Still Want to Help? Interpersonal Coordination's Effects on Helping Behaviour After a 24 Hour Delay.

Liam Cross ^{1,2}

John Michael ^{2,3}

Luke Wilsdon ⁴

Agnes Henson ⁵

&

Gray Atherton ¹

¹ Department of Psychology, Edge Hill University, Liverpool, L39 4QP, UK

² Department of Cognitive Science, Central European University, Budapest, Hungary

³ Philosophy Department, University of Warwick, UK. CV4 7AL, UK

⁴ Department of Psychology, University of Wolverhampton, WV1 1LY, UK.

³⁵ Department of Psychology, Leeds Beckett University, Leeds, LS1 3HE. UK

*Corresponding Author

Email: drliamcross@gmail.com

ABSTRACT

A fast-growing literature is establishing how moving in time together has pro-social consequences, though no work to date has explored the transience of these effects. Across two studies, people who had previously performed coordinated movements were over three times more likely to give their time to help their co-actor when asked 24 hours later than those who had performed an uncoordinated version of the task. Findings showed group-level categorization, but not social affiliation partially mediated helping behaviour. This provides preliminary evidence that the pro-social effects of coordination are sustainable over a longer period than previously reported, and that greater pro-sociality post-coordination may be related to a change in group level categorisation rather than social affiliation.

Keywords: Synchrony, Coordination, Deindividuation, Pro-social behaviour, Altruism.

Still Want to Help? Interpersonal Coordination's Effects On Helping Behaviour After 24 Hours.

Rhythmically coordinating our movements with people over time is a common feature of everyday life. People regularly dance, sing, chant, play music and even walk together in coordinated ways (McNeil, 1995). These forms of interpersonal coordination have been repeatedly shown to promote a wide range of pro-social behaviours amongst co-actors, including increased liking, rapport, trust, helping and cooperation (Anshel & Kipper, 1988; Cross, Wilson & Golonka, 2016; 2019; Good & Ruso, 2016; Hove & Risen, 2009; Kokal, Engel, Kirschner and Keysers, 2011; Launay, Dean & Bailes, 2014; Rabinowitch & Knafo-Noam, 2015; Rabinowitch & Meltzoff, 2017; Reddish, Bulbilia & Fischer, 2013; Reddish, Fischer & Bulbilia, 2014; Reddish, Tong, Jong, Lanman & Whitehouse, 2016; Wiltermuth & Heath, 2009). Despite the pro-social effects of coordination being well established, the transience or longevity of these effects is, as of yet, unknown. Evolutionary accounts have hypothesized that moving together in time has long-lasting effects such as increasing cooperation and cohesion amongst co-actors over time (Brown, 2000; Hagen & Byrant, 2003; Huron, 2001; McNeil, 1995; Merker, 2000). However, the persistence of these effects has not yet been empirically demonstrated, as measures of pro-sociality are typically taken immediately after a coordination period (i.e. Cross et al., 2016; 2019; Hove & Risen, 2009; Reddish et al., 2013; 2014; Wiltermuth & Heath, 2009; Valdesolo & Desteno, 2011).

One study came close to addressing this question (Reddish et al., 2013). In this study, participants, after engaging in a movement task, were requested to take part in an unrelated online survey of varying lengths and were emailed the link to take part 24 hours after coordination. Results showed that those people who had moved

synchronously with each other were more likely to volunteer for the longer study. However, the authors did not report whether previously coordinated individuals were more likely to follow through with their offer to help. Therefore, the present study conceptually replicated the helping paradigm used by Reddish et al., (2013). Crucially, we measured whether previously coordinated individuals, as opposed to those who made similar yet uncoordinated movements were more likely to actually help their co-actor when emailed such a request 24 hours after engaging in the movement task.

One commonly cited mechanism by which coordination is thought to foster pro-sociality is through an increase in social affiliation (Wiltermuth & Heath 2009). This is typically assessed using self-report measures of how close, similar, and connected co-actors feel to one another. However, evidence for the mediating role of social affiliation in coordination's cultivation of pro-social behaviour is mixed (for a review see Cross, Turgeon & Atherton 2019a) . While some studies have found evidence for the role of affiliation as a potential mediator (Reddish et al., 2014; Wiltermuth & Heath, 2009; Wiltermuth, 2012b), other studies do not support this link (Cross et al., 2016, 2017; 2019 Fessler and Holbrook, 2014; 2016; Lang et al., 2017; Reddish et al., 2013, 2016).

More recently work has begun to suggest that greater pro-sociality following coordination may be linked to group rather than individual level relational changes. In other words, pro-sociality is a reflection of changes in how co-actors view themselves in common group terms (Cirelli, 2018; Cross et al., 2017; 2019 Cross, Turgeon & Atherton 2019b; Good, Choma & Ruso, 2017; Pearce, Launay, MacCarron, and Dunbar, 2017). For example, Good et al., (2017) showed that people were more likely to rate themselves and their co-actors as a single group than as separate individuals following a coordination task. Similarly, Cross et al., (2017) showed changes in how

people rated themselves post imagined coordination. In this study, imagining walking in synchrony with people was shown to lead to increases in individuals' ratings of themselves in group as opposed to individual terms, which correlated with other measures of pro-sociality. Therefore, the present study measured both participants' affiliation towards the individual co-actor and their group level categorisation. Specifically, it gauged how much participants felt like individuals versus group members following a coordination period, in order to see which of these variables were more likely to explain any pattern in post coordination helping.

Study 1 therefore, had two aims, to assess: 1) if the pro-social effects of coordination persist twenty-four hours after the coordination had taken place and 2) whether affiliation and/or group level categorisation could explain the relationship between pro-sociality and coordination. It was hypothesised that 1) people who coordinated would be more likely to help their co-actor than those who performed a matched uncoordinated version of the task, and 2) those who had previously coordinated would report feeling more like group members (and less like unique individuals) than those in the uncoordinated condition and 3) this would better mediate helping patterns than measures of social affiliation.

STUDY 1

METHOD

Participants & Design

Seventy students and staff at The University of Buckingham volunteered to participate (two participants declined to record age and gender, of the remaining 68 there were 21 males and 47 females, $M_{\text{age}} = 24.93\text{yr}$, $SD_{\text{age}} = 8.67$). The study employed an experimental design with a single between-subjects factor, Movement Type, which had two levels: Coordinated (i.e. in-phase or 0°), or Uncoordinated

(Control). Participants were tested individually, and there were equal numbers of participants per condition. Participants were assigned to conditions quasi-randomly using a pre-defined order set before testing commenced. Participants were informed at the outset via an information sheet that the study was measuring how personality is related to how we perform movement tasks. This instance of deception was necessary in order to obtain an accurate measure of helping behaviour. This experiment was approved by the School of Science and Medicine Ethics Committee of Buckingham University. Participants were compensated with a small monetary payment (£3) in line with UK minimum wage for 20 minutes work, which is the recommended payment for study participants (Dickert & Grady, 1999).

Manipulation, Measures & Procedure

Participants were brought in to the lab and introduced to the experimenter, who was a visiting researcher from another country and was unknown to the participants. They first took part in the movement task. The participant and the experimenter each moved a joystick (Genius MaxFighter F-17 with force feedback disabled) while sitting side by side. In each condition, the participant moved the joystick horizontally at 0.75Hz. In the coordinated condition, the experimenter moved their joystick at the same speed using a Point Light Display (PLD) to coordinate their movements so as to maintain 0° relative motion (i.e. in-phase). This PLD consisted of two white feedback dots displayed on a black background by a single laptop screen positioned approximately 1m in front of them. In the uncoordinated condition, the participant moved in exactly the same way, but the experimenter alternated their speed between 0.6 Hz and 0.9 Hz (0.75Hz +/- 0.15Hz). The experimenter had been previously trained to move at the various required speeds to ensure they were not falling in-phase with the participant in the uncoordinated condition.

Participants in all conditions first saw two 15s demonstrations of dots moving at the desired phase and frequency. Participants were asked to move in the same way and at the same speed as their respective dot in the demo. The participant was always replicating the movements of the bottom dot, and the experimenter the top dot. In the experimental condition, both dots moved at 0.75Hz (at 0° relative to each other). In the control condition, the bottom dot (representing the participant) still moved at 0.75Hz throughout all trials, while the speed of the top dot (representing the experimenter) alternated from 0.6Hz (slower) to 0.9Hz (faster). Instructions were closely matched between conditions. Participants were instructed that their task was to replicate the movements of the bottom dot. Meanwhile, the experimenter would be making similar movements replicating the top dot. They were told that their task was always to replicate the direction and speed of the bottom dots movement, no matter whether the other dot was the same or not.

Instructions were presented to the participant in text. Verbal interaction with the experimenter was kept to a minimum. The experimenter answered questions verbatim from a carefully worded script to ensure consistency between groups. After the initial PLD demonstrations, participants had 30s practice time to acquaint themselves with the required movements. Following this brief initial practice, participants completed six 60s trials. Each trial was preceded by a four-second version of the PLD demonstration pacing them to the required phase and frequency of movements. This experiment was run on a MacBook Pro with a custom Matlab toolbox (Wilson, Collins & Bingham 2005). Since in-phase coordination is known to be a strong attractor state (Kelso 1995), in the control condition the PLD was only visible for the first 15 seconds of the trial before it disappeared. This was done in order to ensure participants did not end up falling into an in-phase movement pattern with the experimenter in the uncoordinated condition.

Following the movement task, participants completed self-report measures of social affiliation and group categorisation. The social affiliation scale measured how close, similar and connected the participant felt to the experimenter. All responded to using a 185mm continuum, anchored from 'Not at all' to 'Very much so.' Participants were told that there were multiple experimenters running the study, and these questions were necessary to confirm whether there were any differences between individual experimenters. The group categorisation measure consisted of three questions assessing how participants construed themselves in individual vs group terms. It was scored on a 185mm continuum, and contained the below questions:

Q1 – How much do you see yourself as (an individual – a group member)?

Q2 – To what extent do you think of yourself as a unique individual (not at all – very much so)? (this item was reverse scored)

Q3 – To what extent do you qualify as a group member (not at all – very much so)?

The group categorisation measure is identical to that used by Cross et al (2017), originally adapted from Hutter et al., (2013), and it is typically termed as a measure of deindividuation. However, the term deindividuation often has a different connotation than that of the construct measured in this scale. Deindividuation typically refers to a decreased state of self-awareness in which an individual pays greater attention to the collective environment than to their own internalized standard of conduct (Reicher, Spears & Postmes, 1995). This decreased sense of self can result in antinormative “lynch mob” types of behaviour (Festinger, 1952; Zimbardo, 1969), particularly when such behaviour is reflective of what is normative for the group rather than the individual. While research shows that deindividuation is more common in groups and varies as a function of group size (see Postmes & Spears, 1998 for a review), some argue that group immersion is merely a catalyst for the state of

decreased self-awareness which defines deindividuation (Diener, 1979). Others disagree, and instead propose that rather than decreasing self-awareness, deindividuation represents a shift from an individual to a group identity (Reicher, 1984), which is more in line with the measure used here. As there is disagreement about the nature of this construct, this scale will be referred to as a measure of group level categorization, not deindividuation, as we are interested in how people categorize themselves in individual vs group terms.

Before leaving participants were asked if they would be willing to complete a further unrelated study for the experimenter in their own time. They were told that this was not paid but would only take about 30 minutes and could be done online. The wording of this request was read verbatim from a prepared script and standardized across sessions. Participants were asked if they would leave a contact email address and were then emailed a tracked Qualtrics invitation to participate the next day, 24 hours after they had participated. This link directed participants to a pilot study for a different experiment which involved various self-report measures and a common measure of theory of mind and took around 30-45 minutes to complete. This link stayed active for one week, after which participants' email addresses and the tracked invitation were destroyed.

RESULTS

A recent meta-analysis (Morgan, Fischer & Bulbulia 2017) suggests average and expected effects sizes for literature concerning the pro-social effects of coordination are small to moderate. These guidelines were used in interpreting effect sizes reported here. The average effect size for pro-social behaviour was shown to be .28 (range, .25 - .39), while for attitudinal measures it was .17 (range, .1 - .2). Therefore we used these criteria in interpreting our observed effects sizes here.

We first checked that participants were performing the movement task appropriately. All movement trials except for the practice round were analysed. A low-pass Butterworth filter with a cut-off frequency of 10Hz filtered each dot's position time series. A 60Hz time series of the relative phase between the two dots was computed as the difference between the arctangent of each dot's velocity over position at each sample. Mean vector length (MVL) is the circular equivalent of the standard deviation (see Wilson et al., (2005) for more details). It is the normalised length of the resultant vector obtained by summing the relative phase vectors from each time step and measures coordination stability. It effectively summarises how consistent the relative phasing (the coordination) between the movements were. MVL ranges from 0 (indicating minimum stability, a uniform circular distribution) to 1 (indicating maximum stability, no variability). Those who were instructed to move in a coordinated way ($M=.818$, $SD=.082$, $SE=.014$, $Mdn=.837$, range: .660-.962) did achieve more consistent coordination than those in the control condition ($M=.149$, $SD=.068$, $SE=.012$, $Mdn=.13$, range: .043-.283) ($r=.860$). This confirmed that our movement manipulation had created the desired contexts in which we can now interpret the following results.

Whether participants completed the additional survey when sent the link 24 hours later was used as a measure of delayed helping. A greater proportion of people in the coordinated condition completed the online survey than those in the uncoordinated condition. The effect size ($V=.28$) was moderate, in line with expectations based on Morgan et al. (2017). Based on the odds ratio, the odds of those in the coordinated condition revealed them to be 3.625 times more likely than those in the uncoordinated condition to follow through with their offer to help (see Figure 1 for percentages of people who helped in either condition).

Figure 1. The percentages of participants who followed through with their offer to help.

Affiliation composite scores were computed by taking the average of the three affiliation items (Cronbach's $\alpha = .890$). Those in the coordinated condition reported feeling more affiliated to the experimenter than those in the uncoordinated condition. Descriptive statistics can be found in table 1. The effect size ($r = .24$) was slightly larger than expected based on Morgan et al. (2017). The unique item of the solidarity scale was first reversed scored to be in line with the other items. The Cronbach's alpha for combining all 3 items was only .462, the Cronbach's alpha rose to .613, if the unique item was deleted, although this is still not generally considered acceptable (Nunnally & Bernstein, 1994). Therefore we did not combine these items as originally planned and instead analysed individual questions separately. Those in the coordinated condition rated themselves as more like a group member than a unique individual in the comparison question than those in the uncoordinated condition. The effect size ($r = .34$) was considerably larger than expectations based on Morgan et al. (2017). Participants in the coordinated condition also gave higher ratings for the question assessing the degree to which they considered themselves a group member than those in the uncoordinated condition. The effect size ($r = .19$) was small but in line with expectations

based on Morgan et al. (2017). Finally, participants in the coordinated condition also gave marginally lower ratings for the question assessing the degree to which they felt like a unique individual compared to those in the control condition. The effect size ($r=.03$) was considerably smaller than expected based on Morgan et al. (2017). Table 1 gives the descriptive statistics for each of those questions by condition.

		Unique Item	Group-member item	Comparison item	Affiliation Total
Uncoordinated	Mean	130.8	112.23	61.09	65.58
	SD	42.73	40.99	43.9	37.68
	SE	7.22	6.93	7.42	6.37
	Median	135.5	116.67	52.0	59.67
	Range	1-185	22-178	0-154	9-136.33
Coordinated	Mean	128.86	126.12	97.34	85.33
	SD	44.03	40.61	54.1	42.33
	SE	7.44	6.86	9.15	7.15
	Median	138.0	125.0	94.67	97.33
	Range	5-185	41-185	2-185	2-164.33

Table 1. Descriptive statistics for the affiliation composite measure and self-categorisation items.

There was a positive correlation between the items measuring the degree to which participants rated themselves as either an individual or a group member and whether they completed the survey ($r=.270$) and how affiliated they felt towards the experimenter ($r=.290$). However, there did not appear to be a relationship between affiliation and whether somebody completed the survey ($r=.046$). The odds ratio shows that participants were 3.625 times more likely to complete the additional survey if they had participated in the coordinated condition than in the uncoordinated condition. Controlling for affiliation did not substantially decrease the odds ratio, in fact, the odds of someone completing the additional survey if they had participated in the coordinated condition rose slightly to 3.764 when affiliation was controlled for. Controlling for the aforementioned self-categorisation question, however, reduced the

odds ratio by around a quarter. Specifically, the odds of someone completing the additional survey if they had participated in the coordinated condition when group level categorisation was controlled for, was reduced to 2.7. This suggests that affiliation is not likely to be mediating the relationship between coordination and helping behaviour, while group level categorisation may be partially mediating this relationship.

DISCUSSION

The pro-social effects of interpersonal coordination are well established (i.e. Anshel & Kipper 2988; Hove & Risen 2009; Wiltermuth & Heath 2009), and this work now provides the first evidence that lab-based coordination tasks are capable of affecting pro-sociality some time after the actual coordination has taken place. Study 1's results showed that people were over three and a half times more likely to help someone they had coordinated with 24 hours prior than if they had previously performed a similar but uncoordinated movement task with that person.

Results showed that greater group-level categorisation was not only present post coordination but may also partially mediate coordination's effects on helping. The way in which participants classified themselves in individual vs group terms were shown to positively correlate with levels of helping, and controlling for this substantially reduced coordination's effect on cooperation. This was not the case for social affiliation. While greater social affiliation was seen post coordination, this did not seem to interact with coordination's relationship with helping behaviour.

Every attempt was made to minimize the effects of experimenter expectancy and social desirability in this work. Due to the nature of this study, the experimenter could not be blinded to condition, though they were blind to the research predictions. Experimenter interaction with the participant was kept to an absolute minimum. All instructions for the tasks were identical for every participant and presented in text.

Where necessary the experimenter worked from carefully worded scripts and was trained to standardise their behaviour. Therefore, we do not believe that experimenter expectancy and social desirability are likely explanations for our findings. However, the alternative explanation that coordination led the experimenter to act more pro-socially towards the participant, particularly when requesting participation in the future study, cannot be ruled out. Therefore Study 2 replicates these findings and removed this potential confound, by having the experimenter not interact with the participant following the movement task. In Study 2, after the movement task, the participants went to a separate lab to fill in the self-report measures online and a final question was embedded into the end of this survey asking them to indicate if they would be willing to participate in future research for the experimenter.

STUDY 2 METHODS

Study 2 replicates the methods of study 1, while controlling for the potential confound of experimenter effects. Since a wide range of coordination tasks have been shown to foster pro-sociality amongst those who take part (walking, drumming, dancing, tapping, for a review see, Cross Turgeon & Atherton, 2019a) a tapping task like that used by Hove & Risen (2009) was used in lieu of the joystick task from Study 1. Study 2 was tested in a new location, and used a different experimenter, a research assistant at the new institution, who was completely blind to all experimental aims and hypotheses

Sixty students and staff members at The University of Wolverhampton volunteered to participate (24 Males, 36 females, $M_{\text{age}} = 28.2\text{yr}$, $SD_{\text{age}} = 9.6$). Participants were informed at the outset via an information sheet that the study was measuring how personality is related to how we perform movement tasks. This experiment was approved by the University of Wolverhampton Ethics Committee.

Instead of cash, participants were compensated with course credits and entered into a raffle to win Amazon gift vouchers.

Participants were brought in to the lab and introduced to the experimenter, who was a research assistant blind to all experimental aims and hypothesis and unknown to the participants. They first took part in the tapping task using a custom Psychopy script. The participant and the experimenter tapped on a keyboard key (Q or P), whenever they heard a beat, while sitting side by side. In each condition, right handed participants sat on the right and tapped the P key with their index finger of the right hand, the experimenter on the left always tapping the Q key with their index finger (and vice-versa for left handed participants).

The participant always heard a steady metronome of 60BPM in both conditions, and were instructed to tap their key when they heard a beat. In the coordinated conditions the experimenter heard and tapped to the same beat, in the uncoordinated condition the experimenter heard and tapped to an irregular beat, which contained the same number of overall stimuli, but presented in an irregular and unpredictable fashion designed to not co-occur with the participant's beats. See figure 3 for the auditory stimuli. A white cross appeared on the relevant side of the screen whenever a key press was registered. Participants in all conditions first had two 30 second practice trials to familiarise themselves with the task. Participants were asked to tap their respective key in time with the beat they heard. Meanwhile, the experimenter would be tapping to their beat. Instructions were presented to the

participant in text. Verbal interaction with the experimenter was kept to an absolute minimum. After the initial practice there were three 60 seconds trials.

Figure 3 Auditory stimuli for the tapping task, in the coordinated conditions both participant and experimenter heard and tapped to the bottom metronome, while in the uncoordinated condition the participants still heard and tapped to the bottom stimuli, while the experimenter heard and tapped to the top stimuli.

Following the movement task, the experimenter showed the participant to another room where they completed self-report measures of social affiliation and group level categorisation. Due to issues in scale validity with the group categorisation measure from study 1, only the comparison question asking how much do you see yourself as a unique individual (0) or a group member (100) was used here. This was supplemented with a further question assessing how much participants identified as being a part of the same group as the experimenter rated on the same scale. Affiliation was measured using the same three questions from study 1. They completed these measures on Qualtrics, alone in a separate lab, and at the end of the survey were presented with a final screen asking if they would be willing to compete future online studies for the experimenter, which they answered by ticking the yes or no box presented on screen. After completion participants were debriefed on screen and thanked for their time. Twenty four hours after participating, participations were emailed a tracked Qualtrics invitation to participate in a further study which involved

various self-report measures and a common measure of theory of mind which took around 30-45 minutes to complete. This link stayed active for one week, after which the log of participants email addresses and the tracked invitation were destroyed.

RESULTS

We first checked that participants were performing the movement task appropriately. In line with Hove & Risen (2009) we calculated the average proportion of taps occurring within 100ms of each other for each pair across the three trials. Those in the coordinated condition had a greater proportion of taps occurring within 100ms ($M=.835$, $SD=.124$, $SE=.023$, $Mdn=.881$, range: .506-.983) than those in the uncoordinated condition ($M=.191$, $SD=.037$, $SE=.007$, $Mdn=.194$, range: .106-.256). The effect size ($r=0.85$) was in line with study 1, which confirmed that our movement manipulation had created the desired contexts in which we can now interpret the following results.

Whether participants completed the additional survey when sent the link 24 hours later was again used as a measure of delayed helping. A greater proportion of people in the coordinated condition completed the online survey than those in the uncoordinated condition (see Figure 3 for percentages of people who helped in either condition). The effect size ($V=.259$) was slightly larger than in study 1., Based on the odds ratio, the odds of those in the coordinated condition's revealed them to be around 3.33 times more likely than those in the uncoordinated condition to follow through with their offer to help, which is in line with the results of study 1.

Figure 3. The percentages of participants who followed through with their offer to help for study 2).

Affiliation composite scores were computed by taking the average of the affiliation items (Cronbach's $\alpha = .894$). Those in the coordinated condition did not report feeling more affiliated with the experimenter than those in the uncoordinated condition, and the effect size ($r = .044$) was smaller than seen in study 1. Those in the coordinated condition rated themselves as more like group members than unique individuals than those in the uncoordinated condition. The effect size ($r = .3$) was in line with study 1. Participants in the coordinated condition also gave higher ratings for the question assessing the degree to which they considered themselves as part of the same group as the experimenter. The effect size ($r = .27$) was moderate in line with expectations based on Morgan et al. (2017) and the other self-categorisation question here and in study 1. Table 3 gives the descriptive statistics for each of those questions by condition.

		Affiliation	Self Categorization Item	Experimenter Categorization item
Uncoordinated	Mean	38.93	22.93	42.6
	SD	29.15	26.65	32.08
	SE	5.32	4.87	5.86
	Median	37.0	17.5	35.0
	Range	0-100	0-100	0-100
Coordinated	Mean	39.93	38.33	60.43
	SD	24.63	28.25	25.178
	SE	4.5	5.16	4.6
	Median	41.5	35.5	65.5
	Range	0-100	0-100	0-100

Table 3. Descriptive statistics for the group categorisation questions form study 2.

There was a positive correlation between the two items measuring group categorisation ($r=.265$) and between each of the group categorisation questions and whether they completed the survey (Self categorisation, $r=.229$ / Self-Experimenter categorisation $r=.278$). The odds ratio shows that participants were 3.33 times more likely to complete the additional survey if they had participated in the coordinated condition than in the uncoordinated condition. Controlling for the self-categorisation question, however, reduced the odds ratio in line with study 1. Specifically, the odds of someone completing the additional survey if they had participated in the coordinated condition when group level categorisation was controlled for was reduced to 2.861. Controlling for the group-categorisation question reduced the odds ratio even more than the self-categorisation question. Specifically, the odds of someone completing the additional survey if they had participated in the coordinated condition when group level categorisation was controlled for was reduced to 2.53. Controlling for affiliation did not substantially decrease the odds ratio. In fact, the odds of someone completing the additional survey if they had participated in the coordinated condition rose slightly to 3.593 when controlling for affiliation.

In line with the findings of Study 1, Study 2 confirms that affiliation is not likely to be mediating the relationship between coordination and helping behaviour, while group level categorisation may be partially mediating this relationship, that is, both changes in how people see themselves in group vs individual terms, and seeing themselves and their previously coordinated co-actor as part of a common group.

DISCUSSION

It has been previously suggested that throughout human history, moving in time with others leads to long-lasting bonding between co-actors and therefore strengthens group ties, leading to increased cooperation and helping amongst people (Brown 2000; Hagen & Byrant; Huron 2008; McNeil 1995; Merker 2000). This work provides empirical support for such a claim. Specifically, the present two studies showed that after only a short, un-strenuous, five-minute period of rhythmic coordination, participants rated themselves and their co-actor in more common groups terms and displayed greater pro-sociality towards their co-actor 24 hours after the coordination period had taken place. This is a first step towards establishing the persistence of interpersonal coordination's pro-social effects.

Future work should aim to continue this line of inquiry to establish whether greater pro-sociality post coordination is maintained after even longer periods of time. It would also be of interest to establish whether the degree of pro-sociality differs as a function of such a lag. In particular, does pro-sociality post coordination decrease incrementally over time, or does it remain stable until a specific drop-off point in which effects begin to decay or are no longer observed? Such questions require incorporating memory models within the current embodied movement framework, which would help address the function of memory both during periods of coordination and at different time periods post-coordination. It would also be of interest to establish

how other factors affect the lifespan of coordination's pro-social effects such as the duration spent coordinating or the level of task engagement.

Furthermore this work provides further weight to a growing body of literature which does not situate social affiliation as a mediator of the positive relation between coordination and other forms of pro-sociality such as cooperation and helping (i.e. Cross et al., 2016; 2017; Fessler and Holbrook, 2014; 2016; Lang et al., 2017; Reddish et al., 2013; 2016). In other words, the pro-social effects following coordination do not appear to be a by-product of increased liking, closeness and similarity for a coordinated co-actor. Instead, they appear to be more likely driven by changes in group level evaluations (as has previously suggested by Pearce, et al., 2017). Similar arguments have also been made by Rabinowitch and Meltzoff (2017a), Tunge and Cohen (2016a), and Wolf, Launay and Dunbar (2017). For a review of these competing explanations see Cross, Turgeon & Atherton (2019b).

Exploring changes in how participants view their own self-construal, specifically in independent/interdependent terms might prove a useful avenue, as changes in self-construal have also been shown to mediate the relationship between mimicry, another form of interpersonal coordination, and pro-sociality (Ashton, VanBaaren, Chartrand, Decety & Karremnas, 2007). Mimicry is a form of coordination that often involves complementary rather than synchronous actions with a co-actor (Chartrand & Bargh, 1999). Work by Koudenburg, Postmes, Gordijn and van Mourik Broekman, (2015) has shown that both synchronous and complementary coordination affected co-actors' sense of identity by producing a feelings of common group membership. However, they found that complimentary as opposed to synchronous coordination additionally led participants to experience a greater sense of personal value to the group. Thus, future work might wish to explore how complementary, in contrast to synchronous,

movements affect social outcomes such as pro-sociality as well as the role of group identification.

In conclusion, this work provides the first empirical evidence that the pro-social effects of a single coordination episode do persist after a delay. It also shows that people report feeling less like individuals and more like group members after coordination, which may mediate other pro-social effects of interpersonal coordination. Future work should explore changes in self-categorisation and self-construal alongside continuous measures of pro-sociality and other social consequences of coordination in order to further test this hypothesis.

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