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The role of interpersonal movement synchronisation in empathic functions: Insights from Tango Argentino and Capoeira

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Although evidence points to a role for kinesthetic empathy (i.e. spontaneous interpersonal movement imitation and synchronisation) in social interaction, its relationship with emotional and cognitive aspects of empathy is unknown. We compared empathy in Tango and Capoeira experts, which crucially depend on ongoing, mutual interpersonal synchronisation, with empathy in practitioners of Salsa and Breakdance, respectively, which demand less interpersonal synchronisation but are comparable concerning movements and setting. Kinesthetic empathy was increased in the Tango and Capoeira groups. Although no group differences in other aspects of empathy were detected, kinesthetic empathy correlated with emotional and cognitive empathy. Taken together, trait kinesthetic empathy varies in the general population, and appears increased in synchronisation experts.

Keywords: Kinesthetic empathy; Imitation; Synchronisation; Joint action; Embodiment.

Philosopher Theodor Lipps was the first to establish the concept of *Einfühlung*, a term that was later translated into the term empathy (Lipps, 1923). He argued that we simulate observed movements and physical states of others with our own body and, consequently, converge emotionally. He used the experience of watching a tightrope walker as an example: While watching the acrobat, the spectators participate in the movements they observe and hold their breath as if it were them balancing high above the arena. Through putting themselves into the acrobat's shoes, they also gain an understanding of his mental states and emotions. Dance researchers interested in the aesthetic reception of dance cited Lipps and used the term "kinesthetic empathy" to refer to spectators' muscular and emotional responses to watching dancers, arguing that inner mimicry of dance movement involved associated changes in physiological states (Reason & Reynolds, 2010).

Most researchers from psychology agree that empathy includes at least a cognitive and an emotional component. While cognitive empathy refers to understanding other people's mental states, emotional empathy is defined as the ability to experience emotional reactions to the observed experiences of others (Shamay-Tsoory, 2014). However, accumulating evidence supports a third subcomponent of empathy that closely matches the concept of kinesthetic empathy (Decety & Meyer, 2008). It was shown that coordinated joint action such as falling into lock-step when walking side-by-side, often emerges spontaneously during human interaction (Marsh, Richardson, & Schmidt, 2009). Imitation and synchronisation can be seen as two facets of interpersonal movement coordination and have been shown to enhance a variety of social processes such as affiliation, emotional connection, feeling understood and emotion recognition (for a review, cf. Chartrand & Lakin, 2013). Yet, only synchronisation is dynamic, crucially relying on the timing of behaviour, whereas imitation relies more on the coordination of the form of a movement (Chartrand & Lakin, 2013). While a link between imitation

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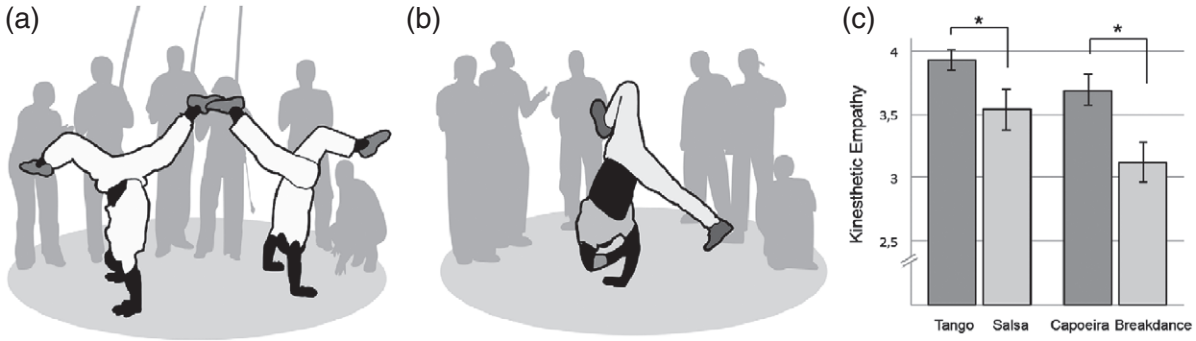

Figure 1. Illustration of Capoeira (panel a) and Breakdance (panel b) movements and group comparisons of kinesthetic empathy (panel c).

and empathy has been established previously (Chartrand & Lakin, 2013), this study set out to investigate the role of interpersonal movement synchronisation in the capacity for kinesthetic, emotional and cognitive empathy.

We assume that similar to spontaneous imitation, spontaneous interpersonal synchronisation arises at least partly from practice (e.g. Heyes, Bird, Johnson, & Haggard, 2005). We hypothesised that kinesthetic empathy is increased in individuals involved in practices that require practitioners to constantly tune in to their partner such as Tango Argentino, which possibly also translates into higher levels of cognitive and emotional trait empathy. Previous findings showed that individuals who are asked to synchronise to an *external* pacemaker feel more connected to other individuals moving in the same rhythm (Marsh et al., 2009). However, while these studies investigated empathy towards a partner in a specific situation, that is empathy on the state level, we believe that it is the training of dynamic, *mutual* synchronisation specifically that increases the likelihood of synchrony to occur beyond the current situation and thus enhances the capacity for empathic functions on the trait level. Since in Tango Argentino movements are improvised, partners are constantly demanded to mutually synchronise their movements (Tateo, 2014). We contrasted Tango dancers with Salsa dancers in kinesthetic, cognitive and emotional empathy, as Salsa compared to Tango is based more on predefined choreographies (Renta, 2004) than continuous improvisation. Thus, although movements of a couple dancing Salsa are also coordinated and partly synchronised, the synchronisation here results more from predefined movement patterns, and synchronisation to the music than dynamic, mutual synchronisation. At the same time, Tango and Salsa share important context features (e.g. both are couple dances often taking place under the eyes of spectators; Renta, 2004; Tateo, 2014).

We further compared empathy in individuals pursuing two other physical practices that are comparable in important core characteristics but differ in terms of interpersonal synchronisation. High interpersonal synchronisation is required in Capoeira, a traditional Brazilian practice played by two opponents simulating a combat (Figure 1a; Merrell, 2005). Synchronisation abilities are specifically needed when one player initiates a movement sequence, while his opponent goes along with the appropriate counter movements (Merrell, 2005). Capoeira players were compared to Breakdancers practising a style of street dance usually performed without a partner, so that no interpersonal movement synchronisation is practised (Figure 1b). Both groups are comparable in that they share certain movement qualities (Krekow, Taupitz, & Steiner, 1999, p. 9) and both involve an element of competition under the eyes of spectators.

Taken together, the quasi-experimental study design involved choosing two groups that practise mutual synchronisation (i.e. Tango and Capoeira) and comparing them to quasi control groups (i.e. Salsa and Breakdance, respectively) that involve less interpersonal synchronisation but are matched in terms of important context characteristics. We hypothesised that people trained in interpersonal movement synchronisation would show higher kinesthetic empathy than the control groups, possibly translating into higher levels of cognitive and emotional trait empathy.

METHODS

Participants

Practitioners involved in Tango Argentino ($N = 117$) and Salsa ($N = 34$) as well as Capoeira ($N = 44$) and Breakdance ($N = 32$) were recruited through dance schools, festivals and mailing lists (Table 1). All participants filled in an online questionnaire using the online survey platform Soscisurvey. Forty-two participants were excluded because they did not match inclusion criteria (age ≥ 18, German mother tongue). All participants provided a web-based informed consent.

TABLE 1
Group characteristics

Group	n *(Female)*	*Age Mean (*SD*)*	*Years of education Mean (*SD*)*	*Years of practice Mean (*SD*)*
Tango	117 (76)	45 (12.1)	15.5 (2.1)	7.3 (6.5)
Salsa	34 (22)	27.9 (7.9)	14.6 (2.1)	4.7 (3.6)
Group difference	$p^a = .98$	$p < .001$	$p = .02$	$p = .003$
Capoeira	44 (26)	25.4 (6.4)	12.5 (7.2)	4.9 (4.5)
Breakdance	32 (8)	25.3 (6.2)	11.6 (5.8)	9.9 (7.1)
Group difference	$p^a = .003$	$p = .94$	$p = .6$	$p = .001$

[a]Group difference in gender distributions.

Measures

Kinesthetic empathy

Because no scale for kinesthetic empathy was available, a short questionnaire was developed and validated in a separate study (cf. Appendix S1, Supporting Information). The kinesthetic empathy scale (KinEmp) comprises nine items that measure the spontaneous tendency for simulation of other's observed movements and physical states (e.g. "I often feel my own body tensing up when listening to somebody who is tense," "I tend to mimic facial expressions of people that I am having a conversation with," for full scale cf. Table S1). Internal consistency of the KinEmp scale was assessed by the calculation of Cronbach's alpha, which revealed moderately high values ($\alpha = .71$). The sum score of KinEmp was normally distributed (Shapiro–Wilk normality test: $W = .98$, $p = .24$).

Emotional and cognitive empathy

The Emotion Mirroring (MIR) scale and the Mental State Perception (MSP) scale of the Cognitive and Emotional Empathy Questionnaire (CEEQ; Savage, Teague, Köhne, Borod, & Dziobek, 2014) were used to measure emotional and cognitive empathy, respectively. The MIR subscale measures how much a person shares the feeling of another person (e.g. "Simply seeing another person smile makes me feel happy"). The MSP subscale measures the ability to infer another person's thoughts and feelings based on observable bodily features such as facial expression or body language (e.g. "Facial expressions and gestures tell me a lot about somebody else's thoughts," for full scales cf. Table S2). Both scales have shown good internal consistency ($N = 98$, MIR: $\alpha = .66$, MSP: $\alpha = .84$) and good construct validity (variance explained by the respective factor was 10.3% (MIR) and 14.7% (MSP); Savage et al., 2014). All scales were rated on a 7-point scale. To prevent carry over effects, items of all three scales (kinesthetic, cognitive and emotional empathy) were mixed and presented as one continuous questionnaire in random order (different for each participant).

Data analysis

Groups were compared in terms of MIR, MSP and KinEmp. As females have consistently been shown to score higher on self-report empathy measures than males (Baron-Cohen & Wheelwright, 2004), we controlled for gender in analyses of covariance. Given that individuals practising Tango and Salsa differed with respect to education and age, these variables were additionally included as covariates when comparing these groups. Two separate analyses of covariance (ANCOVAs) were run to compare the Tango and Capoeira groups with their respective control groups. Correlations between measures were calculated based on Pearson's r correlation coefficients for the groups separately. Differences between correlations were calculated according to Fisher's r to z transformation.

RESULTS

Kinesthetic empathy

Group comparisons (Figure 1c) showed the expected difference: the Tango group reported higher kinesthetic empathy than the Salsa group, Tango: $M = 3.9$, $SD = .83$; Salsa: $M = 3.6$, $SD = .82$; $F(1, 146) = 4.11$, $p = .04$, $\eta_p^2 = .03$. Similarly, the ANCOVA confirmed that the Capoeira group reported higher kinesthetic empathy than the Breakdance group, Capoeira: $M = 3.7$, $SD = .8$; Breakdance: $M = 3.1$, $SD = .7$; $F(1, 73) = 6.53$, $p = .01$, $\eta_p^2 = .08$. The same pattern of results (i.e. higher kinesthetic empathy in the Tango and Capoeira groups) occurred when including the number of years practised as an additional covariate (Tango/Salsa: $\eta_p^2 = .03$, Capoeira/Breakdance: $\eta_p^2 = .11$). When looking exclusively at the more experienced practitioners, that is those that had been practising for more than one year, the group effects were slightly larger compared to the whole sample (Tango/Salsa: $\eta_p^2 = 0.04$; Capoeira/Breakdance: $\eta_p^2 = 0.10$).

Emotional and cognitive empathy

When comparing emotional and cognitive empathy between individuals practising Tango and Salsa, neither the MIR score, Tango: $M = 4.3$, $SD = .8$; Salsa: $M = 4.4$, $SD = .9$; $F(1, 146) = .26$, nor the MSP score, Tango: $M = 5.3$, $SD = .8$; Salsa: $M = 5.2$, $SD = .7$; $F(1, 146) = 0.8$, differed significantly between groups. The same was true for the comparison between individuals practising Capoeira and Breakdance, where neither the MIR score, Capoeira: $M = 4.4$, $SD = .9$; Breakdance: $M = 4.0$ $SD = .74$; $F(1, 73) = .26$, nor the MSP score, Capoeira: $M = 4.8$, $SD = 1.1$; Breakdance: $M = 4.9$, $SD = .86$; $F(1, 73) = 0.84$, were significantly different between groups.

Relationships of kinesthetic empathy with emotional and cognitive empathy

Kinesthetic empathy correlated significantly with emotional empathy in all groups and with cognitive empathy in the synchronisation-heavy groups (i.e. the Tango and Capoeira groups, all $p < .02$), but not the groups low in synchronisation (i.e. the Salsa and Breakdance groups, both $p > .25$, cf. Figure S1). Interestingly, kinesthetic empathy correlated higher with emotional empathy in the Capoeira group than in the Breakdance group (Capoeira: $r = .65$, $p < .001$, Breakdance: $r = .44$, $p = .01$) and also correlated higher with cognitive empathy in the Capoeira group than in the Breakdance group (Capoeira: $r = .45$, $p = .002$, Breakdance $r = .11$, $p = .54$). However, these differences in group correlations did not reach significance when using the Fisher r to z transformation (both $p > .13$). Similar to this pattern of results (higher correlations between kinesthetic empathy and emotional and cognitive empathy in groups that train synchronisation compared to those that do not) correlations were also higher in the Tango group than in the Salsa group for kinesthetic empathy and emotional empathy (Tango: $r = .49$, $p < .001$, Salsa: $r = .41$, $p = .02$) and also for kinesthetic empathy and cognitive empathy (Tango: $r = .3$, $p = .001$, Salsa: $r = .25$, $p = .16$, cf. Figure S2 in the online supplement). A statistical comparison of the correlations using the Fisher r to z transformation, however, did not yield significant results (both $p > .6$).

DISCUSSION

We investigated how repetitive training of dynamic, mutual synchronisation affects kinesthetic, emotional and cognitive aspects of empathy in individuals practising Tango and Capoeira, which crucially depend on high degrees of interpersonal movement synchronisation. Tango dancers and Capoeira players were contrasted with practitioners in Salsa and Breakdance, respectively, which are similar in movement qualities and setting but entail less interpersonal movement synchronisation. More specifically, Tango and Capoeira compared to Salsa and Breakdance crucially rely on constant mutual movement synchronisation between individuals rather than synchronisation to an external pace maker such as musical rhythm.

As expected, the Tango and Capoeira groups reported higher kinesthetic empathy than did the Salsa and Breakdance groups. These findings indicate that practising dynamic interpersonal movement synchronisation in the course of physical practices is associated with higher kinesthetic empathy on a trait level. We deem remarkable that whole-body movement synchronisation as present in Tango and Capoeira is related to trait kinesthetic empathy, which includes synchronisation and imitation on a much broader level, such as the tendency to simulate facial expressions, gestures and physical states in everyday life. One major difference to previous studies showing positive social effects of *rigid* synchrony, that is synchrony that emerges because individuals synchronise to an external pace maker rather than to each other is that these studies manipulated the degree of synchrony to measure the effect on social processes in the *situation*, that is on the state level (Chartrand & Lakin, 2013). Our study, in contrast, is an attempt to investigate effects on the capacity for empathy as a stable individual characteristic, that is on the trait level. Indeed, the results suggest that only mutual, dynamic synchronisation enhances empathic functions on the trait level. This might be explained by considering that practising synchronisation to another individual increases the likelihood for synchrony to occur in future situations, which then can have positive effects on social interactions. When looking only at more experienced practitioners, that is those who likely rely less on fixed patterns but have learned to improvise more freely and thus to synchronise their movements to their partner, the group effect on kinesthetic empathy tended to be higher compared to the whole sample, which further speaks for the importance of mutuality in synchronisation. These findings inform attempts to devise dance therapeutic interventions to foster kinesthetic empathy and suggest that ongoing mutual adaptation in movement as it occurs, for example in Tango Argentino, is a crucial ingredient. However, due to the cross-sectional nature of our study we cannot infer causality. While it appears likely that synchronisation training leads to higher kinesthetic empathy, individuals with higher kinesthetic empathy might choose physical exercises demanding this skill over those that do not.

We did not find group differences with regard to the tendency to mirror an affective state and the ability to infer mental states, questioning effects of interpersonal movement synchronisation on emotional and cognitive empathy. Correlational analyses did, however, reveal that kinesthetic empathy was related to emotional empathy in all groups and to cognitive empathy in the synchronisation-heavy Tango and Capoeira groups. These results are in line with the hypothesis that interpersonal synchronisation is a precursor for emotional and cognitive components of empathy. Interestingly, all associations between kinesthetic empathy and emotional and cognitive empathy, albeit not reaching significance in direct comparisons, were higher in the synchronisation-based practices (Tango, Capoeira) as compared to practices not depending crucially on interpersonal synchronisation (Salsa, Breakdance). This again corresponds to the hypothesis that kinesthetic empathy may provide the scaffolding for higher levels of empathy. Future research would benefit from the use of more objective measures, such as facial muscle response to affective stimuli (Dimberg, Thunberg, & Elmehed, 2000) on one hand, and the

use of qualitative methods on the other, acknowledging the phenomenological roots of kinesthetic empathy.

To conclude, a first effort to investigate physical practice groups to ascertain the role of mutual interpersonal synchronisation in empathy yielded mixed results. No group differences could be observed for cognitive and emotional empathy between physical practices that are rich in synchronisation versus control practices. Yet, sizable group differences in kinesthetic empathy, and correlations between kinesthetic empathy and cognitive and emotional empathy suggest that kinesthetic empathy varies in the general population, is specifically increased in expert synchronisation groups, and might represent a precursor for emotional and cognitive empathy. Further research should be pursued to advance the timely debate on embodiment theory, seeking to ascertain the body motor system's contribution to psychological processes (Marsh et al., 2009).

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Additional methods: Development of the kinesthetic empathy (KinEmp) scale.

Figure S1. Scatterplots depicting correlations of kinesthetic and emotional empathy. Panel (a) shows correlations for the Tango and Salsa groups. Panel (b) shows correlations for the Capoeira and Breakdance groups.

Figure S2. Scatterplots depicting correlations of kinesthetic and cognitive empathy. Panel (a) shows correlations for the Tango and Salsa groups. Panel (b) shows correlations for the Capoeira and Breakdance groups.

Table S1. Items of the Kinesthetic Empathy (KinEmp) scale.

Table S2. Items of the Emotion Mirroring (MIR) and Mental State Perception (MSP) scales from the Cognitive and Emotional Empathy Questionnaire (CEEQ).

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