Social connection on the dance floor: Movement coordination in small group silent disco leads to greater self-other overlap

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Abstract

Social motor coordination (SMC), defined as the intentional or unintentional coordination of movement between individuals in a social setting, has been linked to greater feelings of rapport and social connectedness. Here, we investigated this relationship using a silent disco paradigm where groups of 3 or 4 individuals danced to either the same music or different music. Visual information was manipulated by initially separating the participants with curtains (2 minutes), after which the curtains were opened (10 minutes). Head movements were recorded with a wireless motion tracking system attached to the silent disco headphones. Rapport and social connectedness measures were obtained using questionnaires completed after participation in the silent disco. Results showed that groups who listened to the same music exhibited a greater degree of SMC than groups that listened to different music. Greater degrees of SMC were also observed when group members were able to see one another. Finally, greater SMC was associated with increased self-other overlap and perceptions of interaction quality.

Keywords: interpersonal coordination, social motor coordination, social bonding, dance

Introduction

Grounded in the science of coordination dynamics, social motor coordination (SMC) reflects a process of mutual entrainment whereby the movements of one person spontaneously influence, and are influenced by, the movements of those around them (Schmidt et al., 2011; Schmidt & Richardson, 2008). By attending to those around us, shared patterns of behaviour can emerge without conscious intention (Richardson et al., 2005, Schmidt & O'Brien, 1997), and give rise to shared interpersonal experiences, a key ingredient for building effective social bonds (Miles et al., 2009). It is well established that for SMC to emerge, information about others' actions and intentions are as important as environmental information because human movements are constrained by both environmental limitations and others' actions (Marsh et al., 2009). In particular, visual information has been demonstrated to be an important aspect of coordinating with others. Being able to see others is sufficient for the emergence of not only intentional SMC but also unintentional or spontaneous SMC (Demos et al., 2012; Oullier et al., 2008; Richardson et al., 2005, Schmidt & O'Brien, 1997).

Extant literature shows that movement coordination in social contexts (i.e., social motor coordination) may lead to outcomes that promote or enhance social connectedness. Previous studies on SMC have demonstrated that moving in time with other people has positive outcomes that may be helpful for the formation and maintenance of social connections beyond its potential benefits for health and wellbeing. SMC has been shown to increase prosocial behaviour across all ages (Cirelli, 2018; Kokal et al., 2011; Mogan et al., 2017; Vicaria & Dickens, 2016). It has also been linked with both cooperative behaviour (Keller et al., 2014; Reddish et al., 2013; Wiltermuth & Heath, 2009) and enhanced perceptions of others' cooperativeness (Lang et al., 2017). There is also substantial evidence that SMC is positively associated with rapport or produces outcomes that are helpful for developing and maintaining rapport. Indeed, coordinating one's movements with others in time can increase feelings of closeness, similarity and liking towards them (Bernieri, 1988; Fujiwara et al., 2020; Hoehl et al., 2021; Nozawa et al., 2019; Rabinowitch & Knafo-Noam, 2015; Tarr et al., 2016; Vicaria & Dickens, 2016). This effect has been observed in both pairs of strangers and pairs of affiliated individuals (Sharon-David et al., 2019). Other benefits of SMC that have been empirically observed include greater positive affect (Galbusera et al., 2019; Tschacher et al., 2014), higher self-esteem (Lumsden et al., 2014), and enhanced memory for others (Macrae et al., 2008; Miles et al., 2010; Woolhouse et al., 2016). These findings suggest that SMC leads to outcomes that are beneficial for successful social interactions.

The majority of SMC studies so far had been conducted on dyads performing a variety of tasks such as finger-tapping (e.g., Hove & Risen, 2009; Oullier et al., 2008), rocking chairs (e.g., Demos et al., 2012; Richardson et al., 2007), swinging pendulums (e.g., Richardson et al., 2005; Schmidt & Turvey, 1994), and engaging in conversation (e.g., Fujiwara et al., 2020; Galbusera et al., 2019). Recently, SMC research has investigated group coordination (Chauvigné et al., 2019; Zhang et al., 2018) in more complex and naturalistic activities (Ellamil et al., 2016; Wiltermuth & Heath, 2009). The current study aimed to expand extant literature by investigating multiagent coordination in a more naturalistic task setting. We utilised a 'silent disco' methodology which allows small groups to perform an activity involving complex non-repetitive movements. We hypothesised that: (1) groups who listen and dance to the same audio tracks will exhibit greater magnitudes of SMC

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than groups who listen and dance to different audio tracks; (2) participants will exhibit greater magnitudes of SMC when they have visual information of each other compared to when visual information is unavailable; and (3) greater magnitudes of SMC will be associated with higher feelings of social connectedness, rapport and self-other overlap.

Method

Participants

Participants were undergraduate students undertaking an introductory psychology course. Four groups consisting only of two members were excluded from analyses. Each of the remaining 31 groups comprised of three or four members. The final sample (n = 116) consisted of 85 female students, 30 male students, and one student with undisclosed gender between 17 and 49 years old (M = 19.73, SD = 5.10). Forty-one identified as White/Caucasian, 39 as Asian, 14 as Mixed, 11 as Other, 8 as Middle Eastern, one as Aboriginal/Torres Strait Islander, and one as African.

Design

The study used a 2 x 2 mixed design. Groups of four participants were randomly assigned to one of two Audio Mix conditions, Same or Different. In the Same condition (15 groups, n = 56), group members all listened to the same audio mix (same track at the same time) while in the Different condition (16 groups, n = 60) each group member listened to a different audio mix (different track at any point in time). All groups took part in both Visual Information conditions (No-Visio and Vision). The No-Vision condition consisted of participation in a 2-minute silent disco while curtains were drawn so that group members could not see each other. The Vision condition was a 10-minute silent disco where group members were able to see one another.

Materials

Apparatus and Laboratory Setup

The experiment used four-channel, wireless Silent Disco headphones (Silent Disco, NZ). The headphones had LED panels on the exterior surface of each earpiece displaying the current channel the headphones were tuned into. The LED panels displayed four different colours corresponding to the audio mix (see description below): (a) Red channel; (b) Green channel; (c) Blue channel; (d) Orange channel.

There was a total of four mixes with each mix consisting of four 2.5-minute electronic dance music (EDM) tracks with differing tempo: Track 1 had a tempo of 124 beats per minute (BPM), track 2 was 127 BPM, track 3 was 130 BPM and track 4 was 133 BPM. To control for order effects, four mixes were made where the order of the tracks were counterbalanced (i.e., (a) 124, 127, 130, 133; (b) 133, 130, 127, 124; (c) 130, 133, 124, 127; (d) 127, 124, 133, 130). Participants in the Different condition all listened to a different mix (e.g., participant A listened to mix a, participant B listened to mix b, and so on). Each group of participants in the Same condition was assigned the same mix to listen to. The chosen audio tracks were all House/Techno club music.

Head movements were recorded using a Polhemus LIBERTY™ LATUS™ motion tracking system (Large Area Tracking Untethered System; Polhemus Ltd, Vermont, USA), a wireless motion tracking system that can cover a large enough area for small group Silent Disco and can track up to 12 independent markers. One marker was attached to the top of each participant's headphone.

Nine LATUS receptors were positioned in a 3 x 3 x 3 grid that defined four 1.6 m^2 dance areas within a 3.2 x 3.2 tracking area. The receptors were installed on top of nine 1-m high wooden stands along the sides and middle of the tracking area (see Figure 1). This layout ensured a tracking accuracy of less than 5 mm as participants' markers were always within a 1-m radius of a receptor. Motion tracking data were recorded at a sample rate of 46 Hz and synchronised with the start and end of the silent disco music.

Figure 1: Silent disco laboratory setup

Questionnaires

A Qualtrics survey was used to record demographic information and measure connectedness, rapport, and self-other overlap.

Loneliness was measured using a short-form of UCLA Loneliness Scale (LS) derived from the 20-item UCLA-LS (Russell, 1996). The 10-item short-form version showed high internal consistency (α = .91) and convergent validity (α = .92). Feelings of connectedness were measured using two questions (1) "How connected to others do you feel in general?" and (2) "How connected to others do you feel at this moment?". Both questions were scored between 1 (Not at all) and 10 (Very connected). Feelings of isolation were also measured using two questions (1) "How isolated from others do you feel in general?" and (2) How isolated from others do you feel at this moment?". These measures were completed before and after the silent disco. To measure rapport, participants answered six questions regarding each of the other participants in their group (e.g., participant A answered questions about participant B, C and D) on a 10-point scale from 1 (Not at all) to 10 (Very much/very willing/excellent). These questions have been used in previous studies (Tarr et al., 2016; Wiltermuth & Heath, 2009). The questions assessed liking ("How much do you like participant A?"), similarity ("How similar to you is participant A?"), closeness ("How close do you feel to participant A?"), willingness to get to know others ("How willing would you be to get to know participant A?"), willingness to work with others ("How willing would you be to work with participant A on a group task?") and perceived quality of interaction ("How would you rate the quality of interaction with participant A?").

Self-other overlap was measured using the Inclusion of Other in the Self (IOS) scale (Aron et al., 1992). The IOS scale measures feelings of closeness and interconnectedness with others. It is a single item scale consisting of seven pictures of overlapping circles with the left circle representing the self and right circle representing others. Participants were first asked to select the diagram that best describes their relationship with (1) the group and (2) with each of the other participants in the group. The scale has good reliability (α = .95; test-retest .83) and validity (Aron et al., 1992).

Procedure

Participants were randomly assigned to one of four 1.6 m^2 dance areas of which each had been labelled with the letter A, B, C or D with glow-in-the-dark tape (see figure 1). They were told that they were about to take part in a small silent disco and that the study was interested in how groups of people listen to music and move together. Participants were also told that the experimenter would be behind a curtained area during the silent disco and would be unable to see them. The experimenter then distributed the silent disco headphones and demonstrated how to adjust the headbands and audio volume. Participants were given time to adjust the headphone's headband. A 30-second audio track was then played so that they could adjust the volume.

No-Vision Trial

All lights were then turned off so only the LED lights lining the dance areas were on (see Figure 1). Participants were asked to put their headphones on and the experimenter played the first two minutes of the 10-minute mix (i.e., Same: the first two minutes of Mix A; Different: the first two minutes of the mix they were randomly assigned to). After the No-Vision trial was completed, the experimenter turned the lights on and opened the curtains.

Vision Trial

For the Vision trial, participants were told that they would now listen to the 10-minute mix with the curtains open. The lights were turned off again and the music was played when participants had put on their headphones. After the 10-minute mix has finished, participants were then asked to complete the last part of the questionnaire.

Movement Data Reduction and Processing

The positional movements of participants' heads (via the motion sensor on the headphone) were extracted for movement and coordination analysis. Prior to analysis, these vector time-series were filtered using a 10 Hz, 4th order Butterworth low-pass filter to eliminate measurement noise. The first and last 10 seconds of each trial were removed to eliminate the potential confounding effects of the movement transitions (start-stopping) associated with the onset and end of a trial (i.e., data from the middle 100 s of the 2-minute trials were extracted for analysis).

The amount of participant movement (path length), the frequency of participant movement (peak frequency) and the coordination or behavioural synchrony (coherence) between participants in a group (see below for more details about each of these measures) was assessed. Due to the length of the vision trials, an epoch analysis was employed in which each measure was assessed across 3 x 40 second windows for the no-vision trial and 15 x 40 second windows for the vision trial.

Note also that a preliminary analysis revealed that most of the movement and behavioral coordination occurred in the z or up-down movement direction. A similar pattern was observed across the x (forward back) and y (left right direction). Thus for the sake of brevity only the results for the analysis of head movements in the z-direction (up-down) for peak movement frequency and coherence are reported here. Note that the z-direction best captured the individual's full body and head bob movements, which due to the small 1.6m dance areas was the predominant dance movement observed.

Path Length

Path length corresponds to the distance in meters of the (x, y) movement path that participants tracked during a trial period and captures the magnitude or amount of movement an individual exhibited.

Peak Frequency

A spectral analysis was conducted to ascertain the main frequency of vertical (z) head movements within a trial. This involved calculating the power of the frequency components in the movement time series between 1 and 4Hz, with the peak frequency corresponding the frequency in Hz with the most power. Given the average tempo of the music presented in the mixes, a peak frequency around between 1.8 to 2.2 Hz was expected.

Cross Spectral Coherence

Often simply referred to as coherence (Porges et al., 1980) this measure estimates the covariance between the frequency spectrum of two movement time-series on range from 0 and 1, where 0 reflects no spectral covariance (i.e., no-synchony) and 1 reflects perfect spectral covariance (i.e., perfect synchrony). Coherence is a standard measure of movement synchrony within the social coordination literature and is typically calculated as a function of the peak-frequency of the movements (Richardson et al., 2005, 2007; Schmidt & O'Brien, 1997). This approach was adopted here, whereby the pairwise coherence for each dyadic relationship in a group (i.e., 1↔2, 1↔3, 1↔4, 2↔3, … 3↔4) was computed as the average peak frequency coherence across the two corresponding time-series. The overall average coherence across all possible pairwise combinations was also computed as a group measure of behavioural coordination. Following standard practice (Richardson et al., 2005; Schmidt & O'Brien, 1997) coherence values were Fisher-Z transformed prior to statistical analysis. Research using this approach has found that a coherence score of .2 to .5 is representative of spontaneous (unintentional) coordination (Schmidt & O'Brien, 1997, Richardson et al., 2005; 2007).

Results

Movement and Movement Coordination

For each dependent variable, a preliminary analysis revealed that there was no significant effect of epoch. That is, during both the 2-minute No-Vision and 10-minute Vision trials, movement path, peak frequency and coherence remained relatively stable (see Figure 2). Accordingly, a single measure for each DV for each group was analysed and calculated by averaging across epoch. Because of the multilevel structure of the data (i.e., participants nested across groups) all measures were analysed using linear mixed models (LMM) with Audio Mix (Same vs. Different) and Visual Information (No-Vision vs. Vision) as categorical predictors and a random intercept for groups.

Path Length

As can be observed in Figure 2a, the overall LMM for path length was statistically non-significant, $\chi2(3) = 0.34$, $p = .95$. There were no main effects of Visual Information, Audio Mix, nor an interaction between these predictors, all p's > .05. All participants appear to move around the dance area to the same degree regardless of whether they were listening to the same or different music, or had visual information of their co-participants or not.

Peak Frequency

The overall LMM for peak frequency was statistically significant, $\chi2(3) = 10.36$, $p = .02$. There was a main effect of Visual Information, b = .09, (95% CI: .01, .18), p = .02, with participants exhibiting a slightly faster head movement frequency in the Vision condition (M = 1.92, SD = 0.19) compared to the No-Vision condition (M = 1.83, SD = 0.24). There was no main effect of Audio Mix, b = .09, (95% CI: -.06, .24), p = .23, nor an interaction between Audio Mix and Visual Information, b = -.01, (95% CI: -.13, .10), p = .82 (see Figure 2b).

Coherence

The overall LMM for group level coherence was statistically significant, , $\chi2(3) = 24.20$, $p < .001$. There was a main effect of Audio Mix, b = .03 (95% CI: .01, .05), p = .003, whereby groups that listened to the same audio mix exhibited more coherence (i.e., more movement synchrony) (M = 0.29, SD = 0.09) compared to groups that listened to a different mix (M = 0.22, SD = 0.05). There was also a statistically significant interaction between the effects of Visual Information and Audio Mix, b = -.03 (95% CI: -.06, -.002), p = .04. As seen in Figure 2c, there was a greater increase of coherence from No-Vision to Vision for groups who were listening and dancing to the same mix compared to groups who were dancing and listening to different mix.

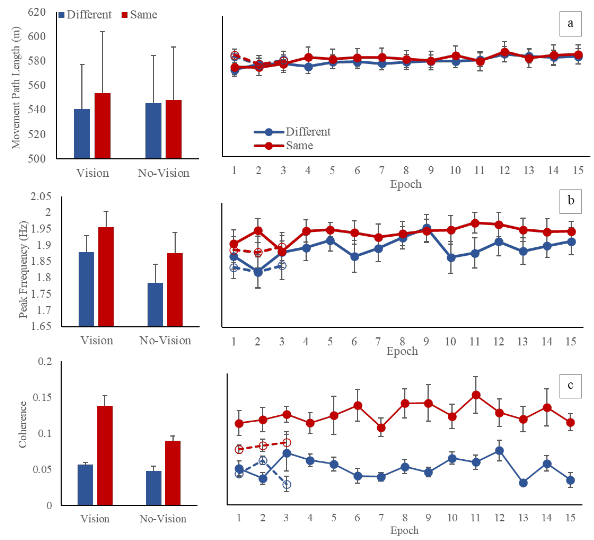

Figure 2:
Path length, path frequency, and coherence comparing Vision vs No-Vision and Same vs Different

Effect of Audio Mix (Same vs Different) on Social Connectedness and Rapport

LMMs were also used to examine whether Audio Mix (Same music vs Different music) influences the difference in social connectedness and rapport measures. The models included each measure as an outcome variable, Audio Mix as a categorical predictor, and a random intercept for group. Analyses revealed no statistically significant effect of Audio Mix (Same vs Different music) on any of rapport measures, all p's > .05. LMM analyses on self-other overlap with (a) the group as a whole and (b) with each of the other participants in the group also failed to reveal any statistically significant effects of Audio Mix on self-other overlap across individual or groups, both p's > .05.

Effect of Movement Coordination on Social Connectedness, Rapport and Self-other Overlap

LMMs were again used to examine the effects of coordination on social connectedness, rapport, and self-other overlap. For analyses examining whether movement coordination (i.e., coherence) influenced these psychosocial measures, the models consisted of connectedness, rapport, and self-other overlap scores as the outcome variables, Audio Mix as a categorical predictor, coherence as a continuous predictor, and a random intercept for groups. Except for perceived quality of interaction and self-other overlap with other individuals in the group, no statistically significant effects were found, all p's > .05.

Although the overall model predicting quality of interaction was only marginally significant $\chi2(3) = 7.05$, $p = .07$, the linear mixed model analysis revealed a significant main effect of coherence on participants' perceived quality of interaction with others in their group, b = 23.77 (95% CI: 3.52, 44.01), p = .02, such that greater coherence predicted increased perceived quality of interaction. There was no effect of Audio Mix (Same vs. Different) on perceived quality of interaction, nor an interaction between Audio Mix and coherence, all p's > .05.

The overall multilevel model predicting Inclusion of Other in the Self (IOS) score was statistically significant, $\chi2(3) = 11.70$, $p = .009$. There was a main effect of coherence on participants' self-other overlap with others in their group, b = 20.31 (95% CI: 3.88, 36.74), p = .02 such that greater coherence predicted higher rating of self-other overlap. There was no main effect of Audio Mix, nor an interaction between Audio Mix and coherence, all p's > .05.

Discussion

As expected, having visual information of other participants in the group resulted in greater SMC. Moreover, participants who listened and danced to the same music exhibited greater SMC, with a greater magnitude of SMC associated with increased self-other overlap and increased perceived quality of interaction.

Social Motor Coordination

As hypothesised, listening to the same music led to greater SMC among participants compared to when listening to different music. However, listening to the same or different music while dancing did not appear to affect either path length or peak frequency suggesting that the coordination that occurred was not a trivial result of participants moving faster or moving around the dance area more than those who listened to different mix. Although previous SMC studies have incorporated music and dance (Reddish et al., 2013; Tarr et al., 2016; Woolhouse et al., 2016), the current study is one of the first to measure and quantify the SMC resulting from listening to same-tempo music. By extension, this study is also one of the first to demonstrate that groups of individuals listening and dancing to the same music exhibit greater degree of SMC, quantified as coherence values, than groups listening to different music.

Also as expected, being able to see other participants in the group (i.e., visual information) resulted in greater SMC. Previous studies involving dyads have long established that movements are more coordinated when individuals are able to see each other (e.g., Demos et al., 2012; Oullier et al., 2008; Richardson et al., 2005, 2007). That participants in the current study produced greater SMC when visual information was available to them is consistent with this prior literature. Although research on the influence of visual information on group coordination is not yet as extensive, one recent study demonstrated that being able to see one another enhances SMC in large group dancing to a familiar choreography (Chauvigne et al., 2019). The current finding confirms the effect of visual information availability on greater SMC in group dancing. It also demonstrates that visual information may result in greater group coordination even when individuals are not restricted by pre-choreographed movements. These results, therefore, suggest that in group context interacting individuals will continue, intentionally or unintentionally, to coordinate their movements when they have complete freedom of movement and can see one another.

Coordination Stability

Coherence as a measurement of SMC has been employed in previous studies involving pairs of participants completing simple rhythmic tasks such as pendulum swinging (Schmidt & O'Brien, 1997) and rocking chairs (Richardson et al., 2005). These studies reported coherence values of .3 to .5 (recall that a coherence value of 1 signifies perfect synchrony) for unintentional coordination resulting from the availability of visual information. The current study's coherence values of .29 for those listening to the same music (vs. .22 for the different music condition) and .26 when visual information was available (vs. .20 when it was not) are comparatively lower. There are several possible explanations for this difference. First, previous studies have primarily focused on simple repetitive rhythmic tasks performed by dyads. The silent disco employed in the current study calls for free, naturalistic, and subsequently, more complex movements. Less constraints and greater degrees of freedom have been reported to reduce synchrony in a dyadic joint action task (Walton et al., 2015), thus in more complex tasks in groups we may also expect lower coherence values. In comparison to more restricted and pre-determined movement tasks such as pendulum swinging, dancing at a silent disco involves a greater variety of possible movements that are harder to align temporally and would subsequently result in weaker SMC.

A further explanation for lower values may also have to do with the fact that simply listening to the same music and having visual information alone may not be necessarily sufficient to elicit high degree of SMC. Some research suggests that visually coupled individuals unintentionally coordinate only when they are directing their attention to each other (e.g., Richardson et al., 2007). Findings that dyads successfully coordinate their movements to a greater degree could be attributed to the fact that individuals must direct their attention to only one other individual. In the current study, the groups of participants consisted of three or four members, and it is possible that unintentionally coordinating one's movements with two or three other people demands more sensorimotor effort and becomes more difficult as attention is split. Alternatively, it is possible that music and visual information might also compete for attention. In a study where pairs sat in rocking chairs, the addition of music to the availability of visual information decreased coordination (Demos et al., 2012). It appears that rather than having a cumulative effect, music and visual information may instead compete for and divide attention. Verbal feedback from participants indicated that some of them could not accurately surmise whether they were listening to the same mix or different mix. The competition between the visual coupling with others in the group and auditory coupling with the music may have led to less synchrony than anticipated, at least for those listening to the same music.

Another possible contributing factor influencing the magnitude or stability of SMC observed in this study is the fact that only head movements were measured and quantified. While measurement of head movement has commonly been employed and shown to be a reliable measure in SMC studies (e.g., Dotov et al., 2021; Hale et al., 2020) and vertical movement has been suggested to be the primary way in which individuals embody musical beat (Solberg & Jensenius, 2019), it may be that quantification of head movement alone is not sufficient to fully capture the extent of coordination that occurred. It might be informative to explore whether recording additional body parts, such as torso, hands, or feet, may subsequently capture more movement nuances. Path length revealed that participants in both conditions moved the same amount around the dance area. Capturing foot movements may reveal differences in the way the dance area is utilised and provide information on how participants move around the space.

The various factors discussed above reveal the different ways the current study could be expanded to gain greater understanding of SMC that occur in groups and how that may differ from dyadic interpersonal coordination.

Social Motor Coordination and Rapport

While SMC did not affect social connectedness and some rapport measures, it was indeed revealed that, consistent with past studies, the degree of SMC influenced self-other overlap and perceived quality of the interaction. Individuals exhibiting greater degree of SMC reported higher self-other overlap with other members of their group (although not to the overall group). The relationship between self-other overlap and SMC has previously been demonstrated (e.g., Feng et al., 2020; Lang et al., 2017; Paladino et al., 2010). Findings from the current study are consistent with the understanding that moving in synchrony leads to feelings of greater closeness or self-other overlap compared to moving asynchronously. Self-other overlap has previously been posited as mediating the effect of interpersonal synchrony on feelings of liking (Lang et al., 2017) and prosocial behaviour (Feng et al., 2020).

The blurring of self and the other may explain why synchronising our movements with others supports the development of rapport. It may be that the greater the overlap between self and the other, the more likely that individuals feel closer, more similar, more willing to interact with others, and like each other better. Feelings of closeness, similarity, liking, and a greater willingness to interact or get to know others may all be beneficial in building rapport with others. Greater degree of SMC in the current study, however, did not lead to greater self-other overlap with the group as a whole. This may be related to the division of attention in group coordination. Because it may have been difficult to pay attention to two or three other individuals at the same time, participants may have been selective in who they were focusing on. They may have paid more attention to one or two others whose movements they perceived as more aligned with their own. As a result, participants may have felt closer or stronger self-other overlap with certain individuals in the group but not to the group as a whole. This might indicate that, in group coordination, the uneven distribution of visual attention may favour self-other overlap with particular members of the group rather than the merging of self with the overall group.

The present study also revealed that greater SMC predicted higher ratings of perceived quality of interaction. It is possible that increased self-other overlap with others in the group as a result of greater degree of SMC improved the way participants view their interactions. The greater assimilation of the sense of self with the sense of others may have prompted participants to feel closer with others which in turn may lead to feeling more positively about social interactions.

It is interesting to note that although listening and dancing to the same music led to greater degree of SMC, listening and dancing to the same music did not result in increased self-other overlap or perceived quality of interaction. It was only the greater degree of SMC that predicted increased self-other overlap and perceived quality of interaction. Informal verbal feedback after the experimental session suggests that a significant number of participants guessed incorrectly or were unable to determine whether their group was listening to the same music or not. It may also be that regardless of the audio mix participants were listening to, they may have been predisposed to coordinate if they thought they were dancing to the same music. Additionally, the difference in tempo in the different music condition, (i.e., 124 BPM, 127 BPM, 130 BPM, 133 BPM) may not have been large enough to delineate it from the same music condition. Thus, participants may not have realised that they were all dancing to a different tempo, suggesting that some of music's effect on social bonding may be attributed to its role in promoting SMC.

The present study is one of the first to measure and quantify the magnitude of SMC in groups performing a complex, unchoreographed, non-repetitive, naturalistic task and, moreover, demonstrates the influence of interpersonal synchrony on aspects of social bonding in a group dance setting. It demonstrated that dancing together in a small group as part of a silent disco leads to the emergence of SMC observed in more structured dyadic interactions. Greater degree of SMC in the group was linked with higher self-other overlap (with others in the group) and higher perceived quality of interaction.

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