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Collective synchrony increases prosociality towards non-performers and outgroup members

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Previous research has found that behavioural synchrony between people leads to greater prosocial tendencies towards co-performers. In this study, we investigated the scope of this prosocial effect: does it extend beyond the performance group to an extended ingroup (*extended parochial prosociality*) or even to other people in general (*generalized prosociality*)? Participants performed a simple rhythmic movement either in time (synchrony condition) or out of time (asynchrony condition) with each other. Before and during the rhythmic movement, participants were exposed to a prime that made salient an extended ingroup identity. After the task, half of the participants had the opportunity to help an extended ingroup member; the other half had the opportunity to help an outgroup member. We found a main effect of our synchrony manipulation across both help targets suggesting that the prosocial effects of synchrony extend to non-performers. Furthermore, there was a significantly higher proportion of participants willing to help an outgroup member after moving collectively in synchrony. This study shows that under certain intergroup contexts synchrony can lead to *generalized prosociality* with performers displaying greater prosociality even towards outgroup members.

The interpersonal matching of rhythmic behaviour – *synchrony* – is a common component of many collective rituals (McNeill, 1995). All over the world and throughout history, people gather together to dance, sing, march, chant, and make music in time with one another. Such synchronization has often been hypothesized as a key mechanism in the purported solidarity-enhancing effects of collective rituals (Durkheim, 1965; Ehrenreich, 2006; Fischer, Callander, Reddish, & Bulbulia, 2013; Haidt, Seder, & Kesebir, 2008; Wiltermuth & Heath, 2009). Recent laboratory studies have found converging evidence in support of this hypothesis. Synchrony has been shown to lead to higher levels of prosociality towards co-performers as assessed via a variety of measures (e.g., cooperation, compassion, helpfulness, liking) in both adults (Hove & Risen, 2009; Launay, Dean, & Bailes, 2014; Reddish, Fischer, & Bulbulia, 2013; Valdesolo & DeSteno, 2011; Wiltermuth, 2012a,b; Wiltermuth & Heath, 2009) and children (Cirelli, Einarson, &

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Trainor, 2014; Cirelli, Wan, & Trainor, 2014; Kirschner & Tomasello, 2010; Rabinowitch & Knafo-Noam, 2015; Tunçgenç & Cohen, 2016; Tunçgenç, Cohen, & Fawcett, 2015).

Although the social effects of synchrony have primarily been investigated in terms of its effects on co-performers, synchronous performances appear to also increase solidarity in larger groups whose members are not all physically co-present during the synchronized performance, as in collective singing of national anthems and collective chanting of national pledges. Although the language of such rituals is often rich in pro-nationalistic primes, the process of synchronization with one's fellow citizens might also have an effect in bonding one to their country (McNeill, 1995; Wiltermuth & Heath, 2009). The current research investigates whether the prosocial effects of synchrony can extend beyond the performance group to other non-performing members of an extended ingroup or other people in general including members of an outgroup.

Previous research has found that two social cognitive mechanisms – perceiving the synchronized group as a team (entitativity; Wiltermuth & Heath, 2009) and perceiving similarity with one's synchronized partner (Valdesolo & DeSteno, 2011) – mediated synchrony's prosocial effect. Because both of these psychological mechanisms are targeted at the specific members of the performance group, it might lead us to expect that synchrony's prosocial effects are restricted to the performance group. A couple of recent experiments support this hypothesis. One study with infants found that the social effects of synchrony were restricted to the synchronizing partner: infants were not more likely to help a neutral stranger after moving in synchrony with the experimenter (Cirelli, Wan, *et al.*, 2014). In another study with high school students, self-reported prosocial tendencies were measured after performing the same movement at the same time (synchrony) or different movements at the same time (partial synchrony). Synchrony was only found to produce a greater increase in prosociality towards co-performers, not fellow students who did not take part in the activity (Tarr, Launay, Cohen, & Dunbar, 2015).

However, other research suggests that the prosocial effects of synchrony may spread beyond the boundaries of the performance group: synchronized participants were more helpful than participants in a non-movement control condition regardless of whether the target of the helpful act was a fellow performer or a non-performer (Reddish, Bulbulia, & Fischer, 2014). A second study by the authors found that this effect also occurred when the prosocial target was a group: participants were more generous to an outgroup (created through the minimal group paradigm) after performing a synchronized task compared to a non-synchronized group task (completing a puzzle).

This finding was originally suggested to be supportive of a *generalized prosociality* model: synchrony shifts individuals' prosocial orientation such that they are more willing to cooperate with others in general (Reddish *et al.*, 2014). Being in synchrony with other people may lead to an increased awareness of one's interconnection with other people resulting in a general shift in one's self-construal towards interdependence with others (Markus & Kitayama, 1991). However, an alternative possibility is that synchrony leads to *extended parochial prosociality*: the prosocial effects of synchrony may extend beyond the performance group but be restricted to an extended ingroup – a more inclusive ingroup, such as a nation, that is made salient by the specific social context. Synchronous performances are often performed before intergroup conflict such as war (e.g., military drill; Fessler & Holbrook, 2014; McNeill, 1995), suggesting that the prosocial effects of synchrony should be bounded to a salient superordinate ingroup. Moreover, the well-established findings in the psychological literature on ingroup bias suggest that participants should favour helping the salient ingroup rather than the outgroup (see Hewstone, Rubin, & Willis, 2002). Reddish *et al.*'s (2014) studies did not compare relative

giving towards an extended ingroup versus an outgroup: therefore, these two competing hypotheses were not directly compared.

To explore the scope of synchrony's prosocial effects, we manipulated synchrony in groups of three or four participants whilst making salient an existing extended ingroup identity through the use of a subtle identity prime. The ingroup in this case was the participants' university (National University of Singapore).To assess prosociality, we used a similar helping measure as employed by Reddish *et al.* (2014), but directly compared giving to an extended ingroup member (an anonymous student from the participant's university) versus giving to an outgroup member (an anonymous student from a rival university). We then compared the generalized prosociality model and the extended parochial prosociality model. The generalized prosociality model hypothesizes a main effect of our synchrony manipulation, with synchrony resulting in greater prosociality compared to asynchrony – independent of group membership. The extended parochial prosociality model hypothesizes an interaction between our synchrony manipulation and the help target: the boost that synchronous movement has on prosociality relative to asynchrony is dependent on who the help target is. The extended parochial prosociality model, like the generalized prosociality model, hypothesizes that synchrony should result in a greater propensity to help an extended ingroup member than asynchrony. However, the critical difference between these two hypotheses is that the generalized prosociality model hypothesizes that synchrony will produce a greater tendency to help when the target is an outgroup member, whereas the extended parochial prosociality model hypothesizes no difference between conditions when the target is an outgroup member.

To replicate previous research, we included self-reported measures of social bonding with co-performers, entitativity (i.e., perceiving the group as a team), and perceived similarity to the group. Based on previous literature (Valdesolo & DeSteno, 2011; Wiltermuth & Heath, 2009), we hypothesized a main effect of our synchrony manipulation on all three of these variables with synchronous movement producing higher means than the asynchrony condition, and with entitativity and similarity mediating the effect of our synchrony manipulation on social bonding with co-performers.

We also aimed to explore what psychological factors may produce any generalized or extended parochial prosocial effect of synchronous movement. One possibility is that synchronizing with co-performers who belong to an extended ingroup could result in the bonding that is created between co-performers being projected on to the extended ingroup. This hypothesis predicts that bonding with co-performers would mediate the relationship between our synchrony manipulation and extended prosociality. Another possibility is that performing synchrony with a salient identity of an extended ingroup increases identification with that extended ingroup. To investigate this hypothesis, we included self-reported measures of social identification and identity fusion. Identity fusion is when a particular social identity that a person holds becomes an essential component of their personal self (Swann, Jetten, Gómez, Whitehouse, & Bastian, 2012). It has been found to be a strong predictor of parochial prosociality such as fighting and dying for one's group (Swann, Gómez, Dovidio, Hart, & Jetten, 2010; Swann, Gómez, Huici, Morales, & Hixon, 2010; Swann, Gomez, Seyle, Morales, & Huici, 2009). We hypothesized that synchronous movement would lead to greater social identification and identity fusion and that these constructs would mediate the relationship between our synchrony manipulation and extended prosociality.

Finally, Launay (2012) argued that in addition to the degree of synchronization between performance members, there are four other key variables in which synchrony and asynchrony conditions may differ that could influence prosociality: (1) motivation to

cooperate together on the task, (2) attention directed at others, (3) prediction of others' actions, and (4) perceived success at the task. We included measures of these control variables as well as the control variables of perceived difficulty, perceived enjoyment, mood, and how well participants new the other participants in their group to check that these constructs do not better explain any detected social effects from our synchrony manipulation.

Method

Participants

Participants were 150 students in groups of three or four[1] (59.3% female; mean age = 21.70, range: 18–29 years). Of these students, 75 were recruited from undergraduate psychology classes at the National University of Singapore and were given course credits for participation. The other 75 were recruited from the wider university student population and were paid for their participation (groups consisted of participants for which all were paid or all were given course credit). Participants for the two methods of recruitments were evenly distributed across the four conditions, $\chi^2(3, N = 150) = 0.47$, $p = .932$.

Procedure

The design was a 2 × 2 between-subject factorial with the independent variables of our *synchrony manipulation* (synchrony, asynchrony) and *help target* (extended ingroup, outgroup).

Participants on arriving at the laboratory venue were provided a written information sheet outlining that they were invited to take part in two studies: the first to do with group coordination; and the second study to do with social attitudes. Our measures of identification were presented as a different second study about social attitudes to help prevent participants from linking the identity prime with these questions. After participants signed consent, they were then led into a room to perform the synchrony manipulation.

Synchrony manipulation

The synchrony manipulation was adapted from Reddish *et al.* (2013). Participants, in groups of three or four, were asked to rhythmically step on foot-pedals with alternating feet for 4 min whilst moving their left arm forward with their left leg and their right arm forward with their right leg. As Reddish *et al.* (2013) found that it was the combination of synchrony with a shared goal that produced the greatest level of cooperative behaviour, a shared goal was included. In the synchrony condition, participants were told that the goal of the task was to move 'in time with each other; this means that you are consistently pressing the pedal at the same time as each other, and moving at the same speed'. They were also told that the experimenter would be measuring how accurately they kept in time with each other through the use of the foot-pedals. To help participants move in time, they heard the same metronome beat played through headphones at 50 beats per minute (bpm). In the asynchrony condition, participants were told that the goal of the task was to move 'out of time with each other; this means that you are *not* consistently pressing the

[1] *There were 22 groups of three and 21 groups of 4.*

pedals at the same time as another, but will be moving at different speeds'. They were also told that the experimenter was measuring how accurately they moved out of time with each other. Each participant in the group heard a different metronome beat played through headphones at 45, 50, 55 bpm, and, if there were four group members, 60 bpm.

The metronome beats for both conditions were played throughout the 4-min movement. The beat was in 4/4 timing with the first beat accented with a cymbal sound and the other three beats a drum sound. Participants moved their left foot forward on the first beat, back on the second beat, their right foot forward on the third beat, and back on the last beat. Participants were informed that after about 30 s they would only hear the first and third beats. This meant that participants had to pay attention to the other participants to help cue the timing of their movements and so increase the sense of shared intentionality, whilst still allowing experimental control over the speed of participants' movements.

Group prime

To make group membership salient and establish a relevant extended ingroup and outgroup, participants' identity as members of the National University of Singapore (NUS) was primed. However, it was important that ingroup salience was not made so obvious as to cue participants to the fact that we were trying to prime identity. To this end, participants were told that the study was being run at a few different universities and that the experimenters would be comparing performance. 'It is therefore important, *as* NUS *students*, that you work together to keep in time [out of time] with each other'. To further make NUS identity salient, a bright orange bag featuring the NUS logo was placed in the room in front of where the students performed the stepping task.

Prosocial measure

After the synchrony manipulation, participants were told they had two questionnaires to complete. The experimenter then told participants: 'I have also been asked by a student if I can distribute some information about research they are doing. So there will be some information about that along with the two questionnaires'. Participants were then given an additional form with the plea for help along with questionnaires. The form was headed by either the NUS logo (extended ingroup condition) or the logo of the local rival university – Nanyang Technological University (outgroup condition). The text stated that the student was at either the National University of Singapore or Nanyang Technological University and looking for volunteers to take part in research that involved filling out a number of surveys online. Participants were asked to indicate on the form whether they were willing to help, how much time they could volunteer, and their email address. The form stated that no payment or grade points would be received – the volunteering was, therefore, unrewarded. Participants were given an envelope to place the form in so as to keep the response anonymous and reduce any tendency to respond in a socially desirable manner. The form was always placed on top of the questionnaires, and the experimenter told participants he would collect the form shortly so that it would be completed before the questionnaires.

Post-activity questionnaire

The post-activity questionnaire included a number of self-report scales to measure potential mediating variables as well as manipulation checks and control variables. To

measure social bonding with co-performers, we used a version of the Inclusion of Other in Self-scale targetted for groups (Swann *et al.*, 2009). Participants were shown a series of seven[2] increasingly overlapping circles and were asked to indicate which picture 'best represents your relationship with the group of people you just did the movement activity with'. The same four entitativity items as used in Reddish *et al.* (2013, Study 2) were used (e.g., 'did you feel you and the other participants were a unit?') along with the single item to assess perceived similarity 'how much did you feel similar to the other participants?' Entitativity and perceived similarity were both measured on a 7-point Likert scale from 1 (Not at all) to 7 (Very much so). As the perceived similarity item was highly correlated with the entitativity scale (r = .73) and maps onto a similar construct, it was included in the entitativity scale (Cronbach's α = .92).[3]

We included two different measures of identification with the extended ingroup (NUS): the verbal identity fusion scale (Gómez *et al.*, 2011; Cronbach's α = .92) and Mael and Ashforth's (1992) group identity scale (Cronbach's α = .85) – what we term *extended fusion* and *extended identification*, respectively. Participants were asked to indicate how strongly they agreed or disagreed on a 7-point Likert scale about a number of statements about their relationship with NUS such as: 'I am one with NUS' (identity fusion scale) and 'when someone praises NUS, it feels like a personal compliment' (group identity scale).

As a manipulation check, the same four items as used by Reddish *et al.* (2014) were used to measure perceived synchrony from 1 (Not at all) to 7 (Very much so): (e.g., 'did you feel the other participants and yourself moved in unison with each other?') (Cronbach's α = .85). To assess the control variables of motivation to cooperate together on the task, attention directed at others, prediction of others' actions, and perceived success at the task, we asked participants on a scale for 1 (Not at all) to 7 (Very much so): (1) one item asking: 'how much did you feel you and the other participants cooperated during the task?'; (2) two items to measure the amount of attention paid to the other participants: 'how much did you pay attention to the other participants?', 'how much did you try to ignore the other participants?' (reverse coded) (Cronbach's α = .70); (3) one item asking: 'how much were you able to predict the other group member's movements?'; and (4) one item asking: 'how successful do you feel your group was at achieving the goal of the movement task?' As further checks for potential differences between the movement conditions, participants were also asked on the same scale of 1 (Not at all) to 7 (Very much so) how enjoyable and difficult the movement activity was and also three questions about their mood: if they currently feel happy, relaxed, and energetic. The scales used to assess the control variables were created by the authors to directly measure the constructs of interest with high face validity.

Finally, participants were asked general demographic questions, how well they knew the other participants and their thoughts on the purpose of each of the supposed two studies.

After completing the post-activity questionnaire participants were thanked, given course credits (or paid), and informed they would be debriefed on the study purpose at the end of the semester (after data gathering was complete). A delayed debriefing was deemed necessary because if the helping measure was revealed as a test to future participants it could compromise the validity of the measure.

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[2] *Two additional pictures where the circles were separated at different distances were included at the start of the scale to help reduce any positive skew when using the scale with groups of strangers (as per Reddish* et al.*, 2013).*

[3] *Cronbach's α without the similarity item was .91.*

Results

Based on responses to the open-ended questions on the study purpose, two participants indicated they thought the plea for help was a test. These participants were removed from all analyses (N = 148 for remaining analyses).

Pre-experimental bonding

The majority of groups consisted of participants who were strangers to each other: 77% of participants had never seen the other participants before. Twenty participants knew at least one other participant 'very well'. These participants were spread relatively evenly across conditions, $\chi^2(3) = 1.80$, $p = .618$.

Manipulation check

As expected, participants in the synchrony condition did indeed perceive being more in synchrony than participants in the asynchrony condition (see Table 1).

Willingness to help

As with previous studies that have used a similar prosocial measure (e.g., Dickert, Kleber, Peters, & Slovic, 2011; Hopkins *et al.*, 2007; Krátký, McGraw, Xygalatas, Mitkidis, & Reddish, 2016; Olivola & Shafir, 2013), willingness to help was strongly positively skewed across all conditions with a total of 38% of participants indicating that they were not willing to donate time. Recent data suggest that different cognitive mechanisms underlie the decision to donate and the decision on how much to donate (Dickert, Sagara, & Slovic, 2011). Because of this, we used a two-part model (Lachenbruch, 2001) to analyse whether our data supported either the generalized prosociality model or the extended parochial prosociality model: we first assessed whether our manipulations influenced the decision to help or not and then examined whether there were differences between conditions in *the amount of time* participants were willing to donate for those participants who were willing to help (nonzero values, n = 92).

We conducted a binary logistic regression analysis with our synchrony manipulation, help target, and their interaction as predictors and the dichotomous variable *willing to help or not* as the dependent variable. As shown in Table 2, there was a significant main effect of our synchrony manipulation as well as a main effect of help target: participants in the synchrony condition were more willing to help than participants in the asynchrony condition, and participants were more willing to help a fellow extended ingroup member than an outgroup member. However, the interaction between our synchrony manipulation and help target was not significant. We also compared whether or not synchrony produced a greater tendency to help when the target was an outgroup as this was the critical difference between the hypotheses for the generalized prosociality model and the extended parochial prosociality model (see Figure 1). In further support of the generalized prosociality model, the proportion of participants who helped an outgroup member was significantly different with individuals in the synchrony condition more likely to help, $\chi^2(1) = 5.36$, $p = .035$, odds ratio = 3.03.

The data were still significantly positively skewed for the amount of time participants were willing to donate (skewness z scores > 1.96 for all conditions). Therefore, we log-transformed the data resulting in much smaller skewness scores (skewness z scores < 0.91). A factorial ANOVA with our synchrony manipulation and help target as

Table 1. Summary statistics and *t*-tests for key variables

	Condition					
	Synchrony	Asynchrony	*t*	df	*p*	Cohen's *d*
Perceived synchrony	5.22 (0.89)	3.18 (0.90)	13.83	146	<.001	2.28
Entitativity	5.12 (0.99)	3.08 (1.17)	11.45	146	<.001	1.88
Bonding with co-performers	5.10 (1.39)	3.17 (0.96)	8.27	146	<.001	1.63
Extended fusion to NUS	3.87 (1.11)	3.82 (1.28)	0.27	146	.788	0.04
Extended identification with NUS	4.60 (1.15)	4.58 (1.07)	0.13	146	.899	0.02
Perceived cooperation	5.13 (1.32)	3.37 (1.65)	7.21	146	<.001	1.17
Feelings of success	5.64 (0.89)	4.80 (1.02)	5.33	145	<.001	0.87
Attention paid to other participants	5.36 (1.04)	3.70 (1.55)	7.71	146	<.001	1.25
Ability to predict others	5.18 (1.25)	3.14 (1.66)	8.49	146	<.001	1.38
Task difficulty	1.78 (0.96)	2.77 (1.49)	−4.89	146	<.001	−0.78
Task enjoyment	4.40 (1.40)	4.18 (1.40)	0.96	146	.341	0.16
Happy	4.36 (1.35)	4.52 (1.44)	−0.69	146	.493	−0.11
Relaxed	4.86 (1.24)	4.82 (1.30)	0.19	146	.848	0.03
Energetic	4.34 (1.47)	4.20 (1.35)	0.61	146	.546	0.10

Note. Reported is the mean with standard deviation in parenthesis.

Table 2. Logistic regression for willingness to help or not

					95% CI for odds ratio	
	B (*SE*)	Wald	*p*	Odds ratio	Lower	Upper
Sync	1.11 (0.47)	5.22	.022	3.03	1.17	7.86
Help target	1.12 (0.50)	5.05	.025	3.06	1.15	8.09
Sync × help target	−1.08 (0.70)	2.38	.123	0.34	0.09	1.34

Note. Sync = synchrony manipulation.
Model $\chi^2(1) = 8.31$, $p = .040$.

the factors and the log-transformed help data as the dependent variable found no significant main effects or interactions, $F_{max} = 0.85$. The critical comparison of a difference between conditions in the amount of time participants were willing to donate to an outgroup member was also non-significant, $t(39) = 0.71$, $p = .483$.

Self-report social bonding and identification measures

In support of our hypotheses, participants in the synchrony condition reported greater social bonding and entitativity with their performance group than participants in the asynchrony condition. However, we found no support for our hypotheses that there would be significant differences between the synchrony conditions in terms of extended fusion with NUS and extended identification with NUS (Table 1).

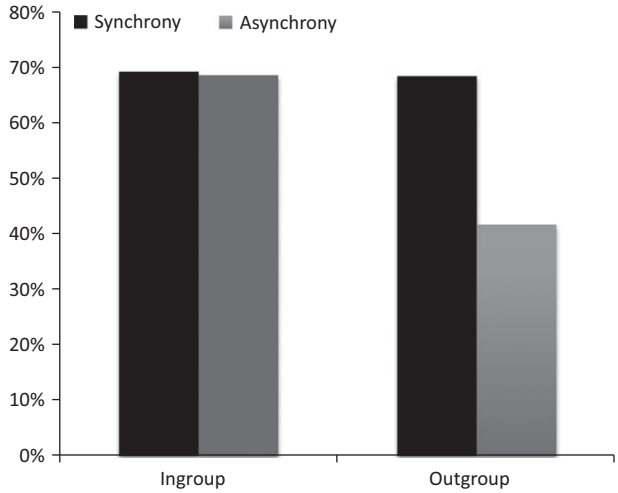

Figure 1. Percentage of participants in each condition that were willing to help.

Mediation analyses

We examined the hypothesis that entitativity would mediate synchrony's effect on social bonding with co-performers using Model 4 of the PROCESS macro (Hayes, 2013) with bonding with co-performers as the dependent variable and our synchrony manipulation as the independent variable (Figure 2a). Using a bias-corrected bootstrap of 5,000 samples, the indirect effect of our synchrony manipulation on bonding with co-performers via entitativity was significant, $b = 1.37$, 95% CI (0.88, 1.92). The direct effect of our synchrony manipulation on bonding with co-performers was also significant, $b = 0.56$, 95% CI (0.02, 1.11).

Next, we examined the hypothesis that social bonding with co-performers might mediate the effect of our synchrony manipulation on the decision to help or not[4] (Figure 2b). To model whether the tendency to help or not was dependent on who the target was, the manipulation of the help target was included as a moderator on both the direct path from synchrony to the dichotomous variable of helping and on the indirect path of the mediator (social bonding) to helping. Model 15 of the PROCESS macro with a bias-corrected bootstrap of 5,000 samples was used to test this moderated mediation, but there were no significant direct or indirect effects. Finally, we also conducted a similar moderated mediation to test the hypotheses that extended fusion (Figure 2c) or extended identification (Figure 2d) might mediate the synchrony–helping relationship. In both cases, there were no significant direct or indirect effects.

Control variables

We conducted exploratory analyses to assess whether any of our control variables differed across conditions and so may better explain our results than synchrony. The synchrony and asynchrony conditions significantly differed across all the four variables highlighted by Launay (2012), with the synchrony condition having higher perceived cooperation, feelings of success, attention directed towards the other participants, and ability to predict

[4] *Only the dichotomous helping variable was used as it was these data that an effect of our manipulation was found.*

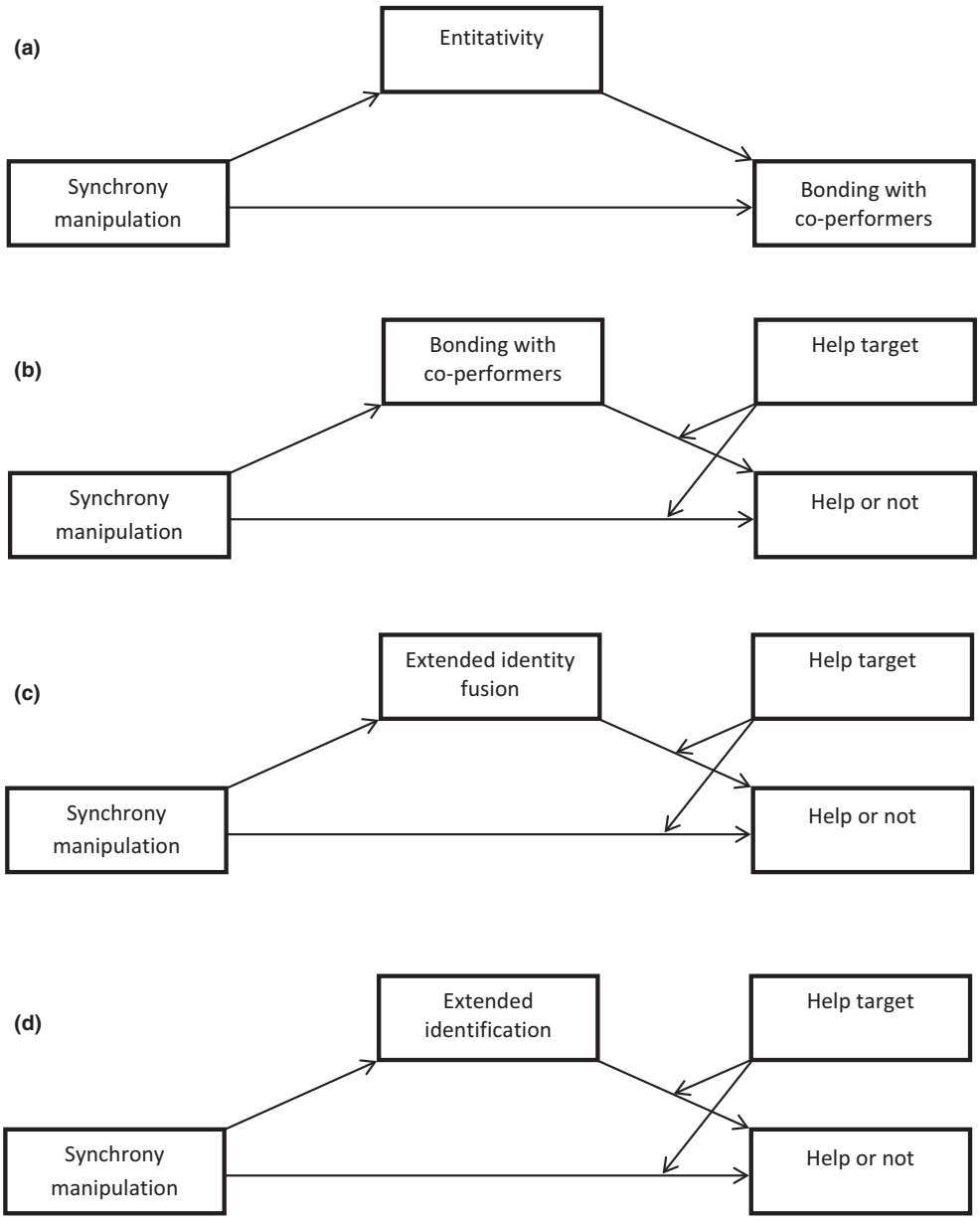

Figure 2. Conceptual diagrams of the estimated mediation models.

others. The conditions also differed in perceived difficulty to perform the task with participants in the synchrony condition reporting it to be easier to perform. There were no differences between conditions in reported levels of enjoyment, or in how happy, relaxed, or energetic participants felt (see Table 1).

Because the conditions differed across these five control variables (cooperation, success, attention, prediction, and difficulty), it is possible that one of these variables may better explain the differences we found between conditions in our social measures (helping, bonding with co-performers, entitativity) than synchrony. To explore whether

this is the case, we conducted regression analysis with our social measures as dependent variables and with the five control variables as predictors along with the synchrony manipulation, the help target manipulation, and their interaction. A logistic regression with the decision to help or not as the dependent variable was not significant, $\chi^2(8) = 12.27, p = .139$ and neither were any of the control predictors. The main effects of our synchrony manipulation and help target were still marginally significant ($p < .10$), and the synchrony manipulation had the highest odds ratio suggesting synchrony still explained the most variance (see Table 3). Multiple regressions with bonding with co-performers or entitativity as the dependent variable were significant (ps $< .001$), and in both cases, the synchrony manipulation was a significant predictor. For both bonding with co-performers and entitativity, the synchrony manipulation was either the best or equal best predictor with the highest standardized coefficient. Perceived cooperation and attention directed towards others were also significant predictors, suggesting these two control variables, in particular, may be important in explaining synchrony's social effects. However, all the control variables were moderately to strongly correlated with each other and also with perceived synchrony so indicating multicollinearity (see Table 4). This suggests that untangling these different factors to isolate the causal antecedent may be difficult.

Discussion

The current study examined whether synchrony can boost prosocial behaviour towards a member of an extended ingroup who did not take part in the synchronous performance but not an outgroup member (extended parochial prosociality model) or if it leads to greater prosociality towards other people in general including members of an outgroup (generalized prosociality model). To assess this, we primed an extended ingroup identity

Table 3. Summary of a logistic regression and linear regressions with the control variables and the experimental manipulations as predictors and the decision to help or not, bonding with co-performers, or entitativity as the dependent variable

	Dependent variable		
	Help or not (odds ratio)	Bonding with co-performers (standardized coefficient)	Entitativity (standardized coefficient)
Synchrony manipulation	2.85	.30**	.34**
Help target	2.57		
Synchrony manipulation × help target	0.41		
Cooperation	0.90	.21*	.34**
Success	0.69	−.03	.06
Attention	1.00	.23**	.17**
Prediction	1.15	.04	.11
Difficulty	0.85	−.10	−.01

Note. *$p < .05$; **$p < .01$.

Table 4. Correlation coefficients between the key variables

	1	2	3	4	5	6	7	8	9	10	11
1. Help – yes/no											
2. Help – time	.71**										
3. Extended fusion	.11	.16									
4. Extended identification	.09	.15	.78**								
5. Bonding with co-performers	.15	.11	.09	.02							
6. Entitativity	.18*	.18*	.19*	.06	.69**						
7. Perceived synchrony	.14	.14	.12	.03	.58**	.81**					
8. Cooperation	.02	.03	.26**	.13	.50**	.68**	.61**				
9. Attention	.09	.12	.12	.13	.51**	.60**	.55**	.52**			
10. Prediction	.13	.08	.15	.08	.47**	.62**	.60**	.56**	.56**		
11. Success	−.07	−.07	.15	.11	.30**	.44**	.43**	.47**	.25**	.43**	
12. Difficulty	−.09	−.03	−.09	−.06	−.31**	−.31**	−.32**	−.25**	−.14	−.31**	−.37**

Note. *$p < .05$; **$p < .01$.

during the synchrony manipulation task and measured willingness to help an anonymous extended ingroup or outgroup member. Our main effect of help target on willingness to help shows that overall there was an ingroup bias: participants after being primed with their university identity were more likely to help a fellow student from their university than a student from another university. Crucially, we found a main effect of our synchrony manipulation, with a greater proportion of participants in the synchrony condition indicating that they were willing to help an anonymous individual outside of the performance group than in the asynchrony condition. This finding is in concordance with previous research that has found that the prosocial effects of synchrony extend beyond the performance group (Reddish *et al.*, 2014). Moreover, the non-significant interaction along with the main effect of our synchrony manipulation supports the hypotheses of the generalized prosociality model. In further support for this model, we found that synchrony, relative to asynchrony, resulted in a significantly greater proportion of participants helping an *outgroup* member: the odds of a participant helping an outgroup member in the synchrony condition were over three times greater than helping in the asynchrony condition.

Although these particular results do lend strong support towards the generalized prosociality model, some of our other results do lead us to be more circumspect. Firstly, synchrony's effect on helping was only found with the decision to help or not. There was no effect of synchrony on the decision on how much time to donate. Based on dual-process theories (Kahneman, 2003), Dickert, Sagara, *et al.* (2011) suggest that donating involves two processes: an initial decision to donate based on more automatic, intuitive processes (stage 1), and a secondary more effortful considered decision on how much to donate (stage 2). As stage 1 is more automatic and associative, it seems logical that this system would be more sensitive to subtle experimental effects such as we found. Although other studies have found that synchrony does increase the degree of helping or cooperation (Valdesolo & DeSteno, 2011; Wiltermuth & Heath, 2009), these studies did not separate out the two processes. It is also possible that this differential effect with the

two processes may be an artefact of the type of helping measure we used. It would be beneficial in the future to replicate these effects with a different measure of prosociality.

Secondly, on close inspection of Figure 1, it can be seen that there appears to be little difference between the synchrony and asynchrony conditions in the proportion of participants willing to help an extended ingroup member. This may appear to counter the hypothesis that generalized prosociality should also boost prosociality towards extended ingroup members. Notably, our results bear a striking similarity to Tunçgenç and Cohen's (2016) data of a significant difference in social bonding to an outgroup between synchronous and non-synchronous conditions, but no difference between conditions in terms of bonding with an ingroup. In Tunçgenç and Cohen's (2016) study, participants performed with outgroup members so the results are not directly comparable to ours, but the similar pattern could suggest that prosocial effects of synchrony directed at an ingroup are moderated by an intergroup context. Another possibility is that our helping measure was not sensitive enough to detect a small effect of synchrony over and above that produced by the ingroup bias of making the participant's university salient. As mentioned above, replication with a different measure of prosociality may shed further light on this issue. However, because of the non-significant interaction in the logistic regression, we advise caution in interpreting this result.

Our finding that the prosocial effects extend beyond the performance group appears to conflict with the studies by Cirelli, Wan, *et al.* (2014) and Tarr *et al.* (2015). However, there are a number of methodological differences which could explain the diverging results. Firstly, Cirelli, Wan, *et al.*'s study was conducted in dyads, whereas our study was performed in small groups with a salient extended ingroup and outgroup. Conducting synchrony in a group context may activate group-based social cognition which produces these generalized effects, whereas any prosocial effect produced by dyadic synchrony is restricted to a specific individual. Secondly, Cirelli, Wan, *et al.*'s study was conducted with 14-month-old infants. It may be that particular prosocial effects produced by synchrony follow developmental trajectories as the social psychological processes that produce them come online (Dunham, Baron, & Banaji, 2008). Tarr *et al.*'s study was conducted with high school students, so developmental effects are less likely. However, unlike our study, non-performers were well known and potentially socially close to performers, which could moderate synchrony's prosocial effects. Crucially, Tarr *et al.* measured prosociality via self-reported closeness, including the Inclusion of Other in Self-scale that we used to measure bonding with co-performers. We found that self-reported closeness to co-performers was unrelated to our measure of willingness to help. Likewise, it may be that self-reported closeness to an outgroup is unrelated to willingness to help members of that outgroup.

Our finding of generalized prosociality may also appear to conflict with anecdotal observations and proposed evolutionary scenarios of the use of synchronized collective rituals before intergroup conflict (Fessler & Holbrook, 2014; McNeill, 1995). However, it is important to note that in our study there was no explicit competition or conflict between the two groups in the experimental context. When such competition is made salient, this may reduce or eliminate the extent to which the prosocial effects of synchrony are generalized. In contrast to this hypothesis, a study comparing the social effects of competitive singing versus cooperative singing found an increase in social closeness to an outgroup in both scenarios, but, interestingly, found a decrease in social closeness when competing with fellow ingroup members (Pearce, Launay, van Duijn, Rotkirch, & Dunbar, 2016). However, in this study participants performed together with the outgroup when competing, which may influence prosociality towards them. Moreover, competitive

singing in this context was a low-risk activity for the group. The moderating effect of intergroup competition may be greater in real-life situations where competitive stakes are high (e.g., life-dependent resources like food or land) or sacred values are compromised (Atran & Ginges, 2012). In situations with high intergroup conflict, members of the outgroup may even be dehumanized, creating a psychological barrier to synchrony's prosocial effects (Waytz, Epley, & Cacioppo, 2010).

In accord with previous studies, we replicated the effect of synchrony boosting self-reported social bonding with the performance group. Furthermore, our data also replicated the role of entitativity in mediating the effect of synchrony on bonding with the performance group. However, the significant direct effect of our synchrony manipulation on bonding to the performance group suggests that there are other important key mediators apart from entitativity that might also be involved in producing this bonding effect. Counter to our hypothesis, the degree of bonding with co-performers did not significantly mediate the relationship with the decision to help or not, nor was it significantly correlated with helping. This suggests that the generalized prosocial effect was not due to a projection of the bonding with co-performers to a wider extended ingroup. This finding parallels the results of Fessler and Holbrook (2014) in which synchrony's significant effect on participants' impression of the formidability of an outgroup member was independent of synchrony's bonding effect and suggests that some of synchrony's social effects can occur independently of bonding with co-performers. Our measures of extended fusion and extended identification also did not significantly mediate the synchrony-helping effect – which was not too surprising given that synchrony did not produce parochial prosociality.

What then may account for our finding of generalized prosociality? Studies have found that participants pay more attention towards synchronized partners (Macrae, Duffy, Miles, & Lawrence, 2008; Woolhouse & Lai, 2014; Woolhouse, Tidhar, & Cross, 2016) with shared attention leading to greater social bonding (Wolf, Launay, & Dunbar, 2016). Such shared attention during synchronization could lead participants to become more aware of their social context. This is turn could lead to a shift towards a more interdependent self-construal. However, Reddish *et al.* (2013) did not find an effect of synchrony on interdependent self-construal, and in our data, attention directed towards others was poorly correlated with the tendency to help or not. Another related idea is that as the creation of synchrony is a cooperative task, synchrony may prime cooperativeness in general or accentuate cooperative norms. But again, perceived cooperation was poorly correlated with the tendency to help or not so this possibility is not well supported by our data. A further possibility is based on Fessler and Holbrook's (2014) finding that synchrony diminishes perceived formidability of an opponent. This effect could by driven by feelings of collective empowerment produced by synchrony. Such empowerment may lead participants to feel that they have more resources at their disposal and so increases generosity even to non-threatening outgroup members. Further possibilities likely exist for which only further experimentation can empirically verify.

A notable limitation of our study is that the synchrony conditions differed across a number of other key factors. Although the synchrony manipulation was a better predictor than these control variables based on the regression analyses, perceived cooperation and attention still explained a significant proportion of the variance of self-reported bonding with co-performers and entitativity (whilst controlling for the other variables). This may raise questions about how effective our manipulation was in isolating synchrony *per se* as the critical factor in producing the effects we found. Although it may be possible that future studies are able to manipulate synchrony in other ways to help keep such factors as

attention to others, perceived success, etc., constant across conditions, it is likely that the social effects of synchrony are produced by the amalgamation of these factors. In addition to the matching of behaviours in time (i.e., the behavioural output that we label as synchrony), it is possible that factors involved both in the production of synchrony and how the synchrony is interpreted also influence prosociality – factors such as the shared intention to act together, careful attention directed towards others, the prediction of others' actions, and a cue for successful cooperation. In the context of our experiment, these factors together may have boosted entitativity and in turn bonded individuals to the performance group (Launay, 2015).

In conclusion, we found that the prosocial effect of synchrony extends beyond the performance group and appears to lead to generalized prosociality, even to outgroup members. In accordance with previous studies, we also found that synchrony boosts bonding within the performance group, in part by boosting feelings of group entitativity. Although we are cautious about the generalizability of these results across various intergroup contexts, they nonetheless suggest that collective synchrony has the potential to bond large groups together, even if group members do not perform together. Moreover, they could suggest a role for synchrony in increasing cooperation between groups. Singing and dancing together may not just be a fun past-time, but may be able to play a role in making the world a nicer place to live.

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