond during pregnancy (Figueiredo et al., 2007). Social bonds are dynamic memory complexes with emotion regulation features, which serve altruistic purposes (Hackman et al., 2014). Neuropeptides serve to coordinate autonomic and endocrine consequences of positive social experiences with behavioural states and support the formation and maintenance of social bonds (Carter & Keverne, 2002). In terms of a mother and her infant, these bonds are complimentary (Filippa et al., 2018), as Filippa, Monaci and Grandjean (2018) found that infants' responsiveness to their mother increases the mother's emotional involvement with the child. Parents emotional involvement in caregiving affects the interactions with their infant and the quality of the relationship and care they provide (Figueiredo et al., 2007).

Attachment

The optimal early development of an infant is dependent on a stable, secure relationship between a mother and infant (Walker, 2004). Emotional availability of both parents and infants are associated with the development of attachment security (IV et al., 2010). Of all the different attachment styles, secure attachment results in the most positive developmental outcomes, including social competence and emotion regulation (Viddal et al., 2014), therefore making it the highest standard of attachment. Attachment is necessary for a close affiliative relationship to develop between an infant and their caregiver (Hong & Park, 2012). Attachment patterns are linked to characteristic maternal behaviour in the infant's first year of life (Raval et al, 2001). In terms of securely attached infants this means consistent responses from their mother (Bell & Ainsworth, 1972).

Gallace and Spence (2010) found that touch plays a role in the development of attachment between a mother and her infant and the prevailing attachment patterns in an infant's life.

Schneider-Rosen (1993) used a replication of the *Strange Situation* to explain behaviours between a securely attached infant and their caregiver. This demonstrated that when a stranger enters the room and engages with their mother, an infant engages in certain behaviours (Schneider-Rosen, 1993). These behaviours include seeking contact or proximity with the mother when a stranger enters but gradually responding to the stranger and affiliative behaviours with the stranger if the mother is present and engaging with the stranger (Schenider- Rosen, 1993). A child becomes "attached" to their caregiver when they have a strong motivation to be physically close and make contact with this caregiver, especially in situations where the infant is frightened or ill (Hong & Park, 2012). This then develops to using a parent as a base for dependence and exploration as they grow (Hong & Park, 2012), as seen in the Strange Situation. According to Levitt (2013) relationships with high closeness are also continuations of early attachment relations, with similar functions and similar operations, as the socio-emotional capacities that may develop from a secure attachment between a mother and her infant continue to be developed and expressed in close relationships (Booth & Jernberg, 2009). Having a close relationship with parents in adolescence has been linked to better adjustment even in adolescence (Attar-Schwartz, 2015) showing that attachment styles and the resulting closeness between a mother and her infant will influence the outcome of many aspects of an individual's development long after infancy.

Closeness

A key variable in evaluating the quality and outcome of both social and personal relationships is interpersonal closeness (Villanueva, 2017). Interpersonal closeness is important in developing and sustaining relationships (Dibble et al., 2012). This relational closeness involves emotional bonds between a pair and idiosyncratic knowledge of each other (Dibble,

Levine & Park, 2012). According to Dibble and colleagues (2012) relational closeness is the strength of an individual's dependence within a dyad; affectively, behaviourally and cognitively. Cognitively, as one perceives an overlap between themselves and another person, closeness is developed (Villanueva, 2017). This encompasses the frequency, diversity and strength of the interaction's individuals have with each other (Dibble et al., 2012, Villanueva, 2017). In a review by Villanueva (2017), she found that interpersonal closeness was often interchanged with intimacy and defined in relation to many other factors of a relationship, including trust, global affect, ease, help and support. Before giving help and support an individual relies on a number of cues to make their decision, and while genetic relatedness plays a role, as does emotional closeness, which may be the input informing the individual of what resources and to what extent these resources should be designated to each of the individual's relationships (Hackman, et al., 2014). Emotional closeness is an internal variable consolidating the different cues of closeness and describes the presence and strength of social bonds (Hackman et al., 2014). Maxwell (1985) found that there are 10 behaviours that are used to describe closeness within any relationship: separation distress, naturalness, touching, following, imitation, help and gifts, similarity, disclosure and reciprocity and synchrony. These are observable behaviours, and the presence of the behaviours indicate closeness within the relationship. Over time this closeness leads to both members being more empathetic towards each other and a higher inclination towards altruism (Attar-Schwartz, 2015).

Synchrony

Human attachment is developed through an interaction between both biological attunement of social cognitive and empathy networks, and close behavioural synchrony (Feldman, 2012). Synchrony is the temporal concordance between behavioural patterns of more than one

individual (Feldman, 2012). This synchrony is the attunement between online physiological processes and the physiology of one member in a dyad and the behaviours of the other individual (Feldman, 2012). Tasks that involve high interpersonal motor synchrony led to affiliation between adults, increased cooperative behaviours, higher ratings of likability, and may be a key component of musical engagement in the development of social bonds (Cirelli et al., 2014). This synchrony is how individuals become members of and collaborate with social groups, the first of which occurs as infants learn reciprocity in the context of mother-infant nursing dyads (Feldman, 2012). Researchers Rabinowitch and Knafo-Noam (2015) conducted a study to examine the influence of synchronous interactions between children, finding that when they completed a similarity and closeness questionnaire, those that had participated in a synchronous interaction were rated more similar and closer than those that had not. This developed feelings of similarity and affiliation between the synchronous individuals, reiterating the same results as those found in adults (Rabinowitch & Knafo-Noam, 2015). Trainor, Cirelli and Trehub (2018) proposed that synchrony may help infants identify in-group members and recognize self-similarity. Infants are sensitive to interpersonal synchrony and prefer synchrony, which is created during singing (Trainor et al., 2018).

Infant-Directed Singing

Trainor, Cirelli and Trehub (2018) found that infants develop early sensitivity to temporal organization of musical sequences. Music enhances an infant's mood (Trainor et al., 2018) and perceptions of infants were found to be influenced by passive movements to music, movements not used in talking interactions between infants and their caregivers (Trainor et al., 2018). Caregivers sing regularly to infants and it benefits and increases reciprocal parent-infant bonding and sooths the infant, reducing distress.

Pearce, Launay and Dunbar (2015) cite a potential explanation for the enhanced affect created by singing as the association between singing and the release of neuropeptides including oxytocin and β-endorphin which reduce the effects of stress and pain and boost feelings of well-being.

The emotional content of maternal speech and song is modulated by the infant's behaviour, often imitating the baby (Filippa et al., 2018), though infant directed song (ID song) tends to be more emotionally expressive than infant directed speech (ID speech) (Trainor, et al., 2018). ID speech is marked by short, slow utterances with longer pauses and high variability in pitch and ID song follows this pattern, characterized by high pitch and slow tempo, but ID song is constrained by the pitch and rhythm of the specific song (McMurray et al., 2013).

In ID song episodes with mother-infant dyads singing results in more sustained attention and arousal modulation than speech does, leading to intense engagement, calming, relaxing, decreasing anxiety and a decrease in cortisol compared to the play/talk activity (L'Etoile, 2006, Trainor et al., 2018, Fancourt & Perkins, 2018). This is associated with affect regulation, secure attachment and helps with the child's development (L'Etoile, 2006). In their 2018 study, Fancourt and Perkin's results indicated that a single session of singing lead to significant increases in perceived mother-infant closeness compared to the playing and talking activity condition. The researchers highlighted the icebreaker effect as a possible explanation for these results. The effect demonstrates that singing is a fast promoter of social cohesion, in this case between a mother and her infant (Fancourt & Perkins, 2018), by enhancing the willingness to coordinate with other individuals (Pearce et al., 2015).

To further explore these conclusions in the environment of mother-infant dyads this study seeks to address questions left by previous studies. Past research on the effects of singing on

closeness has involved multiple infant mother dyads participating in the study in the same room and therefore were unable to be conclusive about the influence other mothers had on perceptions of closeness due to the unnatural context. This study seeks to fill that gap and clarify whether or not singing creates more closeness between infants and their mothers than speaking to their infant, which could be a potential explanation for the regulatory effect maternal singing has on infants. The use of questionnaires in previous studies has led to a neglection of the infant's perception of closeness, which this study aimed to include in the measurement of closeness within the mother-infant dyad. Therefore, this study reviews several observable behaviours indicating closeness and their presence in the episodes was coded to create closeness scores for each member of the dyad.

Two episodes were explored, an ID speech episode and an ID song episode, measuring closeness between the mother-infant dyad in each episode to determine the differences between speech and song contexts. It was hypothesized that the mother-infant closeness scores in the speech episode would be incongruent with the scores in the song episode.

Methods

Participants

Using previously collected video recordings of mother-infant dyads, data was collected from 18 dyads. Three of those dyads were excluded. Two were due to incomplete video footage of one of the episodes, and the other as a result of the presence of an individual outside of the dyad during the recordings. As a result, only 15 pairs were included in the analysis. Eleven of the infants were female while four were male. The infants ranged in age from 6.9 to 9.1 months old, with a mean age of 7.8 months.

Materials and Procedure

The mother-infant dyads were recorded in the lab. Mothers were asked to engage their infant in a play interaction using speech or song. Recordings were made of the interactions such that there was an infant-directed speech episode and a disruption episode – during which a researcher disrupted the interaction and engaged the mother in conversation – and an infant-directed song episode. The order of the ID speech and the ID song episodes were alternated in different participant dyads, with the disruption episode always occurring in between.

The length of the recordings varied by dyad, so to be consistent, three minutes of each the speech and song episodes per dyad were coded. The first episode was coded from the three minutes before the disruption while the second episode was coded from either the three minutes following the disruption or when the mother began singing after the disruption episode in the ID song condition.

To measure closeness between mothers and their infants, a coding scheme was developed using the criteria for closeness in relationships as described by Maxwell (1985). This scale included measurements of separation distress, naturalness, touching, following, imitation, reciprocity and synchrony, help and gifts, similarity and disclosure, as described below. Each behaviour (or set of behaviours) was operationalized so that the behaviours could be coded and scored to measure closeness within the mother-infant dyads.

Separation Distress

Separation distress was expanded upon and measured using the scale developed by Schecter and McCaw (2010) which ranges from 0 (*no observable distress when separated*) to 4 (*crying and physical agitation when separated*).

Naturalness

Naturalness was measured by the frequency of the disclosure of intense feelings such as crying or smiling.

Touch

Touching was measured by the duration of a touch from each individual (either the mother or the infant) from the first contact until contact was broken.

Following

Following was measured by the frequency of following behaviours such as following with gaze or with movements.

Imitation

Imitation was measured by the frequency of imitation behaviours, for example if the baby smiles the mother does as well, and vice versa.

Reciprocity and Synchrony

Reciprocity and synchrony was measured using the Caregiver-Infant Reciprocity Scale developed by Apicella et al. (2013) which looked at behaviours during the dyad's interactions such as state involvement, responsive and activating behaviours. For example, name prompts, vocalizations and stimulating gestures. With the exception of state involvement, these behaviours were measured by frequency of the occurrence.

Help and Gifts

Help and gifts was measured by the frequency of prosocial behaviours. For example, engaging in comforting behaviours or offering the other a toy they had been playing with.

Similarity

Similarity was omitted from the measurements as typically in literature similarity is measured by comparing self-reports on attitudes and perspectives, which is impossible to do with

an infant. Therefore, in this study the measure of similarity will be omitted as Trainor, Cirelli and Trehub (2018) proposed the role of recognizing similarity as part of developing synchrony. As a result, similarity will still be measured, just as part of a different measure. Additionally, Rabinowitch and Knafo-Noam (2015) reported that children who had participated in synchronous interaction, regarded those individuals as similar and closer to themselves than any they had not had a synchronous interaction with. In this way similarity was assimilated into the measures of synchrony.

Disclosure

Disclosure through discussion, in the way Maxwell (1985) included it as an aspect of her closeness criteria, is not possible to measure in preverbal infants. Therefore, disclosure was also omitted from the coding scheme.

Reliability

Two raters, one being the main researcher, coded 6 random videos separately to establish reliability, with an interobserver reliability of 83.45 across the 6 dyads. The remaining 9 were then coded by the researcher. Participants were not coded in order, to prevent order bias whilst becoming comfortable with the coding scheme.

The mother and the infant in the dyad were recorded individually and therefore were rated individually. Using the closeness criteria outlined above, each dyad member was observed, and the presence of the behaviours were recorded. Individual Closeness scores were calculated through scoring frequency of the behaviours as a point. Separation distress was reverse scored so that no presence of distress was rated 5 points and a high presence of distress was 0 points. The events coded by duration were changed into points 0-1 seconds resulting in a score of 1 point, 2-3 seconds resulting in a score of 2, 3-4 seconds as a score of 3 and 5-6 seconds being a score of

4, and 7+ being 5 points. After scoring the individuals, the mother-infant Closeness (Dyad Closeness) scores per episode (speech versus song) were created by summing the scores of the mother and her infant.

Results

Dyad Closeness

To address the main hypothesis of the study, a dependent *t*-test was conducted which found that the mother-infant dyads Dyad Closeness scores were significantly higher during the Song Episode (M = 88.93, SD = 17.21) than during the Speech Episode (M = 72.4, SD = 20.15), $t(14) = 2.16$, $p < .05$, $d = 0.56$.

Expanding on these findings the Dyad Closeness scores were analyzed taking into consideration the Episode Closeness scores and the Individual Closeness scores of each member of the dyad. A 2 X 2 between-subjects ANOVA was conducted with mother-infant Dyad Closeness scores as the dependent variable and Episode (Speech vs Song) and Dyad Member (Infant vs Mother) as the independent variables. The results indicated that there was a significant main effect for Episode, $F(1, 56) = 4.37$, $p < .05$, $\eta^2 = 0.72$ with those in the Song episode (M = 44.47, SD = 14.57) showing higher Dyad Closeness scores than the Speech episode (M = 38.80, SD = 14.76). There was also a significant main effect of Dyad Member, $F(1, 56) = 56.58$, $p < .05$, $\eta^2 = 0.50$, with Mothers (M = 51.83, SD = 11.07) demonstrating higher Individual Closeness than their Infants (M = 31.43, SD = 10.43). No interaction was found between the Episode and the Member of the Dyad. These results are shown in *Figure 1*.

To analyze the influence of some of the control variables present in the study, a repeated measures ANOVA was conducted. Dyad Closeness was the dependent variable with Episode (Speech versus Song) as a repeated measure, and Dyad Member (Mother vs Infant), Gender

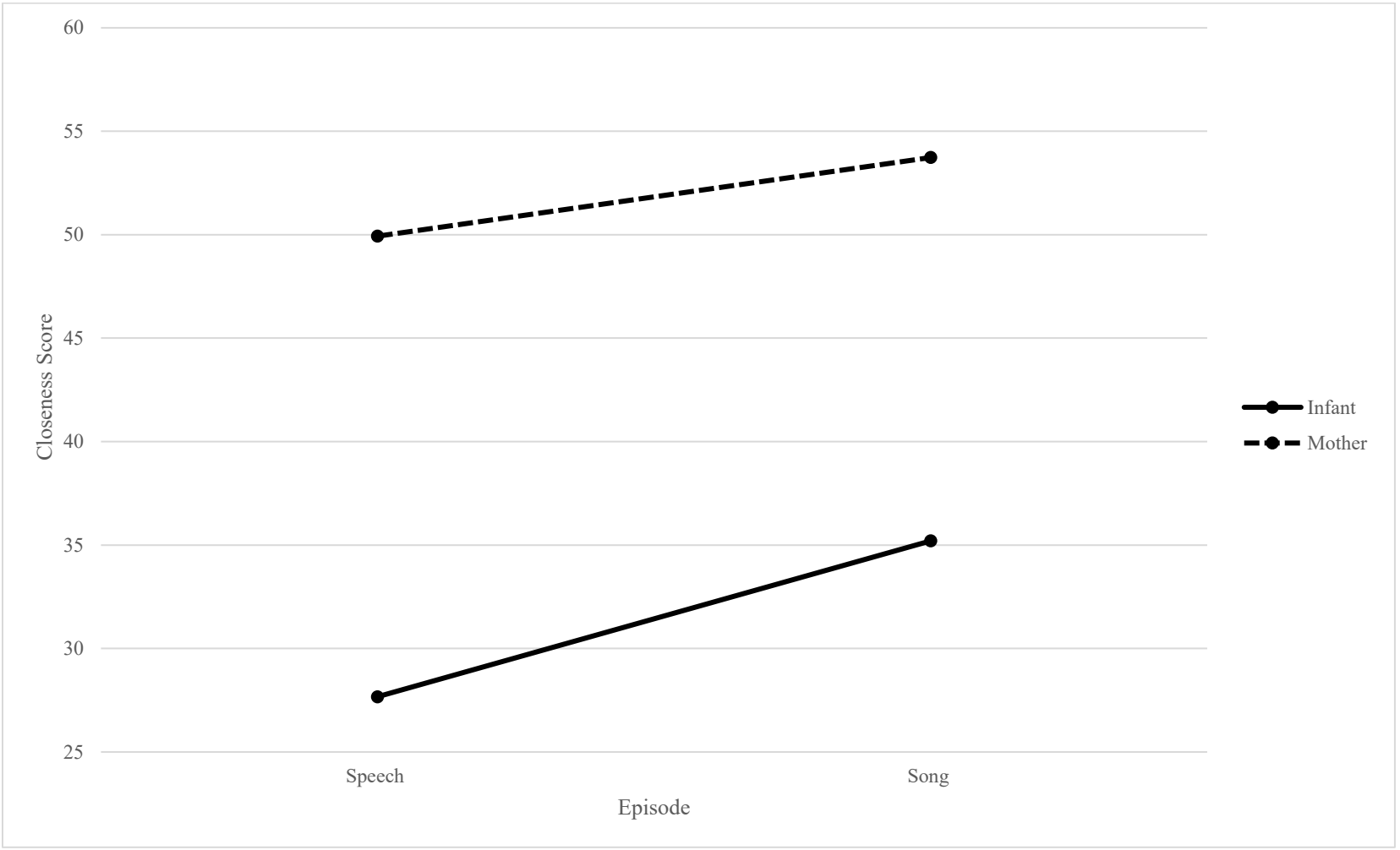

Figure 1: The Closeness Scores including the presence of the behavioural indicators of closeness for each episode (total between the dyad) were analyzed against the Dyad Member finding only main effects of the two independent variables, but no interaction.

(Male vs Female) and Episode Order (Speech First vs Song First) as between subjects measures. The analysis showed a significant main effect of Dyad Member $F(1, 56)= 25.21$, $p < .05$, $\eta^2 = .69$, consistent with previous results. No main effect of Episode was found and there were no significant interactions, showing that when control variables were taken into consideration, they may moderate the effect of Episode on Closeness but not Dyad Member.

Duration of Touch as a Mechanism Within Closeness

As previously outlined, touch has an influential role on bonding and in turn closeness within a relationship and to better understand the mechanisms facilitating the apparent closeness between a mother and her infant, the duration of a touch in seconds was analyzed alongside the Closeness scores to better understand the association and impact of touch on closeness.

A correlation was conducted to determine the relationships between the Touch Duration by mother during the Song episode, mother's Touch Duration during the Speech episode, infant's Touch Duration during the song episode, infant's Touch Duration during the speech episode, and the Individual Closeness scores of infants during Speech and during Song, and the Individual Closeness scores of mothers during the speech and song episodes.

Infant Closeness scores during Speech were found to be significantly correlated with their mother's Closeness score during the Song episode, $r(13) = -.55$, $p < 0.05$ and with their Touch Duration during the Speech condition $r(13) = .57$, $p < 0.05$. Infants' Closeness scores during the Song episode were found to have a significant relationship with their Touch Duration scores during the Song episode, $r(13) = .72$, $p < 0.05$ and with the Touch Duration of their mothers during the Song episode, $r(13) = .67$, $p < 0.05$. Mothers' Closeness during Speech scores however were not found to be significantly correlated with any of the variables it was being compared with. The mothers' Closeness scores during the Song episode were found to be

significantly correlated with the Touch Duration they exhibited during the Song condition $r(13) = .52$, $p < 0.05$.

The Duration of the mother's Touch during the Song episode was significantly correlated with the Touch Duration their infant exhibited during the Song condition, $r(13) = .57$, $p < 0.05$ and a significant correlation was also found with their infant's Touch Duration during the Speech condition, $r(13) = .83$, $p < 0.05$. The infant's Touch Duration during the Song episode was significantly correlated with their mother's Touch Duration during the Speech episode, $r(13) = .57$, $p < 0.05$. It was also found to have a significant relationship with the Touch Duration the infant exhibited during the speech episode, $r(13) = .67$, $p < 0.05$. The Duration of the infant's Touch during the Speech episode was significantly correlated with their mother's Touch Duration during the speech episode, $r(13) = .83$, $p < 0.05$. See *Table 1* for a complete list of r and p values for the correlations.

To further examine Touch Duration and the variables influencing the exhibition of the behaviour, a repeated measures ANOVA was conducted. Duration of Touch in seconds was used as the dependent variable and Episode (Speech vs song) as a repeated measure and Dyad Member (Infant vs Mother), Gender (Male vs Female) and Episode Order (Speech First vs Song First) as between subjects measures. A main effect of Dyad Member was found, $F(1)= 10.68$, $p < .05$, $\eta^2 = .49$. Additionally, a main effect of Episode was found, $F(1) = 5.55$, $p < .05$, $\eta^2 = .34$. No significant main effects were found of Gender or Episode. The interaction between Dyad Member and Episode was almost significant with a $p = 0.59$.

Follow up paired samples t-tests indicated that in infants, the song episode ($M = 19.80$, $SD = 21.93$) resulted in significantly higher Duration of Touch than the speech episode ($M = 8.27$, $SD = 13.20$), $t(14) = -2.74$, $p < .05$, $d = -.71$. Following a similar pattern, in mothers, the

Variable	*n*	*M*	*SD*	1	2	3	4	5	6	7	8
1. Infant Speech Closeness Score	15	27.67	9.37	--							
2. Mother Speech Closeness Score	15	49.93	9.88	.10	--						
3. Touch Duration of Infant During Speech	15	8.23	13.20	.57*	.18	--					
4. Touch Duration of Mother During Speech	15	15.60	12.66	.35	.25	.83**	--				
5. Infant Song Closeness Score	15	35.20	10.36	.15	-.05	.34	.33	--			
6. Mother Song Closeness Score	15	53.73	12.19	-.55*	.29	-.08	.12	.16	--		
7.Touch Duration of Infant During Song	15	19.80	21.93	.05	-.07	.67**	.57*	.72**	.32	--	
8. Touch Duration of Mother During Song	15	57.67	56.25	-.19	-.22	.36	.36	.67**	.52*	.79**	--

* p < .05 **p < .01

Table 1: Descriptive Statistics and Correlations for variables measured in the study.

song episode (M = 57.67, SD = 56.25) had significantly higher Durations of Touch than the speech episode (M = 15.60, SD = 12.66), $t(14) = -3.07$, $p < .05$, $d = -.79$. This can be seen in *Figure 2*.

Discussion

This study was exploratory, with the intention to expand on the results of Fancourt and Perkins' 2018 study by adding a more natural context into the equation of measuring closeness between a mother and her infant and measuring closeness in both the infant and the mother. The findings of this study were consistent with the previous study, which found significantly higher scores of closeness between the dyads during the song episode than the speech episode, with a medium to large effect size, aligning with the hypothesis.

When the dyads were broken down, it was revealed that mothers had significantly higher demonstrations of closeness than their infant, in both episodes. However, when the other variables present in the study, such as the order of the episodes and the gender of the infant were considered, this significant differentiation between the mothers and their infants was not present, with the mother's scores being higher, on average, than her infant. This highlights the limitations of previous research examining closeness only through the self-report of mothers, and how important this study's results and future studies implications to understanding closeness in infants and their caregivers. There was no significant effect of closeness score per episode when the closeness scores within the dyad were broken down to compare a mother versus her infant.

The 2X2X2 ANOVA compared to the 2X2 ANOVA demonstrated that when some of the control variables, such as gender and episode order, were ruled out, some of the variance in the results were dropped. As the analysis revealed no differences between the order of the episodes, whether speech or song came first, any three minutes of the episodes other than the ones

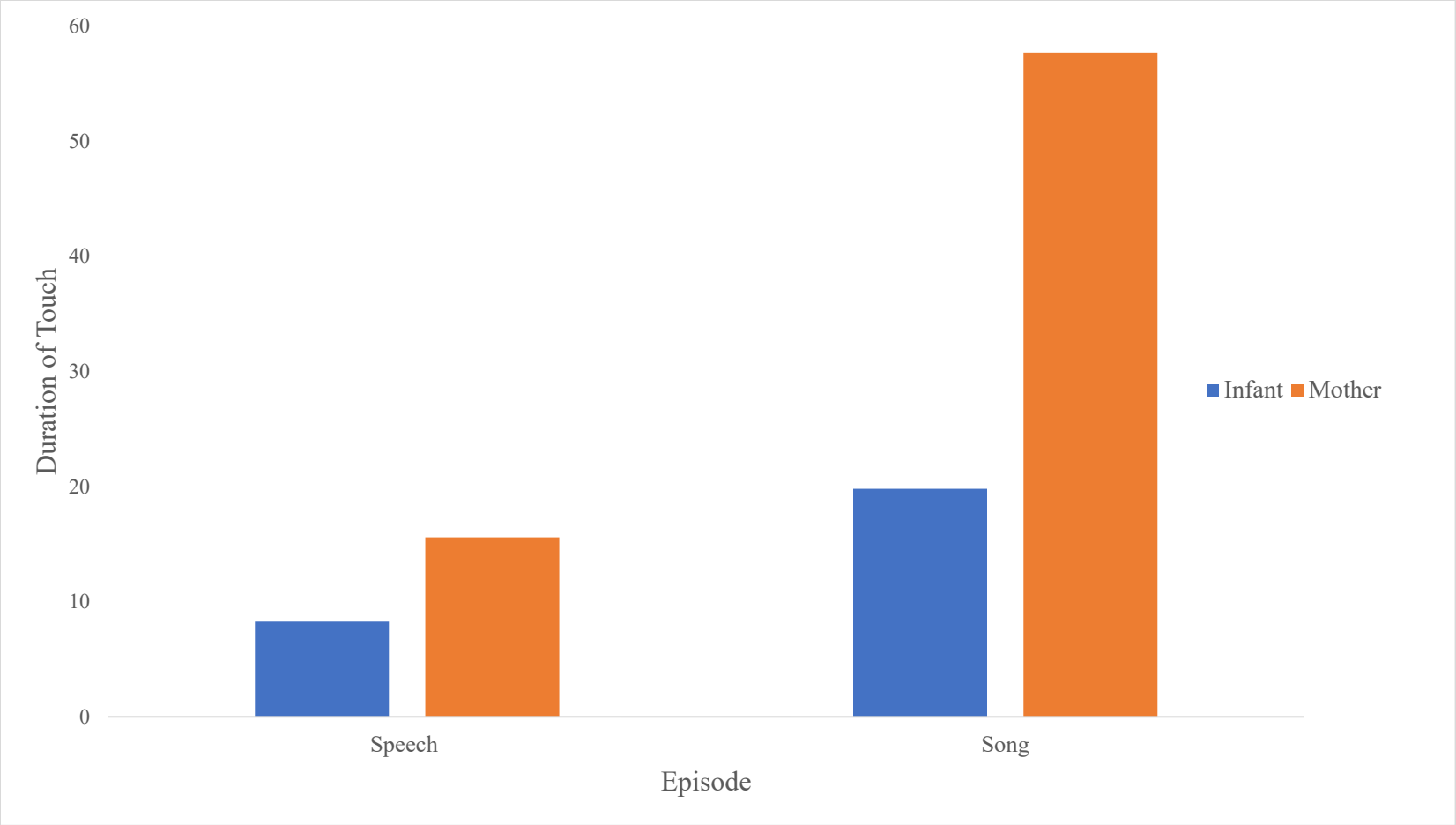

Figure 2: The differences in Duration of Touch in seconds between Speech and Song Episodes by Dyad Members, with the infant Durations indicated in blue and the Duration of Touch by the mother in orange.

observed during the current study could have been chosen to be analyzed and would yield similar results. A future analysis of the same participants during different sections of the episodes would shed light on this conclusion to ensure consistencies.

The variability in the presence of significant correlations between infant's closeness scores and the closeness scores of their mothers in each episode, consistent with the significantly higher scores of the mother, raised questions on why the mother engages in more closeness behaviours than her infant. This was evident as sometimes the mothers would talk and address the infant but not pause to wait for a response. Additionally, when the infant was less responsive to their mother, the mother seemed to put more effort into gaining their attention. Specifically in the song episode, such as catering the songs to the infant which was seen by several mothers singing 'If you are happy and you know it'. This is a song where it is easier to encourage the infant to imitate one's actions and catering the lyrics to whatever action the baby was engaging in themselves. For example, shaking their arms along with the infant. One mother (the mother of Dyad 15) expressed this verbally saying "[Infant Name], you aren't interested in any of my songs". Several other tactics were used to engage their infant including getting close to the face of her infant, and engaging in physical touch with the baby, turning them, bouncing them, and other similar behaviours (as seen by the mother of Dyad 17). When none of the tactics succeeded, mothers integrated toys into their singing, further catering their songs to the items they had begun to engage with. One example of this was the mother of Dyad 8 changing the lyrics of 'Part of Your World' from the *Little Mermaid* movie to include the stuffed horse and then the teddy bear that she had picked up. The mother of Dyad 10 also engaged in these behaviours, changing the lyrics of 'Down by the Bay' to pair with the toy she was holding, such as "Did you ever see a Care Bear in their underwear" whilst playing with the Care Bear. This

object referencing may be one of the methods a mother uses to engage her child when they feel the interaction is lacking, potentially bring into question whether the mother requires more from her infant than the infant does of her. Flacking and colleagues (2012) studied the well-being of mothers while their infants were in the Neonatal Intensive Care Unit (NICU). Physical closeness is disrupted when a preterm infant must be separated from their parent in the NICU and this early separation can lead to maternal anxiety, stress and depression (Flacking et al., 2012). Having the ability to develop emotional closeness in these situations can prevent these risks in mothers and help the parents feel more confident (Flacking et al., 2012), showing a mother's high investment in the parent-child relationship begins at the beginning. The observations in this study may allude to this investment continuing to be strong even after the postpartum period has ended. Future studies would do well to investigate these attention seeking behaviours in mothers and identify exactly how much each member of the dyad benefits from the mother-infant relationship.

The correlations revealed expected consistencies between the closeness scores of each dyad member and their own observed duration of touch during each episode. Positive correlations were also present between the mother's duration of touch and her infant's. This emphasizes that the mother and her infant are in a reciprocal relationship. Surprisingly, this trend was also present across the episodes, with the mother's touch duration positively relating to the duration of her infant's touch across episodes and vice versa with the infant's touch duration. This may indicate the importance of touch in maintaining closeness in a relationship.

The analysis of touch duration apart from the other behavioural indicators of closeness emulated the results found when all the variables were considered. Accordingly, effects of the episode and dyad member were both present, with the mothers participating in longer touching

behaviours than their infants. Gallace and Spence (2010) demonstrated that interpersonal touch is effective in creating bonds, reinforcing the supposition that the mother is the driver of the interaction, potentially even the primary facilitator of closeness, in the mother-infant dyad. Gallace and Spence's (2010) research highlights more generalizability to the current study's results, aligning with the findings of Anderson et al. (2006) who identify high frequencies of touch in close relationships with greater feelings of intimacy during the development of the relationship, using touch as a way of communicating affection and intimacy and creating dyadic specific affiliations (Feldman, 2012).

Furthermore, the conclusion that during song the dyad is more physically interactive could be an indicator that synchrony is being generated more strongly during song than during speech leading to the higher closeness scores. This leads to the conclusion that Maxwell's (1985) behaviour criteria for close relationships is in fact a good indicator of closeness in dyads. Understanding the role of each of the behavioural criteria outlined by Maxwell (1985) in the facilitation of closeness would be a beneficial next step. Comprehending the factors that build affiliative bonds and closeness in a mother and her infant could help better support these interactions to reach the best developmental outcomes.

This study is not without its limitations. One specific restraint was the inability to properly measure separation distress in all of the mothers and infants, as they were never actively separated. During the disruption episodes the researcher present engaged with the baby as well as the mother, meaning the environment to properly measure separation distress was not present. During the recordings, the mothers and infants did not always stay within the full view of the camera, potentially leading the researchers to miss something. Furthermore, the video segments of the infant-mother dyads were inconsistent between participant pairs, both in the time that each

episode lasted and the inconsistencies between what participants chose to do during each episode. For example, some mothers sang to her child for longer periods of time, whereas other mothers spent most of the time talking to her infant. Trainor, Cirelli and Trehub (2018) discovered that the passive movements in music and not talking was what influenced the infant's perceptions. With the similarities in terms of singing and speech times as well as episodes between participants, the lack of these movements in certain dyads could be a potential explanation for the variance in the results.

Additionally, the songs that the mothers sang to their infants ranged from musical numbers, to "Down by the bay" to "If you are happy and you know it", meaning that different kinds of songs were present, not always being infant directed, and ranging from lullabies to play songs. Mothers who sang songs with more of a melody seemed to gain more attention from her infant than those that chose songs with a higher presence of talking, for example 'Patty Cake' versus 'Down by the Bay'. There is potential that the mothers had different perspectives on what the expectations of each episode were, demonstrated by the mother of Dyad 18 having moved the toys away from her infant before the song episode began so there were less distractions, while other mothers took breaks from singing to play with toys with their infant.

Many dynamic variables are present in an infant's life that influence their behaviours, from bathroom schedules, to illness, to what is encouraged by their parents. Several infants were standing and using their mother for support for most of the coded part of the episode, potentially influencing the touch scores and in turn the closeness scores. Overall, future studies should include more specific instructions in order to clarify better the influences on closeness behaviours and allowing researchers to further break down the differences in affects between speech and song within mother-infant dyads. As song has been cited to be influential in

regulating the emotions of infants (L'Etoile, 2006, Trainor, Cirelli & Trehub, 2018, Fancourt & Perkins, 2018), an interesting direction to further these findings would use a more distressing context in which to conduct a similar analysis of closeness. The study could examine if more behaviours become apparent when an infant relies on their mother more strongly to assist them in calming down. Moreover, with the relationship between closeness and attachment (Levitt, 2013, Booth & Jernberg, 2009) a study including a measure of attachment in an ID speech versus ID song study, may be able to uncover an increased explanation the differences in mother-infant dyads during speech versus song contexts. Altogether, the current research has shed light on behaviours present in the close relationships of mother-infant dyads in varying contexts and has opened the floor for future research to provide more clarification on the influences on closeness in parent child relationships.

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