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Case Report

To be in synchrony or not? A meta-analysis of synchrony's effects on behavior, perception, cognition and affect

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ABSTRACT

We meta-analytically investigated the strength of synchrony on four dimensions of response: (1) prosocial behavior, (2) perceived social bonding, (2) social cognition, and (3) positive affect. A total of 42 independent studies (N = 4327) were analyzed in which experimentally manipulated synchronous actions were compared to control conditions in healthy non-clinical samples. Our random effects model indicated that synchronous actions affected all four dimensions of response. Synchrony had a medium-sized positive effect on prosocial behaviors, a small-to-medium-sized positive effect on both perceived social bonding and social cognition, and a small-sized positive effect on positive affect. Notably, synchrony in larger groups increased prosocial behavior and positive affect, but group size did not moderate the relationship between synchrony and perceived social bonding and social cognition. This pattern suggests that distinct process mechanisms (neurocognitive versus affective) might underpin synchrony's effects on dimensions of response as a function of group size.

1. Introduction

Synchronous movements and vocalization involve the matching of actions in time with others (Hove & Risen, 2009). From dancing, to singing to marching, synchrony is a commonplace feature of social life, and evidence for synchrony appears deep in the human record (Reddish, Fischer, & Bulbulia, 2013b). The conservation and prevalence of synchronous action suggests tacit evolutionary benefits (Hagen & Bryant, 2003; Haidt, Seder, & Kesebir, 2008; Henrich, 2015). Specifically, it has been theorized that synchronous activities increase social cohesion amongst group members, enhancing cooperative behavior (Launay, Tarr, & Dunbar, 2016; McNeill, 1995; Turner, 1969).

Quantitative evidence for synchrony's prosocial effects was reported by Wiltermuth and Heath (2009). In one experimental study participants walked around a campus together, and in another study they sang and moved cups. The investigators varied levels of synchrony in both studies and found that synchrony increased donations in a subsequent coordination game involving trust and a public goods game requiring individual sacrifice for group benefit. Wiltermuth and Heath's (2009) finding that synchrony increases cooperation in behavioral economic games has also received substantial support in subsequent studies (Launay, Dean, & Bailes, 2013; Reddish et al., 2013b). Notably, behavioral cooperation has been observed both within behaviorally synchronous groups (Sullivan, Gagnon, Gammage, & Peters, 2015) as well as towards outsiders (Reddish, Bulbulia, & Fischer, 2013a). Other studies have linked synchrony to a wide range of social-affective phenomena beyond prosocial behavior including increased affiliation and liking towards group members (Hove & Risen, 2009; Tarr, Launay, Cohen, & Dunbar, 2015; Tarr, Launay, & Dunbar, 2016), greater levels of subjective rapport (Miles, Griffiths, Richardson, & Macrae, 2010a; Miles, Nind, & Macrae, 2009) and feelings of social connectedness amongst group members (Lumsden, Miles, & Macrae, 2014). Synchrony has also been shown to increase positive affect (Tschacher, Rees, & Ramseyer, 2014) and to improve memory recall of words (Macrae, Duffy, Miles, & Lawrence, 2008).

Though synchrony's effects on positive social response have been widely observed, enthusiasm for synchrony-induced prosociality is mitigated by some failed replications (i.e., Dam, 2012; Schachner & Garvin, 2010). For example, Schachner and Garvin (2010) conducted a direct replication of Wiltermuth and Heath's (2009) third study and found that synchrony did not increase cooperation, nor perceived social bonding (i.e., trust, similarity and feelings of being in the same team). Moreover, larger effects are more likely to be replicated: the relative size of synchrony effects across a larger number of studies needs to be evaluated (see Open Science Collaboration, 2015). Finally, because the experimental studies have assessed social response using behavioral outcomes (e.g., cooperation, helping behavior, economic games), subjective self-report measures (e.g., social

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cohesion, trust, interconnectedness, liking, similarity, entitativity and positive affect, etc.) and social cognition measures (e.g., attention to others, memory, etc.), it is theoretically interesting to disentangle potentially different effects along these different dimensions of social response. Table 3 in the Supplementary Materials presents all the outcomes measures used in all the studies included in this meta-analysis.

Here we conduct a meta-analysis evaluating the relative strength of synchrony effects on both direct prosocial behaviors and subjective ratings of social bonding, and use this evidence to explore proposed psychological mechanisms for synchrony-induced social response. Due to insufficient direct replications available, we conducted a meta-analysis of conceptual replications. We investigated the strength of synchrony on the dimensions of response that have been most thoroughly investigated in the literature: (1) prosocial behavior, (2) perceived social bonding, (3) social cognition, and (4) positive affect.

The quality of any meta-analysis such as ours depends on the choice of relevant comparison conditions. Notably, humans are a hyper-social species and most social action requires some degree of coordinated movement, though not necessarily an exact matching of behavior in time. Consider an assembly line where labor is divided in a sequential order for the step-wise creation of a product. Similarly, human communication is socially coordinated, but is typically sequential rather than synchronous. What is the effect of synchrony compared to social coordination more generally? We address this key question for synchrony research by comparing exact temporal matching of behavior with the effects of socially coordinated but not temporally matched behavior on social/behavioral/cognitive/affective responses.

1.1. Exploring possible process mechanisms

Three mechanisms have been proposed for how synchrony affects people. First, researchers have theorized that as people move in synchrony with each other, the boundaries between the self and other become blurred (Hove, 2008). It is hypothesized that such blurring evokes a sense of oneness with the group as a whole (Swann, Jetten, Gómez, Whitehouse, & Bastian, 2012). At a neurocognitive level, it had been conjectured that the simultaneous activation of one's own muscles and the observation of others behaving in an identical way leads to a blurring of the self and other in the mind of the individual (Hurley, 2008; Rizzolatti & Craighero, 2004). Compared to general socially coordinated behavior such as asynchronous or sequential actions, the model predicts that synchronous actions will suppress self/other boundaries more due to the time- and phase-locked nature of exact synchrony (Hove, 2008). However, the blurring-of-self model does not entail that synchrony increases explicit social cognition or social affect.

Second, it had been theorized that social bonding arises from group-centered social cognition. For example, Macrae et al. (2008) argued that a social allocation of attention during synchronous action affects positive social outcomes through greater attention to and processing of the actions of group members, which then allows group members to translate subjective feelings of social cohesion into joint action (see also Miles, Nind, Henderson, & Macrae, 2010b; Valdesolo, Ouyang, & DeSteno, 2010). A similar logic was investigated in Reddish et al. (2013b), in which social and individual goals were independently manipulated under varying degrees of coordination. In this study, path analysis supported the theorized model in which synchronous actions when combined with shared goals enhance cooperative expectations, and through this path, enhance cooperative behaviors. The notion is that synchrony towards a common goal rehearses cooperation, which enables people to predict each other's cooperation in the future. The authors conjectured that the importance of shared goals may explain the cultural selection and conservation of traditional and religious rituals, in which sacred beliefs and values were prominent. A common logical thread unifying process models such as Macrae et al. and Reddish et al.'s is the proposition that synchronous movements and vocalizations first affect social cognition, which in turn drives cooperative action. Notably, such models do not imply that synchrony increases subjective affect. It is possible that people predict and respond cooperatively without special emotional adjustments.

Third, it had been theorized that synchrony affects people's affective sensibilities. For example Emile Durkheim (1912/1995) coined the term “collective effervescence” to describe the emotional effects of rituals. Durkheim (1912/1995) stated, “Once the individuals are gathered together, a sort of electricity is generated from their closeness and quickly launches them to an extraordinary height of exaltation” (p. 217). Building on Durkheim's theories, Haidt et al. (2008) offered a “Hive Hypothesis” for ritual action, which claims that a person's well-being is enhanced when immersed with social groups. This position builds on the work of McNeill (1995) and Ehrenreich (2006) who postulated that synchronous activities such as rhythmic drumming and dancing performed in rituals foster social cohesion and a sense of oneness with the social group by modulating basic affective states and emotions. Though an increase in positive affect has been found in a non-verbal synchrony study (Tschacher et al., 2014), most laboratory experiments have failed to support consistent influences on social emotions (e.g., Reddish et al., 2013b; Schachner & Garvin, 2010; Wiltermuth & Heath, 2009). Despite a lack of uniformity in the evidence linking synchrony to cooperation by an affective channel, this mechanism remains a strong theoretical contender for explaining the endurance of ritualized synchrony. Notably, there are marked differences between naturally occurring ritual synchrony and laboratory manipulations, which typically are deliberately constructed to eliminate affective “confounds.” On the other hand, the social-affective dimensions of rituals are vividly portrayed throughout ethnographic records, and in systematic studies of naturally occurring religious rituals (Bulbulia et al., 2013; Fischer et al., 2014; Xygalatas et al., 2013). Thus, evidence for even a subtle effect of synchrony on positive affect would be consistent with widely postulated affective mechanisms at work in human rituals.

Importantly, the three process mechanisms we investigate in this meta-analysis are not exclusive. It could be that the three postulated mechanisms variously operate in conjunction, depending on the situation or culture. Moreover, other process mechanisms besides the three we investigate have been proposed to explain synchrony effects on people. For example, neurobiological theories hypothesize that modulation of the endogenous opioid system affects social response, highlighting the role of endorphins, dopamine, serotonin and oxytocin (Launay et al., 2016); in particular in relation to modulations of pain perception (Cohen, Ejsmond-Frey, Knight, & Dunbar, 2010; Sullivan et al., 2015; Tarr et al., 2015). These theories too are consistent with the others we have described; they merely focus on a different level of explanation – the brain. Our present meta-analysis focuses on social, behavioral, affective, and cognitive dimensions. However, neurobiological mechanisms including the endogenous opioid system and neurotransmitter functioning are important horizons of further meta-analyses, once more primary studies are available.

1.2. Might size matter?

We note that the current literature has paid relatively limited attention to the effect of group size on behavioral, social, cognitive and affective responses. Notably, early synchrony research focused on dyadic interactions, where attention amongst pairs was directed to a single interactive partner. However synchronous activities in natural human ecologies typically occur in groups (i.e., dancing, singing, and marching). It is plausible that group size moderates synchrony's effects on various dimensions of response (Launay et al., 2016; Tarr, Launay, & Dunbar, 2014; Tarr et al., 2015). On one hand, the number of interactive partners imposes attentional burdens, and social prediction becomes more difficult (Tarr et al., 2014). On the other hand, the ethnographic literatures that imply effervescent mechanisms are based