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Research Report

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ABSTRACT—Armies, churches, organizations, and communities often engage in activities—for example, marching, singing, dancing—that lead group members to act in synchrony with each another. Anthropologists and sociologists have speculated that rituals involving synchronous activity may produce positive emotions that weaken the psychological boundaries between the self and the group. This paper explores whether synchronous activity may serve as a partial solution to the free-rider problem facing groups that need to motivate their members to contribute toward the collective good. Across three experiments, people acting in synchrony with others cooperated more in subsequent group economic exercises, even in situations requiring personal sacrifice. Our results also showed that positive emotions need not be generated for synchrony to foster cooperation. In total, the results suggest that acting in synchrony with others can increase cooperation by strengthening social attachment among group members.

The decline of the bayonet and the advent of the machine gun have made marching in step a terrible, if not suicidal, combat tactic (McNeill, 1995). Yet armies still train by marching in step. Similarly, religions around the world incorporate synchronous singing and chanting into their rituals (Radcliffe-Brown, 1922). Why? We suggest that acting in synchrony with others can foster cooperation within groups by strengthening group cohesion. If true, our hypothesis may explain the widespread presence of cultural rituals involving synchrony: Such rituals may have evolved as partial solutions to the free-rider problem, the tendency for some individuals to shoulder less than their share of the burden of producing public goods and participating in collective action.

The idea that synchronous movement improves group cohesion has old roots. As historian William H. McNeill suggests, armies, churches, and communities may have all benefited, intentionally or unintentionally, from cultural practices that draw on "muscular bonding," or physical synchrony, to solidify ties between members (McNeill, 1995). This physical synchrony, which occurs when people move in time with one another, has been argued to produce positive emotions that weaken the boundaries between the self and the group (Ehrenreich, 2006; Hannah, 1977), leading to feelings of *collective effervescence* that enable groups to remain cohesive (Durkheim, 1965, Haidt, Seder, & Kesebir, in press; Turner, 1995). Andaman Islanders have been said to become "absorbed in the unified community" through dance (Radcliffe-Brown, 1922, p. 252). Similar observations have been made of Carnival revelers (Ehrenreich, 2006), and ravers dancing to beat-heavy music (Olaveson, 2004). Moreover, Haidt et al. (in press) have argued that people must occasionally lose themselves in a larger social organism to achieve the highest levels of individual well-being.

Despite the speculation that synchrony contributes to group cohesion (Ehrenreich, 2006; Haidt, 2007; Haidt et al., 2008; McNeill, 1995) there is little evidence of this causal linkage. Without such causal evidence, we cannot predict whether groups that evolve

synchrony rituals are better able to tackle joint challenges than those that don't. While we know that making an existing group identity salient can lead individuals to act in the group's interests (De Cremer & Van Vugt, 1999; Kramer & Brewer, 1984), we do not yet know if "being absorbed in a community" through synchronous activity can prompt individuals to act in concert with their group.

Puzzles also remain about what kinds of synchrony promote cohesion. Anthropologists have primarily examined the gross-motor "muscular bonding" that McNeill (1995) highlighted in dancing or marching. Yet cultural life involves many other synchrony rituals, such as religious chanting or singing, that don't involve gross motor movement. And existing hypotheses about why synchrony works seem limited. "Collective effervescence" may describe the joy experienced by rave dancers, but it is unlikely to describe the attitude of soldiers marching together.

We conducted three experiments testing whether synchrony can improve cooperation within groups, particularly when such cooperation entails action that is costly to individuals, as operationalized in standard games used by experimental economists to test coordination and free-riding. Based on the prevalence of synchronous cultural rituals that do not involve muscular bonding, we predicted that synchrony need not involve gross muscular movement to boost cooperation. We further tested whether collective joy was a necessary mediating mechanism, suspecting (based on non-joyful synchrony rituals in the military and religion) that such joy would not be necessary.

STUDY 1

Method

An experimenter led 30 participants (60% female; mean age = 20, *SD* = 2.0) in groups of three on walks around campus. In the synchronous condition, participants walked in step. In the control condition, they walked normally. After their walk, participants completed a questionnaire designed to convince participants that they had finished the experiment.

In an ostensibly separate experiment, a second experimenter conducted the Weak Link Coordination Exercise, which models situations in which group productivity is a function of the lowest level of input (Weber, Camerer, & Knez, 2004; Weber, Rottenstreich, Camerer, & Knez, 2001). In this exercise, each participant chooses a number from one to seven without communicating. As Figure 1 shows, payoffs increase as a function of the smallest number chosen and decrease with the distance between the participant's choice of number and the smallest number chosen in the group. Every participant would do best if all group members chose the number seven, but if participants fear that some individual "weak link" may not choose a high number, they might rationally choose lower numbers. Because misperceptions are costly, the game measures expectations of cooperation.

Participants played six rounds of the game and were paid based on the outcomes of a round chosen at random following the completion of the last round. Participants could not talk during the exercise. Each participant wrote down his or her selection for each round, after which the experimenter surveyed the responses, announced the minimum number selected, and instructed participants to write down a number for the next round. Afterwards, participants answered "How connected did you feel with the other participants during the walk?", "How much did you trust the other participants going into the exercise?", and "How happy do you feel?" using 7-point Likert scales (1 = *not at all*, 7 = *very much*).

Results and Discussion

Consistent with our synchrony-cooperation hypothesis, participants who walked in step chose higher numbers in the first round than did those who did not walk in step (M = 5.4, SD = 1.6 vs. M = 3.6, SD = 1.1), $t(24.6) = 2.09$, $p_{rep} = .92$, $d = 1.29$. Choices in subsequent rounds were not significantly different. Participants in the synchronous condition felt more connected with their counterparts than did those in the asynchronous condition (M = 4.5, SD = 1.4 vs. M = 2.9, SD = 1.9), $t(28) = 2.61$, $p_{rep} = .97$, $d = 0.96$, and trusted their counterparts more (M = 5.6, SD = 1.3 vs. M = 4.1, SD = 1.1), $t(28) = 3.01$, $p_{rep} = .97$, $d = 1.25$. Contrary to

the mechanism of collective effervescence, participants in the synchronous condition did not feel happier than did those in the control condition (M = 4.7, SD = 1.5 vs. M = 4.8, SD = 0.8).

STUDY 2

In Study 2 we explored whether synchrony could boost cooperation above and beyond the effects of two established sources of group cohesion: common identity and common fate (e.g., Brewer & Silver, 1978; Tajfel, Flament, Billig, & Bundy, 1971; Tajfel & Turner, 1986). In the manipulation phase of our experiment, the experimenter verbally referred to the participants as a group, and group members participated in a task together (common identity). Group members also faced a common payoff for their performance (common fate). Thus, for synchrony to be shown to affect cooperation, its effects had to reach beyond common fate and common identity.

Method

In groups of 3, 96 participants (56% female; mean age = 21 years, SD = 1.9) listened to music through headphones while performing tasks requiring differing degrees of synchrony. Each task involved handling plastic cups and listening to music. Participants were told that they would be paid between $1 and $5 based on their group performance during this "Cups and Music" task and that all members of their group would receive the same payment. The music in this study was "O Canada," a song chosen to test whether synchrony can induce cooperation when the soundtrack to the group experience is an out-group anthem (our participants were residents of the United States).

Groups were randomly assigned to one of four conditions: In the control condition (i.e., the no-singing, no-moving condition), participants listened to "O Canada," held a plastic cup above the table, and silently read the lyrics to the anthem. In the synchronous-singing condition, participants listened to the anthem, held the cup, and sang the words "O Canada" at the appropriate times. In the synchronous-singing-and-moving condition, participants

listened to the anthem, sang the words “O Canada,” and moved cups from side to side in time with the music. In the asynchronous condition, participants sang and moved cups, but participants each listened to the anthem at a different tempo, causing them to move their cups at different rates and sing “O Canada” at different times. Participants in all conditions were told that they might hear the same or different versions of “O Canada,” but only participants in the asynchronous condition actually heard different versions. We predicted that participants in the two synchrony conditions would cooperate more in the subsequent Weak Link Coordination Exercise described in Study 1 than would participants in the control or asynchronous conditions.

While participants were told that group performance determined their payment, participants received $4 for their participation in the group study. This payment placed them high in the range of possible payoffs and reinforced feelings of success. After the Cups-and-music task, participants answered “How much did you feel you were on the same team with the other participants?”, “How much did you trust the other participants going into the exercise?”, “How similar are you to the other participants?”, and “How happy are you right now?” using 7-point Likert scales (1 = *not at all*, 7 = *very much*).

Results and Discussion

Figure 2 displays mean participant choices by condition. Counter to the muscular-bonding hypothesis, cooperation did not differ between the synchronous-singing and synchronous-singing-and-moving conditions, $t(49) = 0.16$, $p_{rep} = .54$. As we predicted, participants in these synchronous conditions chose higher numbers in Round 1, $t(70) = 2.06$, $p_{rep} = .93$, $d = 0.58$, and in the final round, $F(1, 29) = 4.26$, $p_{rep} = .92$, $d = 0.74$, than did those in the asynchronous condition. They also reported greater feelings of being on the same team ($M = 5.31$, $SD = 1.34$ vs. $M = 3.71$, $SD = 1.43$), $t(70) = 4.21$, $p_{rep} = .99$, $d = 1.15$. Counter to a collective effervescence explanation, they did not report being any happier ($M = 5.03$, $SD = 1.05$ vs. $M = 4.95$, $SD = 0.74$), $t(67) = 0.27$, $p_{rep} < .61$. Participants in the synchronous conditions cooperated marginally more in Round 1, $t(70) = 1.65$, $p_{rep} = .88$, $d = 1.07$, and in

the final round, $F(1, 29) = 2.60$, $p_{rep} = .86$, $d = 0.63$, than did those in the control condition. Overall, participants in synchronous conditions received higher payoffs (M = \$5.57, SD = \$1.07) than did those in the asynchronous condition (M = \$4.90, SD = \$.68), $F(1, 28) = 4.43$, $p_{rep} = .93$, $d = 0.75$, or control condition (M = \$4.79, SD = \$1.10), $F(1, 28) = 4.97$, $p_{rep} = .94$, $d = 0.72$.

In sum, Study 2 showed that synchronous activity can increase future cooperation. Although all participants had real financial incentives to cooperate, participants in the synchronous conditions cooperated more than did those in other conditions. Synchrony involving large-muscle movements did not produce significantly more cooperation than did synchronous singing alone.

STUDY 3

In Study 3 we explored whether moving in synchrony could boost cooperation when behaving cooperatively conflicts with personal self-interest. We tested whether, after behaving in synchrony with others, people would contribute more to a public account in a commons dilemma known as a public-goods game (Croson & Marks, 2000).

Method

In groups of three, 105 participants (66% female; mean age = 21 years, SD = 2.0) first engaged in the cups-and-music task used in Study 2. We used the same set of synchrony manipulations as in Study 2. Participants then engaged in a public-goods game and finally completed the questionnaire used in Study 2.

In the public-goods game, each of 3 participants had 10 tokens in each of five rounds that he or she could contribute into a public account or keep in a private account. Tokens in the public account earned \$0.25 for every member of the group. Tokens kept in the private account were worth \$0.50 each to the person holding the token but nothing to the other two group members. In this kind of game, individuals obtain more direct value from keeping

tokens in their private account, but full contribution of tokens to the public account maximizes group earnings. As in the classic prisoner's dilemma or the tragedy of the commons, the dominant economic strategy in this exercise is to behave selfishly—keeping one's own resources in one's private account while reaping the benefits of others' contributions to the public account.

Results and Discussion

As Figure 3 illustrates, levels of cooperation in the synchronous-singing condition paralleled those in the synchronous-singing-and-moving condition, $t(52) = 0.08$, $p_{rep} = .52$. Relative to participants in the asynchronous condition, participants in the synchronous conditions allocated marginally more tokens in Round 1, $t(79) = 1.69$, $p_{rep} = .88$, $d = 0.42$, and significantly more tokens in all subsequent rounds, all p_{rep}s > .96. Participants in the synchronous conditions also cooperated marginally more in Round 1, $t(79) = 1.69$, $p_{rep} = .88$, $d = 0.42$, and significantly more in Rounds 2 through 4, all p_{rep}s > .92, than did those in the control condition.

Synchrony made contributions to the public account more persistent over time. Participants in asynchronous conditions contributed significantly fewer tokens to the public account in the last round than they did in the first round, $t(26) = 3.39$, $p_{rep} = .99$, $d = 1.33$, but no corresponding decline occurred in the synchronous conditions. This persistence is particularly interesting because the modal pattern in Public-goods games is for contributions to fall over rounds (Andreoni, 1995).

Participants in the synchronous conditions reported greater feelings of being on the same team ($M = 4.9$, $SD = 1.7$) than did those in the asynchronous conditions ($M = 3.6$, $SD = 2.0$), $t(79) = 3.19$, $p_{rep} = .95$, $d = 0.70$, or control condition ($M = 4.1$, $SD = 1.7$), $t(76) = 1.95$, $p_{rep} = .92$, $d = 0.48$. These feelings of being on the same team partially mediated the effect of condition on tokens contributed in Rounds 3 through 5, Sobel tests > 2.2, p_{rep}s > .94. Thus, synchronous participants continued to cooperate in part because they felt they were on the same team.

Participants in synchronous conditions received higher payoffs (M = \$6.49, SD = \$1.12) than did those in the asynchronous condition (M = \$5.79, SD = \$.97), $F(1, 32.5) = 11.15$, $p_{rep} = .99$, $d = 0.67$, or the control condition (M = \$5.96, SD = \$.89), $F(1, 32.5) = 5.84$, $p_{rep} = .95$, $d = 0.52$. They also felt more similar to their counterparts than did those in the asynchronous condition (M = 4.2, SD = 1.2 vs. M = 3.4, SD = 1.4), $t(79) = 2.50$, $p_{rep} = .95$, $d = 0.61$, and trusted them marginally more (M = 4.6, SD = 1.5 vs. M = 4.0, SD = 1.7), $t(79) = 1.79$, $p_{rep} = .89$, $d = 0.37$. They did not report being happier (M = 4.8, SD = 1.2) than did participants in the asynchronous (M = 5.1, SD = 0.9) or control (M = 4.8, SD = 1.1) conditions.

GENERAL DISCUSSION

Taken together, these studies suggest that acting in synchrony with others can lead people to cooperate with group members. While the studies do not eliminate the possibility that muscular bonding and collective effervescence may, under the right conditions, strengthen the effects of synchrony on cooperation, our results show that synchronous action need not entail muscular bonding or instill collective effervescence to create a willingness to cooperate. Our results suggest that cultural practices involving synchrony (e.g. music, dance, and marching) may enable groups to mitigate the free-rider problem and more successfully coordinate in taking potentially costly social action. Synchrony rituals may have therefore endowed some cultural groups with an advantage in societal evolution, leading some groups to survive where others have failed (Nowak, 2006; Sober & Wilson, 1998).

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Fig. 1. Payoff grid for weak link coordination exercise used in Studies 1 and 2. Payoffs increase as a function of the smallest number chosen by a group member ("minimum value of X chosen") and decrease with the distance between the participant's choice of number ("your choice of X") and the minimum value chosen in the group.

Fig. 2. Mean choices in the weak link coordination exercise in Study 2, as a function of round. Results are plotted separately for the four conditions: synchronous singing and moving; synchronous singing; asynchronous singing and moving; and no singing, no moving (control).

Fig. 3. Contributions to the public account in Study 3, as a function of round, plotted separately for the four conditions: synchronous singing and moving; synchronous singing; asynchronous singing and moving; and no singing, no moving (control).