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## Observing Joint Action: Coordination Creates Commitment

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### Abstract

Previous research has shown that interpersonal coordination enhances pro-social attitudes and behavior. Here, we extend this research by investigating whether the degree of coordination observed in a joint action enhances the perception of individuals' commitment to the joint action. In four experiments, participants viewed videos of joint actions. In the low coordination condition, two agents made independent individual contributions to a joint action. In the high coordination condition, the individual contributions were tightly linked. Participants judged whether and for how long the observed agents would resist a tempting outside option and remain engaged in the joint action. The results showed that participants were more likely to expect agents to resist outside options when observing joint actions with a high degree of coordination. This indicates that observing interpersonal coordination is sufficient to enhance the perception of commitment to joint action.

### Keywords

commitment; coordination; joint action; social expectations; cooperation

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From cooking meals to carrying tables and building houses, joint action is a pervasive and important feature of human sociality. Joint action can be defined as 'any form of social interaction whereby two or more individuals coordinate their actions in space and time to bring about a change in the environment' (Sebanz et al., 2006: 70; Butterfill, 2012). It has been argued that humans are uniquely able and motivated to coordinate their actions, and do so more flexibly and in a wider variety of contexts than other species (e.g. Melis & Semmann, 2010; Konvalinka et al., 2010; Garrod & Pickering, 2009; Tomasello, 2009; Silk, 2009).

Moreover, humans tend to find it intrinsically pleasurable to coordinate with others (Melis, 2013; Tomasello, 2009), and there is evidence that coordination can enhance rapport (Bernieri, 1988) and trust (Launay et al., 2013; Mitkidis et al., 2015), and lead to cooperation in social dilemmas (Wiltermuth & Heath, 2009; Van Baaren et al., 2004) as well as pro-social helping behavior (Kokal et al., 2011; Valdesolo & Steno, 2011). The mere observation of interpersonal coordination creates a perception of rapport (Miles, Nind & Macrae, 2009), unity (Lakens & Stel, 2010; Lakens, 2010), and the impression of a shared goal (Ip et al., 2006).

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The present study investigated whether the degree of coordination in a joint action also enhances observers' perception of the agents' commitment to the joint action. When two agents coordinate their contributions to a joint action, they form and implement interdependent, i.e. mutually contingent, action plans. Each agent must therefore have -- and rely upon -- expectations about what the other agent is going to do. Indeed, the higher the degree of coordination, the more spatiotemporally exact must those expectations be. One important consequence is that an agent's performance of her contribution within a highly coordinated joint action expresses her expectations about the other agent's upcoming actions, as well as her reliance upon those expectations. This may generate social pressure on the other agent to perform her contribution in order to avoid disappointing the other's expectation and wasting her efforts. If so, then an observer who takes the perspective of one of the agents involved in the joint action may sense this and expect the agents involved to remain engaged until the goal is completed, and to resist distractions and tempting alternative options.

To test the hypothesis that perceived coordination enhances observers' perception of the agents' commitment to the joint action, we asked participants to view videos of a joint action with high and low degrees of coordination. One individual was presented as having the task of cleaning up a large pile of sand, and a second individual passing by joined in because the pile was blocking his way. In the high coordination condition, the two agents then formed a chain, with one of them scooping sand into a bucket and passing the bucket to the other agent, who emptied it into a container. In the low coordination condition, the two agents worked in parallel, each with his own bucket. The conditions were matched for actual effectiveness (number of overall steps taken and buckets of sand cleaned up).

In the videos in Experiments 1 and 2, it was apparent that the pile of sand would soon be reduced sufficiently for the second agent to pass. The possibility of moving on presented this agent (the 'helper') with a tempting outside option. In Experiment 3, the helper's phone rang as the video stopped, presenting a different tempting outside option (i.e. taking the call). We operationalized perceived commitment as observers' expectation that the agent faced with the tempting outside option would resist this option and remain engaged in the joint action. We asked for an estimate of the time the helper would remain engaged as the pile grew smaller and the way past became clear (Experiments 1 and 2) and how long the observers themselves would remain engaged in that situation (Experiment 2). In Experiment 3, we asked participants how likely they thought it was that the agent would resist the temptation to take the call, and also how likely it was that they themselves would do so if they were in that situation. We predicted that observers would perceive more commitment in the high coordination condition, and would therefore estimate that the helper would continue longer in Experiments 1 and 2, and judge the helper as less likely to take the call in Experiment 3.

We also included further test questions designed to probe the psychological mechanisms underpinning participants' perception of commitment. First, in Experiments 1 and 2, we asked observers how long the initiator of the joint action (the 'helpee') would expect the helper to continue doing his part. If the effect of coordination upon perceived commitment depends upon the fact that agents express their expectations by performing their

contributions to highly coordinated joint actions, then observers may think that the helpee will expect the helper to remain engaged longer in the high coordination condition.

Secondly, we gave half of the participants in Experiment 2 explicit instructions to engage in perspective-taking (i.e. to take the perspective of the helper in predicting how long he would continue to help, and to take the helpee's perspective in judging how long he expected the helper to continue). If coordination increases perceived commitment by creating social pressure for each agent to fulfill the expectation that the other is relying upon and thus to avoid wasting her effort and/or forcing her to stop and re-plan, then taking the helper's perspective may lead participants to sense this social pressure and accordingly to perceive a higher degree of commitment. If, on the other hand, coordination increases perceived commitment simply by revealing agents' expectations -- which observers can use as a heuristic without sensing any social pressure to conform to those expectations or to avoid wasting others' efforts -- then taking the helpee's perspective should increase perceived commitment, whereas taking the helper's perspective may not.

We also asked participants in all experiments to rate the effectiveness of the joint action. If they perceive the high coordination condition as more effective, then they may consider the helper's abandonment of the joint action in the high coordination condition to be more detrimental to the helpee than in the low coordination condition, and therefore expect him to help longer in virtue of a general prosocial tendency to help according to the needs of the helpee.

To investigate whether observers used explicit normative criteria for commitment or an implicit sense of commitment, we asked participants to judge whether the helper had an obligation to help (Experiments 1 and 2) or how (in-)appropriate it would be to take the call (Experiment 3). If coordination affects perceived commitment through implicit expectations, the degree of coordination should not affect judgments about obligations or (in-)appropriateness.

## Experiment 1a

### Method

**Participants**—We used *SurveyMonkey* to implement a web-based observational paradigm. Since each participant gave only one judgment per condition, and since online experiments produce greater variability than lab-based experiments, we expected a high variability in our dependent variables. We therefore opted for a within-subject design and a large sample size (we aimed to recruit 200 participants). We included data from those participants who had already begun the experiment when *SurveyMonkey* registered that this number had been reached. After excluding an additional 16 participants because they did not complete all of the questions, the dataset included 219 participants (127 females) between the ages of 19 and 86 ( $M = 47.62$  years,  $SD = 17.92$  years), all of whom were English-speaking adults living in the United States. Participants received a small monetary payment. The experiment was approved by the United Ethical Review Committee for Research in Psychology (EPKEB) in Hungary.

## Material and Procedure

All participants performed two trials, each of which began with a text describing the following basic scenario:

Peter has the task of cleaning up a pile of sand this morning. He expects it to take him about an hour. His neighbor Thomas is on his way home and finds his way blocked by the pile of sand and decides to help for a bit.

On each trial, participants then viewed one of two versions of a brief video of the interaction. The two trials were presented in counterbalanced order, one on the first trial and the other on the second trial. In the high coordination condition, the two agents form a chain, with one agent filling a bucket and passing it to the other agent in the chain. In the low coordination condition, the two agents work in parallel (see Figure 1).

In each condition, the process is repeated twice once the helper begins -- i.e. the agents either exchange the buckets twice or walk past each other twice. The videos were approximately 40 seconds in length. For each condition, there were two versions for the video, with each agent playing the role of the helper once and the role of the helpee once. Half of the participants viewed agent 1 in the role of the helper in both conditions, and the other half viewed agent 2 in the role of the helper in both conditions. When, after 40 seconds, the video stopped, participants were presented with the following questions, always in this order:

- The 'perceived commitment question': How long do you think he'll continue to help? (0-90 minutes)
- The 'helpee question': How long do you think his neighbor expects him to help? (0-90 minutes)
- The 'obligation question': Does he have an obligation to help? (Yes or No)
- The 'effectiveness question': How effective was the joint action? (6 point scale ranging from highly ineffective to highly effective)

The perceived commitment question tested the prediction that observers would perceive more commitment in the high coordination condition, and would therefore estimate that the helper would continue longer. The purpose of the helpee question was to probe the psychological mechanisms underpinning participants' perception of commitment. If, as we hypothesized, the effect of coordination upon perceived commitment depends upon the fact that agents express their expectations by performing their contributions to highly coordinated joint actions, then observers may think that the helpee will expect the helper to remain engaged longer in the high coordination condition. The purpose of the obligation question was to investigate whether participants use explicit normative criteria for commitment or an implicit sense of commitment. If coordination affects perceived commitment through an implicit sense of commitment, the degree of coordination should not affect judgments about obligations. The purpose of the effectiveness question was to explore the possibility that participants may perceive the high coordination condition as more effective, even though the two conditions were matched for actual effectiveness. If they perceive the high coordination condition as more effective, then they may consider the

helper's abandonment of the joint action in the high coordination condition to be more detrimental to the helpee than in the low coordination condition, and therefore expect him to help longer in virtue of a general prosocial tendency to help according to the needs of the helpee.

Each question was presented on a separate screen in the same order as above. We did not counterbalance the order of questions because our main focus was on the first question.

## Results

For all analyses, we set the significance threshold at  $p = .05$ . We report exact p-values except where p-values are less than .001, in which case we report  $p < .001$ .

For the perceived commitment question (i.e., 'How long do you think he'll continue to help?'), a paired-sample t-test revealed a significant effect of coordination upon perceived commitment: in the high coordination condition, participants gave higher estimates of how long the helper would likely continue to help ( $M = 31.76$ ,  $SD = 22.22$ ) than in the low coordination condition ( $M = 28.99$ ,  $SD = 21.46$ ),  $t(218) = 2.58$ ,  $p = .01$ ,  $d = 0.175$ .

For the helpee question (i.e., 'How long do you think his neighbor expects him to help?'), we observed a numerical difference in the same direction, with participants giving higher estimates in the high coordination condition, ( $M = 32.71$ ,  $SD = 26.96$ ) than in the low coordination condition ( $M = 31.68$ ,  $SD = 26.81$ ), but a paired-sample t-test revealed no significant difference,  $t(218) = 0.97$ ,  $p = 0.33$ . This may be because some participants interpreted the word 'expect' in a normative sense, and performed a normative evaluation: many participants gave '0' as a response to the helpee question (14% in the high coordination condition and 15%), whereas none did so for the perceived commitment question in either condition. Relatedly, many participants gave '30 minutes' as a response to the helpee question (31% in the high coordination condition and 27% in the low coordination condition). Thus, some participants may have performed a simple calculation: knowing that the helpee anticipated working for about an hour, they may have simply divided 60 minutes by 2, and thereby arrived at '30' as an answer.

We did however observe a significant correlation between the differences in estimates that participants gave in response to the perceived commitment question for the two conditions, on the one hand, and the differences in estimates that they gave in response to the helpee question on the other,  $r(219) = .489$ ,  $p < .001$ .

Answers to the obligation question revealed that very few participants perceived an obligation to help. Only 13% of participants answered 'yes' in the high coordination condition and 12% in the low coordination condition. A McNemar's test revealed no significant difference in the proportions of participants answering 'yes' to the obligation question in the two conditions,  $X^2(1, N = 219) = 0.83$ ,  $p = .774$ .

For the perceived effectiveness question, a paired-sample t-test revealed no significant difference between the high coordination condition ( $M = 3.21$ ,  $SD = 1.49$ ) and the low coordination condition ( $M = 3.13$ ,  $SD = 1.44$ ),  $t(218) = 0.77$ ,  $p = .44$ . We did not observe any significant correlation between the differences in response to the effectiveness question

for the two conditions, on the one hand, and the differences in response to the commitment question on the other,  $r(219) = .077, p = .259$ . Nor did we observe any significant correlation between the differences in response to the effectiveness question for the two conditions, on the one hand, and the differences in response to the helpee question on the other,  $r(219) = .018, p = .718$ .

In order to investigate whether the differences in participants' responses in the two conditions may have been driven in part by sequence effects, we also ran a second set of analyses upon the responses that each participant gave to the first video, implying a between-subject design where each participant was assigned to one of the two conditions. For the perceived commitment question, an independent-samples t-test revealed a significant effect of coordination, with participants giving higher estimates in the high coordination condition ( $M = 32.51, SD = 24.16$ ) than in the low coordination condition ( $M = 26.19, SD = 18.99$ ),  $t(217) = 2.14, p = .033, d = 0.293$ . For the helpee question, we observed a non-significant numerical difference in the same direction, with participants giving higher estimates in the high coordination question ( $M = 32.79, SD = 28.58$ ) than in the low coordination condition ( $M = 29.80, SD = 24.82$ ),  $t(217) = 0.823, p = .411$ . A Chi-squared test revealed no significant difference in the proportions of participants answering 'yes' to the obligation question in the two conditions,  $X^2(1, N = 219) = .147, p = .702$ . For the perceived effectiveness question, an independent-samples t-test revealed no significant difference between the high coordination condition ( $M = 3.84, SD = 1.54$ ) and the low coordination condition ( $M = 2.58, SD = 1.50$ ),  $t(217) = .687, p = .493$ . However, we did observe a significant correlation between perceived effectiveness and responses to the perceived commitment question,  $r(219) = .152, p = .024$ . To control for the effect of perceived effectiveness on responses to the perceived commitment question, we also performed an ANCOVA with effectiveness as covariate, which revealed a significant effect of coordination upon perceived commitment even after controlling for perceived effectiveness,  $F(1, 216) = 4.23, p = .01, \eta_p^2 = .019$ . The covariate, perceived effectiveness, was significantly related to the perceived commitment,  $F(1, 216) = 4.79, p = .03, \eta_p^2 = .022$ .

## Discussion

The results revealed the predicted effect of coordination on perceived commitment when participants judged how long the helper would remain engaged. The significant correlation of responses to the perceived commitment question with responses to the helpee question (i.e. the question about the helpee's expectations) indicates that coordination may enhance perceived commitment by making observed agents' expectations salient. However, although a numerical difference in the same direction was observed for responses to the helpee question the difference was not significant -- perhaps because some participants interpreted the word 'expect' in a normative sense, and/or because the response format (0-90 minutes) led many participants to take a detached stance and perform a calculation.

The pattern of responses observed for the obligation question indicates that the difference in perceived commitment between the high and low coordination conditions did not depend on an explicit normative understanding of commitment. Although perceived effectiveness did not differ significantly between conditions (i.e. neither in the within-analysis nor in the

between-analysis), and the effect of coordination upon perceived commitment was significant even when controlling for perceived effectiveness in the between-subjects analysis, the between-subjects analysis did reveal that responses to the effectiveness question were significantly correlated with responses to the perceived commitment question. We therefore ran Experiment 1b to check whether our manipulation successfully targeted perceived coordination.

## Experiment 1b

Experiment 1b was performed in order to check whether the videos were well-matched with respect to the degree of effectiveness perceived by our participants, and also to validate that participants perceived the joint action in the high coordination condition as being more tightly coordinated than the joint action in the low coordination condition.

### Method

**Participants**—As in Experiment 1a, we used *SurveyMonkey* to implement a web-based observational paradigm. To avoid possible demand effects, we opted for a between-subject design. Since the results of the between-subjects analysis of participants' responses to the first test question in Experiment 1a were broadly in line with the results of the analysis of the entire dataset as a within-subjects design, we determined that the same sample size would be sufficient, i.e. 200 participants (100 per condition). We also included data from participants who completed the experiment before *SurveyMonkey* registered that the target of 200 had been reached. After the exclusion of 12 participants who had not completed all of the test questions, our sample included 207 participants (106 females) between the ages of 18 and 81 ( $M = 46.97$  years,  $SD = 17.18$  years), who were randomly assigned either to a high coordination condition (117 participants) or to a low coordination condition (90 participants). All participants were English-speaking adults living in the United States. They each received a small monetary payment. The experiment was approved by the United Ethical Review Committee for Research in Psychology (EPKEB) in Hungary.

### Material and Procedure

Each participant performed one trial. Each trial began with the same text describing the same scenario as in Experiment 1a, followed by one of the same videos as in Experiment 1a (i.e., in the high coordination condition the agents form a chain; in the low coordination condition they work in parallel). When, after 40 seconds, the video stopped, participants were presented with the following questions, each on a separate screen, and always in this order:

- The 'effectiveness question': How effective was the joint action? (6 point scale ranging from 'highly ineffective' to 'highly effective')
- The 'reliance question': To what extent did the agents seem to be relying on each other? (5 point scale from 'not at all' to 'completely')
- The 'coordination question': To what extent did the two agents' actions seem to be coordinated? (5 point scale from 'not at all' to 'completely')



As in Experiment 1a, we included the effectiveness question in order to explore the possibility that participants may perceive the high coordination condition as more effective, and accordingly consider the helper's abandonment of the joint action in the high coordination condition to be more detrimental to the helpee than in the low coordination condition. We also included the reliance question in order to check that participants perceived the agents in the high coordination condition to be more interdependent than in the low coordination condition -- since coordination requires each agent to have -- and rely upon -- expectations about what the other agent is going to do. We hypothesize that this may enhance perceived commitment because when one agent is relying upon her expectation about a second agent's upcoming action, this may generate social pressure on that second agent to perform her contribution in order to avoid disappointing the other agent's expectation and wasting her efforts. The coordination question aimed to check that participants indeed perceived the joint action as being more highly coordinated in the high coordination condition.

## Results

For the perceived effectiveness question, an independent-samples t-test did not reveal a significant difference in participants' estimates between the high coordination (i.e. chain) condition ( $M = 3.85$ ,  $SD = 1.65$ ) and the low coordination (i.e. no chain) condition ( $M = 3.42$ ,  $SD = 1.64$ ),  $t(205) = 1.84$ ,  $p = .068$ . For the reliance question, an independent-samples t-test revealed a significant effect of the chain manipulation, with participants giving higher estimates in the high coordination (i.e. chain) condition ( $M = 3.58$ ,  $SD = 1.11$ ) than in the low coordination (i.e. no chain) condition ( $M = 2.89$ ,  $SD = 1.28$ ),  $t(205) = 8.15$ ,  $p < .001$ ,  $d = 0.577$ . For the coordination question, an independent-samples t-test revealed a significant effect of the chain manipulation, with participants giving higher estimates in the high coordination (i.e. chain) condition ( $M = 3.57$ ,  $SD = 1.15$ ) than in the low coordination (i.e. no chain) condition ( $M = 2.87$ ,  $SD = 1.23$ ),  $t(205) = 4.17$ ,  $p < .001$ ,  $d = 0.588$ .

Although responses to the perceived effectiveness question did not differ significantly between conditions, they were significantly correlated with responses to the reliance question ( $r(1, 207) = .400$ ,  $p < .001$ ) as well as with responses to the coordination question ( $r(1, 207) = .445$ ,  $p < .001$ ). To control for the effect of perceived effectiveness on responses to the reliance and the coordination questions, we therefore performed an ANCOVA with effectiveness as covariate for each of these two other test questions. We found a significant effect of the chain manipulation upon reliance even after controlling for perceived effectiveness,  $F(1, 204) = 63.92$ ,  $p < .001$ ,  $\eta_p^2 = .239$ . The covariate, perceived effectiveness, was significantly related to reliance,  $F(1, 204) = 36.94$ ,  $p < .001$ ,  $\eta_p^2 = .153$ . We also found a significant effect of the chain manipulation upon coordination even after controlling for perceived effectiveness,  $F(1, 204) = 13.73$ ,  $p < .001$ ,  $\eta_p^2 = .063$ . The covariate, perceived effectiveness, was significantly related to coordination,  $F(1, 204) = 46.23$ ,  $p < .001$ ,  $\eta_p^2 = .185$ .

## Discussion

The results revealed that participants did not perceive the joint action in the high coordination condition as being significantly more effective than in the low coordination



condition, but that they did perceive the two agents to be relying on each other to a significantly higher degree, and to be coordinating their actions to a significantly higher degree. Although perceived coordination and perceived reliance were both correlated with perceived effectiveness, the effect of our manipulation upon perceived reliance and perceived coordination is significant even when controlling for perceived reliance. Taken together, these results indicate that the chain manipulation successfully modulates the degree of perceived reliance and perceived coordination, and that it does so independently of perceived effectiveness.

## Experiment 2

Although the results in Experiment 1 revealed the predicted effect of coordination on perceived commitment for the perceived commitment question, we could not demonstrate conclusively that participants expected the helpee to have higher expectations regarding the partner's contribution in the high coordination condition. This may have been because some participants interpreted the question about the helpee's expectations in a normative sense, and/or because asking about the number of minutes the helper would remain engaged led participants to take a detached, calculating stance.

In order to address these issues, we made two changes to the procedure of Experiment 1a. First, in order to discourage participants from taking a detached stance and performing a calculation in giving their responses to the perceived commitment question and the helpee question, we presented them with a 5- point scale ('Not at all', 'a few buckets', 'until about half the sand is cleaned up', 'until most of the sand is cleaned up', 'until the job has been completed') instead of asking them to estimate helping time in minutes (from 0-90). Secondly, in order to probe the psychological mechanisms underpinning the effect of perceived coordination upon perceived commitment, we introduced a perspective-taking condition. If coordination increases perceived commitment by creating social pressure for each agent to fulfill the expectation that the other is relying upon and thus to avoid wasting her effort, then taking the helper's perspective may lead participants to sense this social pressure and accordingly to perceive a higher degree of commitment. If, on the other hand, coordination increases perceived commitment by revealing agents' expectations -- which observers can use as a heuristic without sensing any social pressure to conform to those expectations or to avoid wasting others' efforts -- then taking the helpee's perspective should increase perceived commitment, whereas taking the helper's perspective may not.

## Method and Procedure

**Participants**—As in Experiments 1 and 2, we used *SurveyMonkey* to collect responses from English-speaking adults living in the US, this time with a between-subjects design. Based on the results of Experiments 1 and 2, we aimed to recruit 100 participants for each condition (4 conditions, 400 participants). After the exclusion of 31 participants who had not completed all test questions, our sample contained 376 participants (200 females) between the ages of 18 and 83 ( $M = 47.81$  years,  $SD = 15.07$  years). Each participant received a small monetary payment. The experiment was approved by the United Ethical Review Committee for Research in Psychology (EPKEB) in Hungary.

**Procedure**—For participants in the perspective-taking condition, the test questions included explicit instructions to take a particular agent's perspective (For the perceived commitment question: ‘If you were in Thomas’ position, how long do you think you would help?’ And for the helpee question: ‘If you were in Peter’s position, how long do you think you would expect Thomas to help?’) For participants in the no perspective taking condition, the questions were formulated as in Experiment 1. The effectiveness question and the obligation question were formulated as in Experiment 1 for all participants.

Participants were randomly assigned to one of four condition: high coordination/perspective-taking ( $n = 103$ ), high coordination/no perspective-taking ( $n = 97$ ), low coordination/perspective-taking ( $n = 83$ ), low coordination/no perspective-taking ( $n = 93$ ).

## Results

For the perceived commitment question, the ANOVA revealed a significant main effect of coordination, with participants giving higher estimates in the high coordination condition ( $M = 4.30$ ,  $SD = 1.10$ ), than in the low coordination condition ( $M = 4.00$ ,  $SD = 1.27$ ),  $F(1, 375) = 5.34$ ,  $p = .031$ ,  $\eta_p^2 = .014$ , as well as a significant main effect of perspective-taking, with participants in the perspective-taking condition giving higher estimates ( $M = 4.39$ ,  $SD = 1.19$ ), than participants in the no-perspective-taking condition ( $M = 3.93$ ,  $SD = 1.15$ ),  $F(1, 375) = 13.04$ ,  $p < .001$ ,  $\eta_p^2 = .034$ ). There was no significant interaction between coordination and perspective-taking ( $F(1, 375) = 1.03$ ,  $p = .311$ ).

For the helpee question, the ANOVA also revealed a significant main effect of coordination, with participants giving higher estimates in the high coordination condition ( $M = 3.09$ ,  $SD = 1.64$ ), than in the low coordination condition ( $M = 2.76$ ,  $SD = 1.62$ ),  $F(1, 375) = 4.38$ ,  $p = .046$ ,  $\eta_p^2 = .012$ , as well as a significant main effect of perspective-taking, with participants in the perspective-taking condition giving lower estimates ( $M = 2.76$ ,  $SD = 1.66$ ), than participants in the no-perspective-taking condition ( $M = 3.11$ ,  $SD = 1.60$ ),  $F(1, 375) = 4.79$ ,  $p = .024$ ,  $\eta_p^2 = .013$ . There was no significant interaction between coordination and perspective-taking ( $F(1, 375) = 0.24$ ,  $p = .689$ ).

Few participants perceived any obligation for the helper to contribute to the joint action: 11.5% of participants answered ‘yes’ in the high coordination condition and 16.48% in the low coordination condition; 12.9% of participants answered ‘yes’ in the perspective-taking condition and 14.74% in the no perspective-taking condition. Chi-squared tests revealed no significant effect of coordination ( $\chi^2(1, N = 376) = 1.95$ ,  $p = .164$ ) or of perspective-taking ( $\chi^2(1, N = 376) = 0.27$ ,  $p = .607$ ).

For the perceived effectiveness question, the ANOVA revealed no significant effect of coordination, with participants giving only slightly higher estimates of effectiveness in the high coordination condition ( $M = 4.09$ ,  $SD = 1.80$ ), than in the low coordination condition ( $M = 4.07$ ,  $SD = 1.71$ ),  $F(1, 375) = 0.01$ ,  $p = .937$ , nor of perspective-taking, with participants giving only slightly higher estimates of effectiveness in the perspective-taking condition ( $M = 4.16$ ,  $SD = 1.68$ ) than in the no-perspective-taking condition ( $M = 4.00$ ,  $SD = 1.73$ ),  $F(1, 375) = 0.79$ ,  $p = .430$ .

Responses to the perceived effectiveness question were significantly correlated with responses to the perceived commitment question ( $r(1, 376) = .33, p < .001$ ), as well as with responses to the helpee question ( $r(1, 376) = .128, p > .013$ ).

## Discussion

As in Experiment 1, the degree of coordination in an observed joint action affected perceived commitment. This time the effect of coordination was also present in judgments about the helpee's expectations. Interestingly, the instruction to engage in perspective-taking had opposite effects upon participants' responses to the perceived commitment question and to the helpee question: taking the perspective of the helper led participants to give higher estimates of how long he would remain engaged, whereas participants gave lower estimates of the helpee's expectations when taking his perspective. Thus, while taking the perspective of the helper may lead participants to sense the social pressure to remain engaged in the joint action, they are less aware of any such social pressure when taking the helpee's perspective than when they are not specifically instructed to take either agent's perspective -- perhaps because they tend implicitly to take the helper's perspective when not given any perspective-taking instructions. Neither the degree of coordination nor perspective-taking had any significant effect upon participants' judgments about the effectiveness of the joint action, nor upon their judgments about the whether the helper had an obligation to remain engaged.

## Experiment 3

Experiments 1 and 2 provided evidence that the degree of coordination observed in a joint action modulates the degree of perceived commitment to the joint action. In Experiment 3, we attempted to replicate the key effect of coordination on commitment, and to generalize it by introducing a different tempting outside option for the helper. Instead of presenting the possibility that the helper would be tempted to disengage from the joint action as the pile of sand grew smaller and his way became clear, we asked participants how likely it was that he would resist the temptation to answer a ringing telephone, and also how likely it was that they themselves would do so if they were in that situation.

## Method and Procedure

**Participants**—As in Experiments 1 and 2, data was collected with the help of *SurveyMonkey*. We collected responses from 209 participants (112 females) between the ages of 19 and 79 ( $M = 47.25$  years,  $SD = 14.76$  years), who were randomly assigned to the low coordination condition (99 Participants) and the high coordination conditions (110 Participants), excluding an additional 22 participants who did not complete all of the questions. For the same reasons as in Experiment 1 and 2, we aimed to recruit 100 participants per experimental condition (i.e. 200 in total). We also included data from those participants who had already begun the experiment when this number was reached. The participants were English-speaking adults living in the United States. Each of them received a small monetary payment. The experiment was approved by the United Ethical Review Committee for Research in Psychology (EPKEB) in Hungary.

**Procedure**—Participants in both groups were first presented with a modified description of the same scenario as in Experiments 1 and 2:

‘Peter has the task this morning of cleaning up the pile of sand that you see in this picture. He expects it to take about an hour. As you will see in a very brief video, his neighbor Thomas is passing by and decides to help for a bit.’

The only change to this description was that it no longer stated that Thomas finds his way blocked by the pile of sand. In experiments 1 and 2, we had included this detail because we wanted participants to think that Thomas has a clear (selfish) motivation to remain engaged for a few minutes, but that this motive will be removed in a few minutes. So, if he does remain engaged, it could not be because of any such selfish motive. In order to operationalize perceived commitment in terms of how long the helper could be expected to help, it was also important to avoid describing the scenario in such a way as to lead participants to think that in beginning to help, the helper had decided to help until the goal was fully reached (i.e. until all the sand had been cleaned up). In the current experiment, however, we operationalize perceived commitment in terms of resistance to the temptation to take a phone call rather than in terms of how long he can be expected to continue, so this issue does not apply.

Participants in the high coordination condition then viewed a version of the video in which the two agents formed a chain, whereas participants in the low coordination condition viewed a version in which the two agents worked in parallel. In contrast to the versions of the videos used in Experiments 1 and 2, all videos in Experiment 3 ended as the helper's telephone began to ring. Participants then responded to the following questions:

- The ‘perceived commitment question’: As you saw, the video ended with a phone ringing...how likely do you think it is that he will take the call? (highly unlikely, somewhat unlikely, somewhat likely, highly likely)
- The ‘first-person perceived commitment question’: How likely would you be to accept the call? (highly unlikely, somewhat unlikely, somewhat likely, highly likely)
- The ‘appropriateness question’: How appropriate do you think it would be to take the call? (completely inappropriate, somewhat inappropriate, somewhat appropriate, completely appropriate)
- The ‘effectiveness question’: How effective was the joint action? (6 point scale ranging from highly ineffective to highly effective)

The questions were always presented in this order, because our primary interest was in the first question.

## Results

For the perceived commitment question, an independent-samples t-test revealed a significant effect of coordination, with participants giving higher likelihood estimates in the low coordination condition ( $M = 3.42$ ,  $SD = 0.862$ ) than in the high coordination condition ( $M =$

3.1,  $SD = 1.02$ ),  $t(207) = 2.47$ ,  $p = .014$ ,  $d = 0.340$ . For the first-person perceived commitment question, an independent-samples t-test also revealed a significant effect of coordination, with participants giving higher likelihood estimates in the low coordination condition ( $M = 3.02$ ,  $SD = 0.96$ ) than in the high coordination condition ( $M = 2.62$ ,  $SD = 0.90$ ),  $t(207) = 3.05$ ,  $p = .003$ ,  $d = 0.43$ .

For the appropriateness question, an independent-samples t-test revealed a significant effect of coordination, with participants giving higher estimates of appropriateness in the low coordination condition ( $M = 3.01$ ,  $SD = 0.83$ ) than in the high coordination condition ( $M = 2.69$ ,  $SD = 0.91$ ),  $t(207) = 2.57$ ,  $p = .011$ ,  $d = 0.368$ . Responses to the appropriateness question were significantly correlated with responses to the perceived commitment question ( $r(209) = .267$ ,  $p < .001$ ) and with responses to the first-person perceived commitment question ( $r(209) = .418$ ,  $p < .001$ ).

For the effectiveness question, an independent-samples t-test revealed no significant difference between the low coordination condition ( $M = 3.84$ ,  $SD = 1.54$ ) and the high coordination condition ( $M = 3.69$ ,  $SD = 1.53$ ),  $t(207) = .70$ ,  $p = .489$ . Responses to the effectiveness question were not significantly correlated with responses to the perceived commitment question ( $r(209) = -.06$ ,  $p = .39$ ), with responses to the first-person perceived commitment question ( $r(209) = .03$ ,  $p = .662$ ), or with responses to the appropriateness question ( $r(209) = .100$ ,  $p = .148$ ).

## Discussion

In order to operationalize perceived commitment in Experiment 3, we introduced a different tempting outside option (resistance to the temptation to take the call). As in Experiments 1 and 2, the results support the hypothesis that the degree of coordination within the observed joint actions impacted participants' responses by raising the degree of perceived commitment. Given that participants in Experiments 1 and 2 were no more likely to judge that the helper had an obligation to help in the high coordination than in the low coordination, it was unexpected that participants judged it as more inappropriate for the helper to answer the phone in the high coordination condition than in the low coordination condition. This may be because participants did not interpret the word 'appropriate' in an explicitly normative sense.

## General Discussion

The results of the experiments reported here show that participants expected agents to be more resistant to tempting outside options when observing joint actions with a high degree of coordination than when observing joint actions with a low degree of coordination. This supports the hypothesis that perceiving a higher degree of coordination between individual agents enhances perception of their commitment to a joint action.

In Experiment 2, participants in the high coordination condition also gave higher estimates of how long the helpee would expect the helper to remain engaged. Moreover, the instruction to take the perspective of the helper increased participants' perception of commitment. These results support the hypothesis that coordination increases perceived

commitment by creating social pressure for each agent to fulfill the expectation that the other has and is relying upon, and thus to avoid wasting her effort and/or forcing her to stop and re-plan. Perspective-taking may lead participants to sense this social pressure and accordingly to perceive a higher degree of commitment. In contrast, taking the perspective of the helpee decreased participants' judgments about how long the helpee would expect the helper to remain engaged. This finding is difficult to reconcile with the hypothesis that coordination increases perceived commitment simply by revealing agents' expectations -- which observers may use as a heuristic without sensing any social pressure to conform to those expectations or to avoid wasting others' efforts.

Across the three experiments, participants did not perceive the joint action as significantly more effective in the high coordination condition than in the low coordination condition, so differences in perceived effectiveness between the two conditions cannot explain the effect of coordination upon perceived commitment. This is important, because if participants had perceived the high coordination condition as more effective, they might have considered the helper's abandonment of the joint action in the high coordination condition to be more detrimental to the helpee than in the low coordination condition. Since this was not the case, our results cannot be fully explained in terms of a general prosocial tendency to help according to the needs of the helpee.

It is also unlikely that the differences in responses between the two conditions were due to different normative evaluations between the two conditions. While participants in Experiment 3 did judge it to be more inappropriate to answer the phone in the high coordination condition, participants in Experiments 1 and 2, who were asked a more explicitly normative question, were no more likely to judge that the helper had an obligation to help in the high coordination than in the low coordination. Finally, it is not possible to explain our results by appealing to the pro-social effects of movement synchrony either (Wiltermuth & Heath, 2009; Van Baaren et. al. 2004), since the helper's and helpee's movements were not synchronized throughout the videos in either of the two coordination conditions. It is an open question whether perceived commitment may also be enhanced by continuous synchronization.

Building upon previous research showing that coordination can enhance pro-social attitudes and behavior, our findings indicate that observing highly coordinated joint actions can enhance the perception of commitment to joint action. Consequently, coordination can give rise to an expectation that agents will be resistant to distraction and to tempting alternative options, increasing the likelihood that they will remain engaged until the goal of the joint action has been achieved. Further research is needed to investigate the extent to which these findings generalize to other forms of coordination and other types of joint action.

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**Figure 1. Depiction of the events presented in the videos viewed by participants in the high and low coordination conditions.**

A1-A4 are still frames from the videos in the high coordination condition, in which the two agents form a chain. B1-B4 are still frames from the videos in the low coordination condition, in which the agents work in parallel.