Are We Dancing to the Same Beat? Empathy and Interpersonal Synchronisation in the Silent Disco

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Abstract

Previous studies have begun to examine the role of movement in music for conveying emotions, while some finger tapping studies have found that synchronisation increases interpersonal affiliation. However, music and movement studies have focused on individuals and comparatively few studies have involved participants in a joint setting. The aim of the proposed research is to examine the importance of synchronisation in a dance setting for building interpersonal affiliation. This is tested using a Silent Disco scenario, in which participants hear the music in slightly different timing to each other. Participants are drawn from the population of a Finnish university, and measured on the Big Five. One of each pair hears the original track, while their partner hears it either: unchanged (the synchronised condition), time-shifted by a quarter beat, or with a slightly stretched tempo. Subjective measures of enjoyment and affiliation were used to compare conditions, revealing that pairs subjectively rated their interaction as better when in the synchronised condition, although there was no effect on subjective enjoyment. Three styles of coping with asynchrony were observed, and these may be explained by personality differences. Furthermore, an association was observed between the Agreeableness trait and giving a positive rating to partner interaction in the Synchronised condition, indicating that high Agreeableness may predispose one to be more attuned to interpersonal synchrony. This study may provide new insights into the role of synchronisation in social dancing as it suggests that shared experiences create a greater sense of affiliation when shared in time.

Keywords: silent disco, music and movement, empathy, dance, entrainment

Introduction

An ever increasing body of literature has explored the relationship between music and movement. People move spontaneously to music, and have a capacity for rhythmic entrainment (Chen, Zatorre, & Penhune, 2006). There are also individual differences in the way people move to music (Luck, Saarikallio, Burger, Thompson, & Toiviainen, 2010), and respond emotionally to music (Thompson, McIlwain, Eerola, & Vuokoski, 2012), depending on personality. Music, movement and emotion appear to have much in common.

Dance may be considered the expression of music through movement. A broad definition is used for the purpose of this paper, in which any auditory stimulus with a regular pulse or beat may be considered music. Any movement which is rhythmic in nature, and which is produced with the intention of synchrony with music, may then be considered dance. This definition is contingent upon intention, not actuality, as an individual may intend to dance in time with a beat, but fail to do so for any number of reasons.

Music and Empathy

Empathy is an important process by which we can perceive emotion, both in other people, and in music. It can be defined as the capacity for one to take the perspective of another, and individual differences may be measured in the Trait Empathy construct (Baron-Cohen & Wheelwright, 2004). Individual differences in Trait Empathy have been studied extensively.

Previous research has found relationships between the Big Five and Trait Empathy, in particular with the Agreeableness factor of the Big Five (Bamford & Davidson, 2015; Del Barrio, Aluja, & García, 2004). Furthermore, both Agreeableness and Trait Empathy have been related to aspects of rhythmic ability and dance (Bamford & Davidson, 2015; Strauß & Zentner, 2015). Empathy also has important social roles, in understanding and communicating with others.

Group Bonding through Music

It has also been suggested that synchronous activity focuses participants on others in the group, while transcending differences between individuals (McFerran, 2013); one sees others as bodies in motion, and focus on the motor processes of entraining with that motion, rather than focusing on other traits that may mark the other as different to the self. Furthermore, some have proposed that moving in synchrony serves to blur the psychological divide between the self and the other (Tarr, Launay, & Dunbar, 2014). In essence, this implies that dance enhances empathy between participants.

It is possible that the promotion of empathy through dance is key to its social bonding effect. Behrends, Müller and Dziobek (2012) and Berrol (2006) suggest that dance may be used in therapeutic contexts to enhance empathy. These studies are based upon the idea that synchronous movement may be an empathic process.

While there has been much research on imitation and social bonding, Hove and Risen (2009) were amongst the first to study synchronous movement and social bonding in an experimental setting. They found that, in a finger tapping scenario, a participant would develop a greater sense of affiliation towards the experimenter when both were tapping in synchrony (Hove & Risen, 2009). This effect has been replicated in both infants (Cirelli, Einarson, & Trainor, 2014), and 4-year-old children (Kirschner & Tomasello, 2010). Not only does this demonstrate a relationship between cooperation and synchronous movement, but it also suggests that this behavioural mechanism exists from a very young age.

Some have theorised that neurohormones released during exercise have a social bonding effect, which could explain the effect of dancing on social bonding (Tarr et al., 2014); these neurohormones also increase pain tolerance, meaning that pain threshold can be used as a proxy measurement. Tarr, Launay, Cohen and Dunbar (2015) measured pain threshold as well as self-reported social bonding in High School aged children, finding independent effects of exercise and synchrony on social bonding. Social bonding through dance may be partially influenced by simple physical exhaustion, however interpersonal synchronisation appears also to play a role. Adequately controlling for synchronisation in an experimental setting provides quite a challenge, for which new methodological approaches are required.

The Silent Disco

The concept of a silent disco is a twist on a traditional party in which, rather than having a speaker system, only the participants with headphones can hear the music ("Silent disco," 2015). Some silent disco events even have multiple DJs running multiple channels such that not every participant is even listening to the same music (for example, http://youtu.be/6RKCaHn5LHg). The result is that the shared group experience of dancing together is separated from the experience of rhythmic entrainment with other dancers.

This situation provides an opportunity to study the role of rhythmic entrainment in the experience of social dancing. Indeed, Woolhouse and Tidhar (2010) began investigating this by getting two groups of participants to dance in a room together, while each group was listening to different music in a 2 channel silent disco scenario. Afterwards, each participant was asked to recall certain features of the other participants, finding that memory for those in the same group was better than for those of the other group (Woolhouse et al., 2010).

The silent disco may also be used to examine the role of synchrony in social bonding. A study by Tarr, Launay and Dunbar (2016) found an effect of synchrony on both a questionnaire measure of social closeness and on pain threshold. In this experiment, groups were instructed to perform particular movements, controlling for creativity. Both of these studies provide good examples of the Silent Disco research paradigm.

The Present Study

The present study aims to investigate how important interpersonal synchronisation is to the experience of social dancing. This will be done using a Silent Disco scenario. Unlike the experiment by Tarr and others (2016), the present study allows participants to dance freely rather than to choreographed movements, to maintain a more naturalistic setting. The timing of musical stimuli between participants will be manipulated in three

conditions: Synchronised, Tempo-Shifted and Phase-Shifted. It is expected that participant pairs who listen to congruent musical stimuli, in the Synchronised condition, will feel a greater sense of affiliation towards each other than those listening to incongruent stimuli.

Methods

Participants

Participants were recruited through online advertisements on Facebook and mailing lists. Most participants were current international students at the University of Jyväskylä, between the ages of 19 and 31 (Mean=25.17), and all had completed at least a High School level of education. There were a total of 48 participants (76% Female), making for 24 pairs. Participants self-selected their partner for the silent disco activity, ensuring that all participants were dancing with someone they were comfortable with. This resulted in 20 Female-Female pairs, 3 Male-Female, and 1 Male-Male. All participants were asked to complete the battery of personality measures, as well as questions about music and dance experience. 62% of participants had received some kind of formal dance training, and reported enjoying dancing (Mean=8.3, on a scale of 10). No participants were excluded.

Materials

All participants completed a questionnaire battery as part of recruitment. This battery will include the Empathy Quotient 8-item version (EQ-8), Toronto Empathy Questionnaire (TEQ) and the Big Five Inventory (BFI) in addition to demographic questions about education, musical and dance experience. The EQ-8 is a shortened form of the Empathy Quotient (Baron-Cohen & Wheelwright, 2004), developed by Loewen, Lyle and Nachshen (2009). The BFI is a 44-item measure of the Big Five, included to gain some general insight into participants' personalities (John & Srivastava, 1999).

The musical stimuli were created from 30 second excerpts of six songs. Of these, there were three Motown songs and three electronic dance tracks, of a range of tempi from 90 to 140bpm. Each piece had high pulse clarity and percussiveness, with a strong bass, as these features produce the most regularity in music induced movement (Burger, Thompson, Luck, Saarikallio, & Toiviainen, 2012). Each of the six excerpts was manipulated in one of two ways: either the tempo was stretched by 5% towards 120bpm, or a delay of a quarter-of-a-beat was added to the start of the track. 120bpm was chosen as an ideal average tempo, based on previous research. Stimuli were played using a Max/MSP patch which randomised their presentation order and controlled timing of playback. Participants wore a pair of wireless headphones to isolate the musical stimuli between them.

A self-report questionnaire was also included, to assess how participants felt during the task. This consisted of five questions about their experience while dancing, and was administered at the end of each condition. The questions were: "How much did you enjoy this task?" "How comfortable did you feel during the task?" "How would you rate the interaction between yourself and your partner?" "Did you feel anxious or nervous during the task?" and "How much did you enjoy the music?" Their response was recorded on a 10-point scale.

Procedure

Individual participants were recruited online, and asked to bring a partner with whom they were comfortable dancing. Each pair came into the motion capture lab and were assigned the experimental conditions in random order. Each of the three conditions consisted of 12 musical stimuli, playing the six 30s tracks twice. This allowed for counter-balancing the tempo shifted stimuli. In the 'Synchronised' condition, both participants had the same stimuli, hearing both original and tempo shifted versions at the same time. The 'Tempo' condition presented the original track to one participant, while the other heard the tempo shifted version of that same track; the reverse would also occur, so neither was only getting tempo shifted tracks. Finally, the 'Phase' condition only included songs in their original tempo, but for one participant the stimulus would begin 90^{o} behind the other; again, this was counter-balanced so that both participants would experience being out of phase for each stimulus.

At the start of the study, both participants were informed that the study was about social interaction on the dance floor, and instructed to move freely to the music that they heard. They were told that they would both be

hearing the same music, and that the headphones were simply being used as a side project, to test whether they worked for stimulus presentation in a motion capture setting, for the sake of future research. At the end of the 12 stimuli of each condition, the participants were asked firstly to stand comfortably while the system recalibrated, and then to step towards a computer one at a time to complete a short questionnaire about their experience during the task. Once both participants completed the questionnaire, they would then be asked to step back onto the floor for the next condition. Once the pair completed all three conditions they were debriefed; first being asked what they thought the study was about, as participants were provided very little background to the study, and then being informed of its true aims.

After the lab experiment, all participants were given the personality questionnaire battery, including the EQ-8, TEQ, BFI, OMSI, and demographic questions. This was completed online.

Results

The results presented here specifically concern the questionnaire data collected, and do not include analysis of the Motion Capture data. Analysis was done in the PAST statistics package (Hammer, Harper, & Ryan, 2001).

Effect of Synchrony on Self-Reported Experience

As the questionnaire yielded ordinal data, non-parametric statistics were used. A repeated-measures Friedman's test found a significant effect of synchrony condition on the question "how would you rate your interaction with your partner?", $X^2(2) = 7.1979$, $p < .05$. Post-hoc analysis using Bonferroni corrected Wilcoxon signed-rank tests revealed a significant difference between the Synchronised and Phase conditions, $W = 433$, $z = 2.818$, $p < .05$, with a moderate effect size, $r = .288$, but no difference between the other conditions. Descriptive statistics for the responses to this question may be found in Table 1.

Table 1. Descriptive statistics for answers to the question "How would you rate your interaction with your partner?" across the three synchrony conditions.

	Synchronised	Tempo-shifted	Phase-shifted
N	48	48	48
Median	9	7.5	8
SD	2.07	1.93	2.37

No significant effects of condition were found on any other questions.

Personality

Correlations were conducted between the self-reported rating of partner interaction during the task and personality measures from the TEQ, EQ-8 and BFI. Only the question about partner interaction was chosen, given the observed effect on responses to this question of synchrony, to determine whether there was a possible interaction with personality.

A significant correlation was found between the two measures of Trait Empathy: the TEQ and EQ-8, $r = .504$, $p < .01$. The Agreeableness scale of the BFI correlated with both the TEQ, $r = .484$, $p < .01$, and EQ-8, $r = .390$, $p < .05$. The TEQ was found to correlate with Openness as well, $r = .440$, $p < .05$, while the EQ-8 correlated with Extraversion, $r = .438$, $p < .05$.

Further correlations emerged when considering personality and ratings of partner interaction. Agreeableness had a positive correlation with the partner interaction rating, $r = .401$, $p < .05$, meaning participants who scored higher on Agreeableness tended to rate the interaction as better. This was more pronounced in the Synchronised condition, $r = .451$, $p < .01$, than in the Tempo-Shift and Phase-Shift conditions, indicating a possible interaction effect between the experience of dancing in synchrony and Agreeableness.

Discussion

The results presented here provide some support to the primary hypothesis, that

interpersonal synchrony is important to social affiliation on the dance floor. Participants did report a better interaction with their partner when they were both listening to the same music, in the same time. Furthermore this effect seemed more pronounced for those who scored higher on Agreeableness.

The Importance of Synchrony

Each pair danced together in a silent disco scenario, so that the music could be presented in different timings between participants. They completed three different conditions (presented in a random order): synchronised, tempo-shifted, and phase-shifted. The condition allocated to the pair had a significant effect on how they rated the interaction with their partner. The effect of being out of phase seemed to be the most pronounced, which significantly, negatively impacted upon their experience of dancing with their partner. It is worth noting that with the Tempo condition, subjects would, at least sometimes, find the beat falls in synchrony, while the Phase condition would always be out of phase. Therefore, it may be that Tempo-shift could be considered a less consistent, and thus more disruptive, form of Phase-shift. Having a dance partner always slightly behind, or ahead of the beat may be worse than a partner who drifts in and out of phase.

Unexpectedly, there was no effect of synchrony on any of the other self-report measures of the task experience. One may have predicted that enjoyment of the music may be influenced by social interaction while listening to it, but ratings of musical enjoyment remained unaffected by the movements of the partner. This is, however, consistent with the findings of Tarr and others (2016), who similarly found that synchrony only influenced social bonding, but not personal enjoyment of the music.

Personality

There were some expected correlations within the personality traits measured. Previous studies have found a relationship between Trait Empathy and the Agreeableness factor of the Big Five (Bamford & Davidson, 2015; Del Barrio et al., 2004). This was replicated here, finding a strong positive relationship between Agreeableness, EQ-8 and TEQ. It is particularly encouraging that the EQ-8 and TEQ share a relationship, as they purport to measure the same construct of Trait Empathy, and consist of rather similar items.

Positive, but relatively weaker, relationships were also observed between the EQ-8 and Extraversion, and between the TEQ and Openness. This may indicate that these other factors of the Big Five reflect other aspects of Empathy. Some previous research also suggests that the Big Five themselves are not entirely unrelated factors (Anusic, Schimmack, Pinkus, & Lockwood, 2009; Digman, 1997). Indeed, the present study did observe relationships between Agreeableness and Neuroticism, as well as Conscientiousness and Extraversion. Care must be taken, however, in interpreting relationships within the Big Five in a relatively small sample.

Personality and Synchrony

Given that personality data had been collected, it was possible to investigate how self-reported ratings of the task experience were influenced by personality. The most interesting relationship was between Agreeableness and self-reported partner interaction. When broken down into the three conditions, the strongest positive relationship between Agreeableness and the rating of partner interaction was found in the Synchronous condition. This suggests, perhaps, that those who score higher on Agreeableness are particularly perceptive of others moving in synchrony with them.

Previous studies have found an effect of interpersonal synchrony on social bonding or pro-social behaviour, but have been more strictly controlled, involving finger tapping or simple movements (Cirelli et al., 2014; Hove & Risen, 2009). The work by Tarr and others (2016) also found an effect of synchrony on social bonding in a dance setting, however both their measurement of social bonding and manipulation of interpersonal synchrony were quite different in nature to the present study. Their 'partial synchrony' condition presented the music in the same time, but instructed participants with different choreography, while the 'no synchrony' condition presented participants with entirely different musical stimuli. By prescribing choreography to participants, Tarr and others (2016) may not have in fact been measuring the effect of synchrony, but that of imitation.

While interpersonal synchrony has been less studied, there is comparatively more research on imitation and social bonding. It is generally found that behavioural imitation creates social affiliation (Lakin & Chartrand, 2003). Casual observations of people, when moving freely on a dance floor, reveal imitation in abundance. Dancing is a creative enterprise, and dancers gain the approval of their co-dancers through imitation of movements.

Creativity may be important. A study on group singing by Sanfilippo (2015), found that both acting in synchrony with others, while also maintaining creative expression through limited degrees of improvisation, yielded a far greater social bonding effect that all singing in unison. The same may be true for dancing; social bonding may occur best when dancers can create and imitate, in synchrony.

The potential implications of this area of research are great, although somewhat beyond the scope of this study. Understanding how dance enables social bonding has implications for our understanding of the function of music-dance throughout our evolutionary history. There are also possibilities to gain greater understanding of the neurological structures behind social cognition. Finally, there may be applications in social policy and in therapy, if it is possible to increase social connectedness, pro-social behaviour, or even empathy, through dance.

Conclusions

The present study explored the importance of interpersonal synchrony in building feelings of affiliation in a social dance setting. It suggests that synchrony is an important factor in the experience of interacting with a partner on the dance floor, by using the silent disco scenario to control the timing of musical stimuli between partners, and thus controlling their degree of synchrony. While in the synchronous condition, participants self-reported having a better experience interacting with their partner than in the two asynchronous conditions. Furthermore, personality measurements indicate that people who were high on Agreeableness were more sensitive to synchronous movement, rating their experience of this condition as better than their less Agreeable peers. Further research will examine the styles adopted by participants when their partner is dancing to a different beat: to lead, to follow, or to ignore. This may also be related to personality differences. Behavioural measures of social affiliation will also be used to reinforce the self-report measure.

As much of the background literature is theoretical, with few studies specifically testing interpersonal synchronisation and affiliation, the present study adds empirical weight to the theory that music and dance serve a purpose in building social cohesion. This has implications for dance and music therapy, as it emphasises the importance of interpersonal synchrony in the therapeutic process, for building affiliation between therapist and client, or between clients in a group setting. Furthermore, it supports an argument for rhythmic art forms (music and dance) as community building projects to enhance social cohesiveness. Three factors that may contribute to the social bonding effect of dance are identified: shared creativity, imitation of gesture, and synchrony of movement. More research is required to fully understand the role of these three factors, however the present study supports the assertion that interpersonal synchrony leads to a greater sense of affiliation than simply sharing the experience of dancing (but not in time). This has implications for some of our theoretical constructs surrounding the mechanisms and functions of music in a social setting. It may be that moving in time through music in dance is a uniquely powerful way of bringing people together.

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