



## Coordinating bodies and minds: Behavioral synchrony fosters mentalizing



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### ABSTRACT

Behavioral synchrony, physically keeping together in time with others, is a widespread feature of human cultural practices. Emerging evidence suggests that the physical coordination involved in synchronizing one's behavior with another engages the cognitive systems involved in reasoning about others' mental states (i.e., mentalizing). In three experiments ( $N = 959$ ), we demonstrate that physically moving in synchrony with others fosters some features of mentalizing – a core feature of human social cognition. In small groups, participants moved synchronously or asynchronously with others in a musical performance task. In Experiment 1, we found that synchrony, as compared to asynchrony, increased self-reported tendencies and abilities for considering others' mental states. In Experiment 2, we replicated this finding, but found that this effect did not extend to accuracy in mental state recognition. In Experiment 3, we tested synchrony's effects on diverse mentalizing measures and compared performance to both asynchrony and a no-movement control condition. Results indicated that synchrony decreased mental state attribution to socially non-relevant targets, and increased mental state attribution to specifically those with whom participants had synchronized. These results provide novel evidence for how synchrony, a common feature of cultural practices and day-to-day interpersonal coordination, shapes our sociality by engaging mentalizing capacities.

From army drills, prayer prostrations, gospel singing, daily calisthenics in large Japanese corporations, circling the Hajj, dancing the hora, to doing the wave at sporting events, collective cultural practices the world over, and throughout time, are often marked by the presence of some form of synchronized behavior – the act of keeping together in time with others.

Anthropologists have long hypothesized that synchronizing with others is an effective means by which to foster social bonds among unrelated individuals (e.g., Ehrenreich, 2006). McNeill (1995) even suggests that the synchronized army drill may very well be one of history's greatest military innovations for its effects of sustaining the tight bonds that enable groups of individuals to act as singular units. Ehrenreich (2006) and McNeill (1995) argue that synchrony in collective practices may have persisted in the cultural marketplace because of the social benefits it provides to groups. Accordingly, there is considerable experimental evidence that synchronizing behaviors with others, as compared to moving asynchronously (i.e., performing the same actions but at a different time) increases social cohesion and cooperation even in the laboratory, and out of a meaningful or culturally important context (e.g., Fischer, Callander, Reddish, & Bulbulia, 2013; Hove & Risen, 2009; Lakens & Stel, 2011; Miles, Nind, & Macrae, 2009; Valdesolo & DeSteno, 2011; Valdesolo, Ouyang, & DeSteno, 2010; Wiltermuth & Heath, 2009). Furthermore, synchronizing with

conspicuous can strengthen in-group affiliations early in development (Wen, Herrmann, & Legare, 2016) encouraging prosocial helping (Kirschner & Tomasello, 2010), even in infancy (Cirelli, Wan, & Trainor, 2014).

Although there is evidence that synchrony provides social benefits to groups, the precise mechanisms by which physically moving in time with others fosters cooperation and cohesion are still debated. In a review of the evidence, Rennung and Göritz (2016) suggest that other directed attention and self-other blurring may in part explain synchrony's effects on human sociality. Indeed, this self-other blurring may be a consequence of the simultaneous perception of others' actions and activation of the same neural systems in the perceiver that occurs when synchronizing with others (Knoblich & Sebanz, 2006, 2008). And in turn, this has been hypothesized to foster social connection through increased empathy and perspective taking (Kaplan & Iacoboni, 2006; Wheatley, Kang, Parkinson, & Looser, 2012). Here, we provide further rationale and direct tests of this hypothesis that synchrony enhances some aspects of mentalizing – the processes by which we infer and reason about the mental states of others (Baron-Cohen, Leslie, & Frith, 1985; Frith & Frith, 2006).

Mentalizing is a broad term that encompasses a suite of cognitive processes implicated in, for example, agency detection, gaze following, emotion processing, joint attention, and causal reasoning

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(Apperly & Butterfill, 2009). These processes can, with the right combination of cognitive resources and motivation (Converse, Lin, Keysar, & Epley, 2008; Lin, Keysar, & Epley, 2010), lead to the more explicit reasoning about others' affective and cognitive mental states more typically associated with the term (Frith & Frith, 2006). Thus, when we refer to mentalizing, we mean the broad overarching system involved in inferring and reasoning about the mental states of others.

## 1. Coordinating bodies and minds

Across the lifespan, the temporal coordination of behavior is implicated in the construction and navigation of the boundaries between self and other. Within the first year of life, infants follow the 'gaze' of amorphous blobs (i.e., otherwise non-social targets) when they behave contingently, suggesting that synchrony may be a cue to agency, and that our sensitivity to this cue develops early (Johnson, Slaughter, & Carey, 2000). Furthermore, 4-month olds use this information to inform future interactions and demonstrate preferences for previously socially-contingent others, even after a substantial time delay (Bigelow & Birch, 1999). Feldman (2007) hypothesized that parent-child synchronization scaffolds the development of children's capacities for intention reading and empathy and longitudinally demonstrated that synchrony in the first year of life positively predicted empathic capacities in adolescence. Thus, synchrony not only prompts parts of the mentalizing process (i.e., agency detection and gaze following) but actively contributes to its development.

Across the lifespan, synchrony is employed unconsciously in maintaining and establishing new social relationships. Individuals are more likely to spontaneously synchronize their movements with others they like (Miles, Griffiths, Richardson, & Macrae, 2010), but also to help bridge the psychological distance between members of minimal groups (Miles, Lumsden, Richardson, & Macrae, 2011). Interestingly, adolescents diagnosed along the Autism Spectrum – marked by reductions in mentalizing (Baron-Cohen et al., 1985) – naturally synchronize with others less than typically developing counterparts, and report greater difficulty with intentionally synchronizing their behaviors with others (Fitzpatrick et al., 2016). These results follow from the extensive literature exploring the social consequences of another form of interpersonal coordination – behavioral mimicry – in which mimicked behaviors are similar in form, but are not temporally bound as they are in synchrony. In reviewing the evidence, Chartrand and Lakin (2013) consistently implicate mentalizing as both a motivator and consequence of behavioral mimicry. For example, individuals with a greater propensity for perspective taking are more likely to mimic others' bodily and facial movements (Chartrand & Bargh, 1999). Furthermore, mimicking, and being mimicked, increases mentalizing accuracy (i.e., the ability to accurately estimate the mental states of others; Stel & Vonk, 2010). And similarly, Koehne, Hatri, Cacioppo, and Dziobek (2016) demonstrated that the degree to which individuals perceived themselves to be synchronizing with another individual in a staged virtual interaction predicted the extent to which participants felt like they could understand the mental states of others. This is suggestive evidence that we synchronize, in part, to mentalize – to glean insights into others' mental states.

Synchronized collective cultural practices may pass on these benefits to individuals in addition to or, perhaps, as a consequence of fostering social cohesion. Indeed, the proposed mechanisms by which synchrony fosters social cohesion – other directed attention and self-other blurring (Rennung & Göritz, 2016) – are also conditions that foster mentalizing. Individuals are prone to both perceiving and attributing mind where there is none (e.g., to electronic gadgets; Waytz, Epley, & Cacioppo, 2010), and failing to acknowledge and attribute mental states where they certainly exist (e.g., in outgroup members; Harris & Fiske, 2006). But, mind perception and mental state reasoning is more frequent among individuals who seek to connect and coordinate with each other (Waytz, Gray, Epley, & Wegner, 2010). Thus, by

focusing one's social attention on their interaction partners (Macrae, Duffy, Miles, & Lawrence, 2008), synchrony may also increase the likelihood that individuals perceive and engage with others' mental states. Furthermore, the accurate perception of a mind does not necessarily result in the accurate estimation of its contents as accurate reasoning about others' mental states is often biased by one's egocentric perspective (Birch, 2005; Epley, Morewedge, & Keysar, 2004). And thus, by blurring the boundaries between self and other, and reducing egocentrism, synchrony may also foster more accurate mental state reasoning.

As reviewed, there are a number of ways in which mentalizing has been operationalized in the literature, with the unfortunate consequence of only sparse work exploring the overlap among them (Lindeman & Lipsanen, 2017; and see Schaafsma, Pfaff, Spunt, & Adolphs, 2015 for a discussion). We contend that there is also an important distinction between mentalizing propensity and mentalizing accuracy – which we argue, are not always clearly, or easily, disambiguated in measures of mentalizing. In the following experiments, we employed a diverse set of measures to assess synchrony's effects in fostering different aspects of mentalizing, including whether these hypothesized effects are specific to propensity or accuracy and whether the targets of mentalizing are socially relevant or not.

## 2. The current research

In three experiments, we investigated if, and in what ways, synchrony enhances mentalizing. In *Experiment 1*, we examined whether synchronizing with other individuals increased participant's self-reported propensities for considering the mental states of other people in general. In *Experiment 2* we tested the replicability of these initial findings, and whether synchrony would also increase mentalizing accuracy, specifically in emotion recognition from pictures of eyes. *Experiment 3* had two main goals. First, it included a baseline, no movement control condition in addition to the synchrony and asynchrony conditions, to isolate with more precision the source of the effects. That is, we assessed, relative to control, whether synchrony fostered mentalizing, or rather that mentalizing was disrupted by an asynchronous interaction. Second, it probed an increasingly specific set of mentalizing measures to directly test two possible pathways by which synchrony might foster mentalizing: (1) by directing attention to socially relevant minds in one's immediate environment, and (2) by decreasing egocentric biases. *Experiments 2* and *3* also assessed the effects of synchrony on feelings of social cohesion in order to examine whether any observed differences in mentalizing were explained by increases in social cohesion. All study materials, data, and analyses scripts are available at: [osf.io/5xmb2](https://osf.io/5xmb2). All measures, manipulations and exclusions are fully disclosed in this article. No additional data was collected post-data analysis.

## 3. Experiment 1

In this first experiment, we investigated whether participation in a synchronized task in the lab would increase self-reported mentalizing. Specifically, we manipulated whether participants moved and sang in or out of synchrony with others in a musical performance task and then measured responses on the Empathy Quotient (EQ; Baron-Cohen & Wheelwright, 2004) – a self-report measure of mentalizing propensities. We hypothesized that EQ scores would be higher, overall, in the synchrony as compared to the asynchrony condition.

## 4. Methods

### 4.1. Participants

One-hundred and sixteen (83 females) undergraduate students at a Canadian university completed this study in exchange for course credit.

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