Observing Synchrony in Dyads:

Effects on Observers' Expectations and Intentions

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Word count: 7983 words

Authors' notes regarding funding. William James Center for Research, ISPA - Instituto Universitário is supported by the FCT Grant No. UID/PSI/04810/2013

Acknowledgements: The authors would like to thank to Hugo Toscano, Thomas Shubert, and Daniel Lakens for sharing their stimuli material with us.

Authors contributions: All authors were involved in all parts of the research.

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Abstract

This research tested whether observing members of a dyad behave in synchrony influences observers' expectations and intentions about that dyad. In four studies, participants observed a dyad move in synchrony and were asked to make inferences about them. Results suggest that interpersonal synchrony serves as a social cue, such that observers expect the members of the dyad to work well together. Moreover, synchrony makes observers more likely to want to affiliate with the dyad. These findings shed light on how the social function of synchrony extends beyond the people who experience it to those who observe it.

Keywords: adaptability; affiliation; dyads; collective efficacy; interpersonal synchrony.

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Interpersonal synchrony shapes collective experiences by building common understanding, empathy and agreement (Kupper, Ramseyer, Hoffmann, & Tschacher, 2015; Lumsden, Miles, & Macrae, 2014). It fosters collaboration and promotes feelings of affiliation (Allsop, Vaitkus, Marie, & Miles, 2016; Launay, Tarr, & Dunbar, 2016). It enables social bonds to form quickly or to be reactivated as a way to prepare individuals for collective action (Wiltermuth & Heath, 2009), and it increases attention towards interaction partners (Macrae, Duffy, Miles, & Lawrence, 2008; Miles, Nind, Henderson, & Macrae, 2010).

Despite the wealth of research exploring the effects of synchrony on those who experience it, less attention has been paid to potential effects for those who observe it. The present studies investigate those effects by experimentally manipulating the synchrony with which dyads act, and test whether that influences observers' belief that the people in the dyad work well together, and their intention to affiliate with the dyad. If so, this means that the effects of synchrony reach beyond the boundaries of the group.

The few existing studies about the effects of synchrony on external observers show that synchronous groups are perceived to be more entitative, that is, to be seen as a unit, and that its members are thought to have rapport (LaFrance, 1985; Lakens, 2010; Lakens & Stel, 2011; Miles, Lind, & MaCrae, 2009; see also Vicary et al., 2017, for evidence that synchrony boosts aesthetic judgments of dance performance). This research builds on that previous work and tests whether inferences about synchronous groups also hold for whether group members are thought to work well together and adapt in the face of challenges, and whether observers of synchronous groups wish to affiliate and coalesce with them.

Indeed, there is research showing that the advantages of experiencing synchrony (i.e., for the group members) extend beyond the affective realm of how group members feel towards each other, and that there may be advantages at the cognitive level as well, for example, in facilitating action planning (Knoblich & Jordan, 2003), observational learning (Wilson & Knoblich, 2005), and how efficiently knowledge is transmitted between group members (Wilson, 2001). However, these are advantages of experiencing synchrony. The question in the present research is whether external observers expect those advantages, when perceiving rather than experiencing synchrony. That is, does the lay psychology of observers lead them to infer that other people acting in synchrony work better together? And does it make them want to affiliate and form a coalition with them? The present research tests whether interpersonal synchrony influences observers' inferences about the collective efficacy (i.e., do they work well together?) and adaptability (i.e., are they better able to surpass challenges?) of dyads. We predicted that observers' estimations of a dyad's collective efficacy (*Hypothesis 1*) and adaptability (*Hypothesis 2*) are higher when they act synchronously rather than asynchronously.

Interpersonal synchrony also signals the capacity for nurturing relations and overcoming problems that threaten group survival (Caporael, 1997). Moreover, experiencing synchrony can make group members feel more affiliated with each other (e.g., Cacioppo et al., 2014; Hove & Risen, 2009). Thus, we also predicted that observers would be more willing to affiliate with a dyad (*Hypothesis 3*) when watching them act synchronously rather than asynchronously.

Finally, the present studies took a dynamic approach to the study of synchrony. Many previous studies on synchrony look at the effects of synchronous vs. asynchronous interactions separately. While this approach is certainly beneficial in the

control it provides to the experiments, it misses the fact that groups do not act consistently in synchrony or asynchrony. The present studies use a repeated measures design whereby observers see dyads acting in synchrony vs. asynchrony at two different times, time 1 (T1) and time 2 (T2), in order to test whether changes in synchrony lead to changes in the beliefs and attitudes of observers. We predicted that observers' estimations of dyad collective efficacy (*Hypothesis 4*), adaptability (*Hypothesis 5*), and their affiliation intention (*Hypothesis 6*) towards the dyad would increase when asynchrony comes before synchrony and will decrease when asynchrony comes after synchrony.

Study 1

Method

Procedure

Participants were informed that this was a study on how humans form impressions about others' capacity to start and manage a business. They saw two videos (from Schubert, Toscano, & Waldzus, 2016; Toscano & Schubert, 2016) showing two women walking side-by-side facing forward. Each video lasted approximately 19 seconds. In order to ensure that movement alone accounted for any differences in participants' responses, the videos were muted, actors did not move their lips, and they kept their facial expressions as neutral as possible. One video showed the dyad walking in synchrony (actors moved the same limbs and kept identical frequency of limb movement while walking). The other video showed the dyad walking in asynchrony (actors moved opposite limbs, with different frequencies of limb movement while walking).

After each video, participants were asked five questions concerning their beliefs about the dyad's collective efficacy (adapted from Jex & Bliese, 1999; $\alpha_{T1} = .64$, $\alpha_{T2} =$

.72): “Think of the two people you just saw on the video. Imagine that they decide to start a business together. How likely are these two people to: be successful at this business; fail at this business (reverse coded); have the necessary competences to be successful together; be able to make decisions together; trust in each other’s capacity to manage the business?”

Then participants were asked about the dyad’s ability to adapt. Six items were adapted from Marques-Quinteiro, Ramos-Villagrasa, Passos, and Curral (2015; α_{T1} = .74, and α_{T2} = .78): “Now imagine that the two people you just saw on the video have managed to implement their business. One day, they receive a letter from the Tax Department demanding that they pay a debt that is so high that the survival of their business is severely threatened. How likely are these two people to: be capable of solving the situation; be forced to declare bankruptcy (reverse coded); find innovative ways to deal with the situation; develop an action plan to deal with the situation in a short period of time; learn new competences to deal with the situation; maintain focus while dealing with the situation?”

Participants were then asked to answer a question assessing their intentions to affiliate with the dyad: “Imagine that the two people you saw in the video invited you to join them to manage the business. How likely would you be to accept their invitation?”.

Responses to all items described above (collective efficacy, adaptability and affiliation intention) were given on a scale from 1 (very unlikely) to 5 (very likely).

Finally, perceived synchrony was measured with three items developed by Lakens and Stel (2011) (α_{T1} = .58, α_{T2} = .78): Participants rated the extent to which they agreed that “these people are a unit”, “these people can collaborate as a unit”, and “these people feel as if they belong together”. Responses were given on a scale from 1 (totally disagree) to 5 (totally agree). Some caution might be advised when interpreting

results on this measure, as perceived synchrony might not always match actual synchrony. Indeed, Vicary et al. (2017) found that actual synchrony was not always contingent with ratings of perceived togetherness made by observers. However, even if actual synchrony does not overlap perfectly with perceived synchrony, the latter might still be predictive of observers' thoughts and feelings towards the dyad. Therefore, in the present studies, we use perceived synchrony not only as a manipulation check, but also as a potential correlate of scores on the main dependent variables.

The procedure just described was implemented for each of the two videos.

Data regarding rapport were also collected in Studies 1-3. The results for rapport are presented in the accompanying supplementary file. We report all measures, manipulations, and participants' exclusions for all studies.

Design

Participants were randomly assigned to one of two movement conditions. Movement condition was manipulated as a mixed-subjects factor, controlling for the order of that condition between-subjects (i.e., synchrony-asynchrony vs. asynchrony-synchrony).

Participants

Participants from Studies 1 and 3 originated from the same pool, but they only participated in one study. Studies 2 and 4 used different pools for data collection (social media recruitment and Mechanical Turk, respectively).

Participants in Study 1 were 68 individuals, with ages ranging between 18 and 53 years old (M = 20.71, SD = 4.80). Seventy-one percent of them were female and 94% were Psychology students. Participants received either course credit or a 5-euro voucher. We did not conduct an a priori power analysis, but instead aimed to collect 30

or more participants per condition. Data were not analysed prior to terminating collection.

Results

Between-subjects effects. Table 1 shows the descriptive statistics. The analysis of the between-subjects results was performed for T1 only. There were no significant differences between the synchronous vs. asynchronous conditions: collective efficacy, $t(66) = 0.64$, $p = .524$, 95% CI [-0.18; 0.36]; adaptability, $t(66) = -0.35$, $p = .731$, 95% CI [-0.32; 0.22]; affiliation intentions , $t(66) = -0.75$, $p = .455$, 95% CI [-0.65; 0.29]. Hypotheses 1, 2 and 3 were rejected.

Within-between subjects effects. The results of the within-subjects analysis yielded an interaction between order and movement condition for collective efficacy, $F(1, 66) = 12.36$, $p = .001$, $\eta_p^2 = .16$ and affiliation intention, $F(1, 66) = 4.41$, $p = .040$, $\eta_p^2 = .06$. The results for adaptability failed to reach the significance standard, $F(1, 66) = 3.78$, $p = .056$, $\eta_p^2 = .05$. Hypothesis 4 and 6 were supported. Hypothesis 5 was rejected.

Pairwise comparisons. Significant mean differences were found for collective efficacy, $M_{diff} = 0.44$, $SE = 0.10$, $p < .001$, 95%CI [0.27; 0.68], and affiliation intention, $M_{diff} = 0.27$, $SE = 0.13$, $p = .043$, 95%CI [0.01; 0.54], but only when synchrony was presented before asynchrony. When asynchrony was presented in the first place, no significant differences were found.

Perceived synchrony. The results for the manipulation check revealed the same pattern: There were no between-subjects differences, $t(66) = 0.13$, $p = .898$, 95% CI [-0.37; 0.42]. The interaction between order and condition is significant, $F(1, 66) = 20.77$, $p < .001$, $\eta_p^2 = .24$, with pairwise comparisons showing significant differences, but only when synchrony came before asynchrony, $M_{diff} = 0.91$, $SE = 0.17$, $p < .001$,

95%CI [0.57; 1.25]. Finally, and more importantly, perceived synchrony predicted inferences and intentions towards the dyad: five out of the six correlations between perceived synchrony and the three main dependent variables were positive and significant (see Table 2).

Discussion

The results of Study 1 suggest that only when the dyad was first seen acting in synchrony and subsequently in asynchrony, did observers decrease their estimations of its collective efficacy and showed less interest in affiliating with it. In contrast, when the dyad was first seen acting in asynchrony and then in synchrony, participants did not change their estimations of collective efficacy and adaptability; nor did this affect their affiliation intentions. These findings suggest that, from the observers' point of view, synchrony only becomes salient and potentially informative when a state of synchrony ceases to exist and turns into asynchrony.

Even though we did not predict this order effect, similar results can be found in previous research (e.g., Tajadura-Jiménez, Lorusso, & Tsakiris, 2013; Toscano & Schubert, 2015). For instance, Toscano and Schubert found that the extent to which a person judges another person's face as more or less trustworthy as a function of synchrony only changed when the synchronous stimulus occurred before the asynchronous one. Similarly, our results suggest that the most relevant information for individuals to make estimations of dyads' collective efficacy and adaptability is the contrast between synchrony and asynchrony.

One part of the explanation for these findings can be found in the general evaluation theory (Hsee & Zhang, 2010): The fact that it was not synchrony per se, but rather the contrast in different states of synchrony that influenced observers' evaluations of the dyad, is consistent with the notion that certain attributes are not easy to evaluate

in isolation. In fact, this seems to occur only when one is able to assess and directly compare different states of the attribute. In other words, some features might only become visible and acquire weight in decisions when people are confronted with multiple options where those features are present vs. absent (e.g., Krüger, Mata, & Ihmels, 2014). Research on fluency (Hansen, Dechêne, & Wänke, 2008; Wänke & Hansen, 2015) also shows the importance of contrasting stimuli: Absolute fluency has low informative value because there is no contrasting stimulus on which individuals can ground their appraisals, whereas relative fluency is highly informative because it relies on contrasts between two different stimuli, which give the perceiver a reference. Moreover, and parallel to our findings, Hansen et al. (2008) found that changing from high to low contrast may be more salient than changing from low to high contrast, which might explain the order effect that we found.

Theory on the feature-positive effect (Newman, Wolff, & Hearst, 1980) would also suggest that a feature such as interpersonal synchrony grows more salient when synchrony becomes absent after having been present, as opposed to becoming present after having been absent. Specifically, seeing asynchrony after synchrony might influence perceptions because the cue is more noticeable when changing from presence to absence. In contrast, an initial asynchronous/absent condition is not as effective at establishing synchrony as a conspicuous cue. This explanation is also in line with the aforementioned relative fluency effect documented by Hansen et al. (2008).

Grounded on this line of reasoning, one possible interpretation for the results in Study 1 is that the repeated measures design enabled participants to use a joint evaluation mode while judging the dyads. The fact that participants could contrast two different synchrony stimuli might have helped them make more differentiated judgments about the dyads. In Study 2, we tested the robustness of this finding.

Study 2

In order to test whether the effect of the synchrony manipulation is larger when there is a contrast between synchrony and asynchrony, and specifically when synchrony precedes asynchrony, we created an additional condition to the series of synchronous and asynchronous conditions, such that three moments were presented: Some participants saw a synchrony-asynchrony-synchrony (SAS) sequence, whereas others saw an asynchrony-synchrony-asynchrony (ASA) sequence. The rationale was that, if synchrony could only have an effect when contrasted with a subsequent asynchrony condition, then there should be a difference between synchrony at T1 and asynchrony at T2, but not between asynchrony at T1 and synchrony at T2, as in Study 1. Moreover, once synchrony has been established as a relevant cue, it should maintain its referential value for subsequent judgments, and a difference both between asynchrony at T2 and synchrony at T3, in one condition, and between synchrony at T2 and asynchrony at T3, in the other condition, would be expected. In short, it was expected that significant differences in participants' estimations would emerge between stimuli every time asynchrony was presented after synchrony.

Method

Procedure and design

The procedure and design were identical to Study 1, except that participants saw three videos per condition, instead of two: 1) synchrony-asynchrony-synchrony; or 2) asynchrony-synchrony-asynchrony. The targets were the same as in Study 1.

Participants

Participants were 52 individuals, with ages ranging between 24 and 66 years old (M = 37.37, SD = 10.42); 69% female. Participants were recruited through social media. Participation was voluntary, with no financial compensation. To compute the necessary

sample size, we used G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007) to conduct a power analysis on a mixed design (F-test, repeated measures, within-between interaction), and selected the procedure based on effect from direct variance, considering the partial eta squared ($\eta_p^2 = .05$) of Study 1. The input parameters were: effect size $f = 0.23$, $\alpha = .05$, power = .80, groups = 2, measurements = 3, correlation among repeated measures = .24, non-sphericity correction = 1 (default). This analysis suggests that, for a critical F of 3.09, at 80% power, a sample size of 48 was required.

Measures

The measures were the same as in Study 1: Collective efficacy ($\alpha_{T1} = .81$, $\alpha_{T2} = .84$, $\alpha_{T3} = .90$), adaptability ($\alpha_{T1} = .88$, $\alpha_{T2} = .84$, and $\alpha_{T3} = .92$), affiliation intention, and perceived synchrony ($\alpha_{T1} = .80$, $\alpha_{T2} = .75$, $\alpha_{T3} = .82$).

Results and Discussion

Between-subjects effects. Table 1 shows the descriptive statistics. Similar to Study 1, the results of between-subjects comparisons at T1 do not reveal significant differences between conditions: collective efficacy, $t(50) = 1.01$, $p = .319$, 95% CI [-0.17; 0.51]; adaptability, $t(50) = 1.27$, $p = .209$, 95% CI [-0.14; 0.64]; affiliation intentions, $t(50) = 0.83$, $p = .411$, 95% CI [-0.40; 0.96].

Within-between subjects effects. The results of the within-subjects analysis yielded an interaction between order and condition for collective efficacy, $F(2, 100) = 7.06$, $p = .001$, $\eta_p^2 = .12$, adaptability, $F(2, 100) = 4.20$, $p = .018$, $\eta_p^2 = .08$, and affiliation intention, $F(2, 100) = 5.24$, $p = .007$, $\eta_p^2 = .10$.

Pairwise comparisons. The results of pairwise comparisons suggest that in the SAS condition, seeing synchrony at T1 vs. asynchrony at T2 led to significant differences in expected collective efficacy, $M_{diff} = 0.39$, $SE = 0.12$, $p = .002$, 95%CI [0.12; 0.63], adaptability, $M_{diff} = 0.45$, $SE = 0.13$, $p = .001$, 95%CI [0.20; 0.71], and

affiliation intention, M_{diff} = 0.56, SE = 0.22, p = .014, 95%CI [0.12; 1.00]; seeing asynchrony at T2 vs. synchrony at T3 only led to significant differences in ratings of collective efficacy, M_{diff} = -0.34, SE = 0.12, p = .006, 95%CI [-0.59; -0.10]. For the ASA condition, whereas seeing asynchrony at T1 vs. synchrony at T2 did not produce differences, seeing synchrony at T2 vs. asynchrony at T3 led to different ratings of collective efficacy, M_{diff} = 0.30, SE = 0.12, p = .013, 95%CI [0.06; 0.53]. Although the trend for adaptability and affiliation intention at T2 vs. T3 is as expected (see Table 1), these differences were not significant.

Perceived synchrony. Results for the manipulation check revealed no significant between-subjects differences, $t(50) = 2.01$, p = .050, 95% CI [0.001; 1.42], but the order-by-condition interaction emerged, $F(1, 100) = 9.80$, $p < .001$, $\eta_p^2 = .16$. Pairwise comparisons show that in the SAS condition, significant differences were found for synchrony vs. asynchrony, M_{diff} = 0.87, SE = 0.20, $p < .001$, 95%CI [0.46; 1.27], and asynchrony vs. synchrony, M_{diff} = -0.71, SE = 0.20, p = .001, 95%CI [-1.10; -0.31]. In the ASA condition, significant differences were found for synchrony vs. asynchrony only, M_{diff} = 0.42, SE = 0.19, p = .031, 95%CI [0.04; 0.80]. Importantly, and as in Study 1, perceived synchrony predicted expectations and intentions toward the dyad: all nine correlations between perceived synchrony and the three other dependent variables at times 1, 2 and 3 were significant (see Table 3).

The results from Study 2 suggest that the extent to which synchrony influences observers' expectation and intentions towards a dyad is moderated by the order in which dyads are seen interacting in synchrony vs. asynchrony.

Study 3

Despite their consistency, the Studies 1 and 2 results were derived from a single pair of targets. In order to test the generalizability of these findings, Study 3 included an

additional pair of targets. This enabled us to test whether the inferences that observers make from seeing dyads act in synchrony vs. asynchrony are limited to the same dyad: or whether they spill over from watching a dyad act in a certain state of synchrony to then watching another dyad act in a different state of synchrony. Furthermore, since walking synchronously or asynchronously might be perceived as being more or less effortful (Lumsden et al., 2014; Semin & Cacioppo, 2008), and because that may account for the inferences about the dyad's attributes, we added a measure of perceived effort as a control.

Following the results from Study 1 and Study 2, we expected that observers would use synchrony to infer collective efficacy and adaptability, and to form affiliation intentions towards the dyad, but only when synchrony would be followed by asynchrony. No hypotheses were derived apriori for the effect of seeing the same versus different pairs of targets.

Method

Procedure and design

The procedure was the same as in Studies 1-2, except that in Study 3 we had a mixed design where movement condition was presented as a within-subjects factor, while the order of that condition (i.e., synchrony-asynchrony vs. asynchrony-synchrony) and pair of targets (i.e., same vs. different) were between-subjects factors. Two pairs of targets were used: the one from the previous studies and a new pair. These were also women walking side-by-side in the same environment (these new videos were also tested by Schubert et al., 2016).

Participants

Participants in Study 3 were 58 undergraduate psychology students with ages ranging between 18 and 46 years old (M = 22.36, SD = 6.89); 84.5% female. We used

G*Power 3.1.9.2 (Faul et al., 2007) to conduct a power analysis on a mixed design (F-test, repeated measures, within-between interaction), and selected the procedure based on effect from direct variance, considering the partial eta squared from Study 2 (η_p^2 = .08). The input parameters were: effect size f = 0.29, α = .05, power = .80, groups = 4, measurements = 2, correlation among repeated measures = .28, non-sphericity correction = 1. This analysis showed that for a critical F of 2.80, with the actual power of 83%, a sample of 52 participants was required.

Measures

Collective efficacy (α_{T1} = .76, α_{T2} = .88), adaptability (α_{T1} = .81, α_{T2} = .91), and perceived synchrony (α_{T1} = .75, α_{T2} = .75) were measured as in Studies 1-2. Affiliation intention was measured using six items adapted from Cacioppo et al. (2014): "Thinking of the two women you just saw walking side-by-side, how likely would you be to: join their business venture, if invited; feel rapport with them; trust them; like them; enjoy collaborating with them; feel close to them?" (α_{T1} = .90, α_{T2} = .92). Responses were given on a scale from 1 (very unlikely) to 5 (very likely). Perceived effort was also measured as a control measure, adapting one item developed by Lumsden et al. (2014): "How much effort do you think the two people are exerting while walking?". Responses were given on a scale from 1 (no effort at all) to 5 (a lot of effort).

Results

Between-subjects effects. The results of the between-subjects analysis at T1 (see Table 1) did not reveal significant differences across conditions: collective efficacy, $t(56) = 1.86$, $p = .069$, 95% CI [-0.02; 0.57]; adaptability, $t(56) = 0.45$, $p = .657$, 95% CI [-0.24; 0.38]; affiliation intention, $t(56) = 0.95$, $p = .349$, 95% CI [-0.21; 0.59].

Within-between subjects effects. Perceived effort did not influence results on any of the three dependent variables at either time, all Fs ≤ 0.59, all ps > 0.05. The

predicted order-by-condition interaction emerged for collective efficacy, $F(1, 54) = 13.82$, $p < .001$, $\eta_p^2 = .20$, adaptability, $F(1, 54) = 10.18$, $p = .002$, $\eta_p^2 = .16$, and affiliation intention, $F(1, 54) = 9.19$, $p = .004$, $\eta_p^2 = .15$. None of the 2-way interactions was qualified by a significant 3-way interaction with pair of targets (all Fs ≤ 3.67, all ps $\geq .061$).

Pairwise comparisons. All ratings decreased when participants saw asynchrony after synchrony: collective efficacy, $M_{diff} = 0.50$, $SE = 0.14$, $p = .001$, 95%CI [0.21; 0.79]; adaptability, $M_{diff} = 0.50$, $SE = 0.15$, $p = .001$, 95%CI [0.21; 0.80]; affiliation intention, $M_{diff} = 0.44$, $SE = 0.15$, $p = .006$, 95%CI [0.13; 0.75]. No significant differences were found when comparing synchrony after asynchrony. And no significant contrasting effects were observed for different dyads.

Perceived synchrony. The manipulation check did not show significant differences between-subjects, $t(56) = 1.49$, $p = .096$, 95% CI [-0.08; 0.95], but showed the order-by-condition interaction, $F(1, 54) = 24.11$, $p < .001$, $\eta_p^2 = .30$, and a target–by-condition interaction, $F(1, 54) = 5.49$, $p = .023$, $\eta_p^2 = .09$. Regarding the order-by-condition interaction, pairwise comparisons suggested that expected collective efficacy increased in the asynchrony vs. synchrony condition, $M_{diff} = -.56$, $SE = 0.19$, $p = .005$, 95%CI [-0.94; -0.18], and decreased in the synchrony vs. asynchrony condition, $M_{diff} = 0.80$, $SE = 0.20$, $p < .001$, 95%CI [0.39; 1.21]. As for the target–by-condition interaction, perceived synchrony decreased when participants saw different dyads, $M_{diff} = 0.45$, $SE = 0.20$, $p = .028$, 95%CI [0.51; 0.84]. Finally, and more importantly, in five out of six tests, perceived synchrony correlated with the other dependent measures (see Table 4).

Discussion

Replicating the results of Studies 1-2, this study showed that the synchrony with which dyads act (manipulated or measured) influences observers' expectations and intentions toward those dyads. As in the previous studies, this occurred only when synchrony was presented before asynchrony. Since the 3-way interaction was not statistically significant for pair of targets, we cannot draw any conclusions regarding the existence of boundary conditions under same vs. different pair of targets. Therefore, the findings up until this third study are consistent in that the order in which participants observe others behaving synchronously or asynchronously matters for how well observers think that synchronous dyad members work together, and whether that makes observers wish to join them

Study 4

In Studies 1-3, a very specific cover story was used, concerning whether the dyad members would be successful in a business venture. Moreover, there was only one type of synchronous movement (walking side-by-side), and there was no control condition. Study 4 aimed to solve these limitations and strenghten our findings.

In this study, a different set of actors performing a different type of synchronous behaviour was presented, and we included a control condition to ensure that interpersonal synchrony was causing the observed effects. Furthermore, instead of asking about specific business abilities, no context-specific cover story was presented, and we simply asked observers about a more general belief that the dyad could work well as a team.

Method

Procedure and design

Participants were told that this was a study on social relations in groups. They watched a video and were asked about the dyad's collective efficacy, perceived effort and interpersonal synchrony.

Participants were presented with 9-second movie clips showing two women waving their left arm either synchronously, or asynchronously (used in Lakens & Stel, 2011). As in Studies 1-2, only one pair of targets was used. Study 4 had a mixed design whereby movement condition was presented as a within-subjects factor, while the order of that condition (i.e., synchrony-asynchrony vs. asynchrony-synchrony) and experimental vs. control conditions were set as between-subjects factors.

In the experimental conditions, participants watched a sequence of two videos where the target pair was presented side-by-side, as in the previous studies. In the control group, participants were presented with sequences of videos where the individual targets appeared one after the other. That is, participants would first see one video showing a member of the dyad alone waving her arm, and only afterwards they would see another video showing the other participant waving her arm, separately.

Critically, the exact same image stimuli were used in the experimental and control conditions. Whereas in the experimental condition the two women appeared simultaneously in the video, in the control condition the exact same videos were cropped in half, which enabled the separate presentation of each member of the dyad, one after the other, instead of simultaneously. The rationale was that synchrony (or lack of) could be inferred much more easily in the conditions where the members of the dyad were presented simultaneously rather than separately, because synchrony (and asynchrony) can only exist when two individuals interact.

Participants

Participants were 57 individuals, recruited through Mechanical Turk. Ages ranged between 18 and 72 years old (M = 35.02, SD = 13.60); 58% female. We used G*Power 3.1.9.2 (Faul et al., 2007) to conduct a power analysis on a mixed design (F-test, repeated measures, within-between interaction), and selected the procedure based on the effect from direct variance, considering the partial eta squared of Study 3 (η_p^2 = .066). The input parameters were: effect size f = 0.27, α = .05, power = .80, groups = 4, measurements = 2, correlation among repeated measures = .34, non-sphericity correction = 1 (default). This analysis showed that for a critical F of 2.78, with the actual power of 81%, a sample of 56 participants was required.

Measures

Three items were used to measure expected collective efficacy: "How well would you expect these two people to work together as a team?", "How effective would you expect these two people to be in solving problems together?", and "To what extent do you agree that together, as a team, these two people can achieve much more than each of them by themselves?" (α_{T1} = .89, α_{T2} = .91). Responses were given on a scale from 1 (totally ineffective) to 5 (totally effective).

Perceived synchrony was measured by asking: "To what extent do you agree that the two people felt in synchrony while waving?" Responses were given on a scale from 1 (totally disagree) to 5 (totally agree). Perceived effort was measured as in Study 3.

Results

Between-subjects effects. The analysis of between-subjects estimations in the experimental conditions revealed a significant difference in expected collective efficacy,

$F(1, 53) = 6.64$, $p = .013$, $\eta_p^2 = .11$, with the synchronous condition leading to more positive estimations than the asynchrony condition. No differences were observed in the control group, $F(1, 53) = 0.37$, $p = .546$, $\eta_p^2 = .01$.

Within-between subjects effects. Differently from Study 3, perceived effort influenced participants' estimations of collective efficacy on both measurement occasions, Fs ≤ 11.67, all ps $< .05$. When controlling for perceived effort, the results for collective efficacy revealed a three-way interaction, $F(1, 51) = 4.30$, $p = .043$, $\eta_p^2 = .08$ (see Table 1). The same analysis without controlling for perceived effort as a covariate reveals similar results: $F(1, 53) = 6.98$, $p = .011$, $\eta_p^2 = .12$.

Pairwise comparisons. For the experimental condition, expected collective efficacy decreased when participants saw synchrony vs. asynchrony, $M_{diff} = -1.10$, $SE = 0.29$, $p < .001$, 95%CI [-1.68; -0.52], and increased when they saw asynchrony vs. synchrony, $M_{diff} = 1.06$, $SE = 0.26$, $p < .001$, 95%CI [0.53; 1.59]. For the control group, a significant decrease in collective efficacy was observed for the synchrony vs. asynchrony condition, albeit to a smaller extent than in the experimental condition, $M_{diff} = -0.73$, $SE = 0.32$, $p = .026$, 95%CI [-0.09; -1.36], and no difference was observed for asynchrony vs. synchrony.

Perceived synchrony. The manipulation check showed significant between-subjects differences, $F(1, 53) = 34.82$, $p < .001$, $\eta_p^2 = .40$, for the experimental group; as well as a three-way interaction, $F(1, 51) = 11.14$, $p = .002$, $\eta_p^2 = .18$, for within-subjects differences. Pairwise comparisons for the experimental group showed significant differences in the synchrony vs. asynchrony condition, $M_{diff} = 2.61$, $SE = 0.42$, $p < .001$, 95%CI [1.77; 3.45], and the asynchrony vs. synchrony condition, $M_{diff} = -2.67$, $SE = 0.46$, $p < .001$, 95%CI [-3.59; -1.75]. For the control group, significant differences were only found in the synchrony vs. asynchrony condition, $M_{diff} = 1.53$, $SE = 0.50$, $p = .004$,

95%CI [0.51; 2.54], and again to a smaller extent than in the experimental condition. More importantly, and replicating what was observed in all previous studies, the correlation between perceived synchrony and expected collective efficacy was significant at both times (see Table 5).

Meta-Analysis

The results of the between-subjects comparisons at T1 were not always consistent. Thus, to test the robustness of our findings we conducted internal meta-analyses of the between-subjects differences for collective efficacy, adaptability, affiliation intentions, and perceived synchrony at T1. Since the four experiments were methodologically similar, we conducted these meta-analyses using a fixed effects model in which the mean effect size (i.e., mean correlation) was weighted by sample size (Cumming, 2014; Goh, Hall, & Rosenthal, 2016). We first converted Cohen's *d* into Pearson's correlation *r* for ease of analysis. All correlations were then Fisher's *z*-transformed for analyses and converted back to Pearson correlations for presentation (Goh et al., 2016).

Collective efficacy and perceived synchrony were analysed in Studies 1-4 (the control group from Study 4 was not included). Adaptability and affiliation intentions were analysed in Studies 1-3 (these measures were not included in Study 4).

Results showed significant differences for all dependent variables: $M\ r_{collective\ efficacy}$=.21, Z=3.20, p <.001; $M\ r_{adaptability}$=.09, Z=1.20, p <.001$M\ r_{affiliation}$ =.11, Z=1.46, p <.001; $M\ r_{perceived\ synchrony}$ =.28, Z=3.94, p <.001. It seems that the synchrony with which a dyad is seen leads observers to believe they are capable of working well together, and feel more willing to affiliate with the dyad.

General Discussion

The results of four studies, using different dyads, different forms of synchrony, different dependent variables, different samples and several forms of control, suggest that synchrony influences people's expectations and attitudes towards dyads. Specifically, interpersonal synchrony in dyads influences observers' estimations of collective efficacy and adaptability, as well as their willingness to affiliate with those dyads. Whereas most previous research focused mainly on the effects of experiencing synchrony (i.e., for the group members), the present research examined the effects of experiencing synchrony for outside observers. We collected experimental evidence for these effects, whereby the manipulation of synchrony influenced observers' responses towards the dyads, as well as correlational evidence, such that perceived synchrony predicted observers' responses in 21 out 23 tests throughout the four studies.

Regarding the order effect observed in Studies 1-3, the evidence was less consistent. This effect was not expected a priori. However, upon observing it in Study 1, we set out to test it in Studies 2-3, which again supported it. However, this was not the case in Study 4, where synchrony led to more favourable expectations and intentions than asynchrony regardless of which condition was presented first. Therefore, the findings are mixed and inconclusive with regard to this order effect.

Implications

This research builds on recent work which looked into how synchrony in dyads influences the way observers see them as tight unit and as having rapport; LaFrance, 1985; Lakens, 2010; Lakens & Stel, 2011; Miles et al., 2009). Nevertheless, it extends that work by investigating how observers' inferences carry over to more cognitive domains about the dyad's capacity to achieve a common goal, as well as observers' intentions to affiliate and form a coalition with the dyad.

The current research also goes beyond previous contributions by investigating synchrony in a dynamic fashion. Rather than simply contrasting inferences about synchronous vs. asynchronous stimuli, we examined how observing changes across these states influences observers' intentions and beliefs. Considering the evidence that synchrony promotes not only affective states but also cognitive work (Wilson, 2001; Wilson & Knoblich, 2005), this means that lay psychology is able to pick up on valid cues to navigate the social world. That is, perceivers expect synchronous group members to work better together, which is probably the case.

Finally, the fact that observers are more willing to join synchronous groups suggests that the perception of synchrony might be a key mechanism in group formation. This research adds to the growing body of research suggesting that interpersonal synchrony has a key role in promoting sociality, and that its effects extend to the groups' proximate context (e.g., Caporael, 1997; Konvanlinka et al., 2011; Launay et al., 2016; Miles et al., 2009; Mogan, Fischer, & Bulbulia 2017; Sebanz et al., 2006).

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Table 1

Mean values and standard deviation for Studies 1 through 4.

Study 1	[a] Synchrony vs. Asynchrony				[b] Asynchrony vs. Synchrony			
	Time 1		Time 2		Time 1		Time 2	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Collective efficacy.	3.22	0.63	2.75	0.61	3.13	0.48	3.16	0.45
Adaptability.	3.11	0.63	2.83	0.58	3.15	0.47	3.14	0.51
Affiliation intentions.	2.39	1.00	2.12	1.05	2.57	0.95	2.69	1.16
Perceived synchrony.	3.44	0.80	2.54	0.92	3.42	0.83	3.60	0.94

Study 2	[a] Synchrony vs. Asynchronous vs. Synchrony						[b] Asynchrony vs. Synchrony vs. Asynchronous					
	Time 1		Time 2		Time 3		Time 1		Time 2		Time 3	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Collective efficacy.	3.39	0.72	3.00	0.51	3.34	0.71	3.22	0.48	3.25	0.61	2.96	0.62

Adaptability.	3.41	0.14	2.96	0.12	3.37	0.14	3.17	0.13	3.14	0.11	3.06	0.13
Affiliation intentions.	2.80	0.25	2.24	0.22	2.80	0.23	2.51	0.24	2.63	0.21	2.37	0.23
Perceived synchrony.	3.77	1.18	2.91	1.02	3.61	1.04	3.21	0.82	3.30	0.91	3.23	1.00

Study 3	Same pair of targets								Different pair of targets							
	[a] Synchrony vs. Asynchrony				[b] Asynchrony vs. Synchrony				[c] Synchrony vs. Asynchrony				[d] Asynchrony vs. Synchrony			
	Time 1		Time 2		Time 1		Time 2		Time 1		Time 2		Time 1		Time 2	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Collective efficacy.	3.34	0.63	2.71	0.59	2.95	0.59	3.43	0.67	3.49	0.47	3.12	0.73	3.33	0.49	3.30	0.67
Adaptability.	3.20	0.66	2.58	0.64	3.06	0.58	3.39	0.73	3.38	0.62	3.00	0.74	3.38	0.50	3.31	0.61
Affiliation intentions.	2.92	0.84	2.44	0.93	2.61	0.52	3.16	0.78	3.02	0.63	2.62	0.67	2.94	0.96	2.78	0.61
Perceived synchrony.	3.20	1.21	2.76	1.09	3.15	1.13	3.93	0.77	3.93	0.68	2.83	0.80	3.10	0.73	3.45	0.85

Study 4	Experimental group								Control group							
	[a] Synchrony vs. Asynchrony				[b] Asynchrony vs. Synchrony				[c] Synchrony vs. Asynchrony				[d] Asynchrony vs. Synchrony			
	Time 1		Time 2		Time 1		Time 2		Time 1		Time 2		Time 1		Time 2	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Collective efficacy.	3.71	0.95	2.58	0.74	2.62	0.88	3.67	1.26	3.33	0.77	2.92	0.73	3.27	0.74	3.38	0.90
Perceived synchrony.	4.00	1.21	1.38	0.72	1.64	0.84	4.29	1.20	3.42	1.08	2.00	0.95	2.33	1.18	3.00	1.13

Note. Study 1, [a]$n = 33$. [b]$n = 36$. Study 2, [a]$n = 25$. [b]$n = 27$. Study 3, [a]$n = 29$. [b]$n = 29$. [c]$n = 27$. [d]$n = 31$. Study 4, [a]$n = 28$. [b]$n = 27$. [c]$n = 27$. [d]$n = 28$.

Table 2

Correlations for Study 1.

	1	2	3	4	5	6	7
1. Collective efficacy $_{T1}$	1	-	-	-	-	-	-
2. Adaptability $_{T1}$	.33**	1	-	-	-	-	-
3. Affiliation intention $_{T1}$	.24*	.32**	1	-	-	-	-
4. Perceived synchrony $_{T1}$	.40**	.34**	.15	1	-	-	-
5. Collective efficacy $_{T2}$	.37**	.29*	.29*	.06	1	-	-
6. Adaptability $_{T2}$	.17	.46**	.25*	.10	.47***	1	-
7. Affiliation intention $_{T2}$	.15	.24	.73***	.004	.51***	.46***	1
8. Perceived synchrony $_{T2}$	.01	.15	.21	.31*	.54***	.51***	.48***

Note. *** $p < .001$. ** $p < .01$. * $p < .05$.

Table 3

Correlations for Study 2.

	1	2	3	4	5	6	7	8	9	10	11
1. Collective efficacy $_{T1}$	1	-	-	-	-	-	-	-	-	-	-
2. Adaptability $_{T1}$	.68***	1	-	-	-	-	-	-	-	-	-
3. Affiliation intention $_{T1}$	.53***	.53***	1	-	-	-	-	-	-	-	-
4. Perceived synchrony $_{T1}$	.69***	.57***	.47***	1	-	-	-	-	-	-	-
5. Collective efficacy $_{T2}$	.44**	.33*	.13	.31*	1	-	-	-	-	-	-
6. Adaptability $_{T2}$	.29*	.49***	.04	.28*	.72***	1	-	-	-	-	-
7. Affiliation intention $_{T2}$	.20	.30*	.52***	.22	.59***	.41**	1	-	-	-	-
8. Perceived synchrony $_{T2}$	.13	.07	.12	.39**	.52***	.36**	.49***	1	-	-	-
9. Collective efficacy $_{T3}$	.45**	.42**	.31*	.37**	.43**	.29*	.17	.08	1	-	-
10. Adaptability $_{T3}$	.33*	.57***	.24	.36**	.19	.36**	.05	.01	.78***	1	-
11. Affiliation intention $_{T3}$	.29*	.47***	.76***	.35*	.14	.03	.60***	.14	.55***	.51***	1
12. Perceived synchrony $_{T3}$	.29*	.32*	.36**	.55***	.10	.01	.16	.68***	.68***	.65***	.60***

Note. *** $p < .001$. ** $p < .01$. * $p < .05$.

Table 4

Correlations for Study 3.

	1	2	3	4	5	6	7
1. Collective efficacy $_{T1}$	1						
2. Adaptability $_{T1}$	.53***	1	-	-	-	-	-
3. Affiliation intention $_{T1}$	.47***	.45**	1	-	-	-	-
4. Perceived synchrony $_{T1}$	.41**	.22	.34**	1	-	-	-
5. Collective efficacy $_{T2}$	.15	.12	.07	-.06	1	-	-
6. Adaptability $_{T2}$	-.06	.25	-.02	-.15	.84***	1	
7. Affiliation intention $_{T2}$	.04	.11	.35**	-.01	.69***	.59***	1
8. Perceived synchrony $_{T2}$	-.14	-.05	-.09	.17	.45***	.40**	.57**

Note. *** $p < .001$. ** $p < .01$.

Table 5

Correlations for Study 4.

	1	2	3
1. Collective efficacy $_{T1}$	1	-	-
2. Perceived synchrony $_{T1}$	.63***	1	-
3. Collective efficacy $_{T2}$	-.06	-.28*	1
4. Perceived synchrony $_{T2}$	-.39**	-.60***	.56***

Note. *** $p < .001$, ** $p < .01$, * $p < .05$.