Journal of Behavioral Economics for Policy, Vol. 6, Special Issue 1, 93-107, 2022

Knowledge acquisition or incentive to foster coordination? A real-effort weak-link experiment with craftsmen

Mathieu Lefebvre[1]*, Lucie Martin-Bonnel de Longchamp[2]

Abstract
This paper presents an artefactual field experiment with craftsmen working on renovation projects to assess the effect of training programs and incentive schemes on coordination. Workers frequently fail to coordinate their tasks when not supervised by a project coordinator. This is particularly important in the construction sector where it leads to a lack of final performance in buildings. We introduce two different incentives: a first contract paying craftsmen only according to their individual performance, and a second contract paying a group of three craftsmen with a weak-link payment according to the group's worst performance. In addition, we test these incentives on two different subject groups: one is composed of craftsmen trained to coordinate their tasks, and the others are not. The results suggest that trained subjects coordinate at significantly higher effort levels than non-trained subjects when facing an individual-based incentive. However, when facing a group-based incentive, non-trained subjects seem to "catch up" trained subjects in terms of coordination level, while these latter subjects do not significantly increase their performance level.

JEL Classification: C01; C91; C92; C93

Keywords
coordination — real-effort weak-link experiment — artefactual field experiment — individual incentive — group incentive

[1] *Aix Marseille Univ, CNRS, AMSE, Marseille, France.*
[2] *BETA, University of Strasbourg, Strasbourg, France.*
***Corresponding author**: mathieu-julien.lefebvre@univ-amu.fr

Introduction

Coordination is a key to success for teams. For example, a sports team can have the best athletes, or a business the most talented employees but if they cannot coordinate their actions towards the goal, they will not succeed. Although necessary, specialisation and skills are not always sufficient to achieve the best outcomes. In this paper, we present the results of a real-effort artefactual field experiment[1] in which we compare, in a within-group design, individual-based and group-based incentives to coordinate on high effort levels for craftsmen working on renovation projects. The originality of the experiment is that it gathers "real" workers from the construction sector where, given the weak-link property of the tasks, coordination is essential, (i.e., one worker fails to achieve her goal and all the work is spoiled). Furthermore, we do not only assess the effects of different incentives, but also look at the impact of training to coordination by comparing subjects having exogenously been trained to coordination, and others who have not been.

A long literature has shown that, in many different situations, teams end up coordinating at inefficient outcomes (e.g., Van Huyck et al., 1990; Weber et al., 2001; Brandts and Cooper, 2006), and thus, failing to coordinate. Such coordination failure can be due to several reasons, but strategic uncertainty is an important factor making incentive contracts "fragile", particularly in environments presenting a weak-link property (Van Huyck et al., 1990; Cooper et al., 2018). This uncertainty arises when subjects find it too risky to exert a high-effort level (i.e., choosing the payoff-dominant effort), when they are not sure about their team members' strategies, while keeping in mind previous actions. Additional mechanisms are thus required to increase coordination, especially in larger groups.

Previous studies have pointed out five different tools that are helpful to facilitate coordination in weak-link situations. First, *costless pre-play communication* has been shown to promote coordination (see, for instance, Cooper et al., 1992; Blume and Ortmann, 2007). When subjects can send messages to their team members, before choosing their action, it reassures players on the other team members' intentions to target high effort levels, and helps them overcome strategic

[1] As defined by Harrison and List (2004), an artefactual field experiment is "the same as a conventional lab experiment but with a nonstandard subject pool".

uncertainty. Secondly, *endogenous group formation*, where subjects can endogenously choose their group members, has also proved to be very effective. Particularly, Riedl et al. (2016) show how exclusion can be a disciplining device.[2] When high performers can exclude low performers, the latter increase their effort to avoid being excluded. Chen (2017) also points out a social identity effect such that "a person who chooses her own group will more strongly identify with that group, and care more about the outcome of the group's other members".[3] Thirdly, Bornstein et al. (2002) show that *competition between groups* is also effective in increasing coordination[4]. They show that members of a group of seven were coordinating at much higher levels when additionally confronted to an inter-group payment. In such a competition, the group presenting the overall weakest effort level was paid nothing, whereas the other one was paid according to the weakest performance of their group members. The authors show that even when paying the "less efficient" group less (instead of nothing) than the other group, inter-group competition was still significantly more effective (but slightly less) than no competition. Fourthly, Chaudhuri et al. (2006, 2009), Schotter and Sopher (2003) and Attanasi et al. (2017) have proven the effectiveness of *inter-generational advice*. In their game, they simulate non overlapping generations with groups playing non simultaneously. When the first range of groups are done, they can pass on advice (in the form of written messages) to the succeeding groups (i.e., the next generation). Chaudhuri et al. (2009) explain that the second generation must start at an efficient level in order to maintain it in the following periods. Subjects, thus, have to receive the right advice and choose the right action. To achieve this, the authors show that the mechanism is most effective when the advice given from one generation to the next is shared to everybody and made common knowledge. A last efficient mechanism is the *priming of subjects' identity*, tested by Chen et al. (2014).[5] More specifically, when priming a minority identity (e.g., Asian, Caucasian), subjects are less likely to coordinate at high effort levels, whereas priming a school identity significantly increases efficient coordination and high payoffs. Thus, identity and subjects' prejudices play an important role in coordination.

On the grounds of these evidence, this paper presents a weak-link game, where the *weak-link* is the worst performance exerted by the member of a group of three players. Our subjects are craftsmen working on renovation construction sites. In a within-group design, we introduce successively an *Individual-based Incentive*, and a *Group-based Incentive*. Following Bortolotti et al. (2016), we implement a real-effort task, instead of a chosen-effort set-up, for two reasons. First, the "selection" of the highest effort with the *Individual Incentive* (and thus the efficiency of this incentive) would be trivial in a chosen-effort set-up. Second, an effort chosen by the subject might not represent her real abilities, and thus, the effort she would exert in reality.

The novelty of our experiment is twofold. First, we do not only compare individual and group incentives for active workers from the construction sector, but we specifically assign subjects individual performance targets they should achieve. Second, we look at the impact of exogenous training courses on group coordination. More specifically, the pool of subjects is made of construction craftsmen, working, among others, on (low energy) renovations, in the Region Grand Est, in north-eastern France. These craftsmen are working for different companies, they also may have different skills (e.g., electrician, carpenter, builder), but they are all used to work on renovation sites.[6] In particular, some of these craftsmen have been incentivised to coordinate their efforts (and tasks) through a training course on efficient coordination (the so-called *DORéMI* program). This training course teaches the craftsmen (1) efficient low energy renovation techniques, (2) how to coordinate their complementary tasks with other craftsmen, and (3) the importance of coordination to achieve high performance. Our control group is composed of craftsmen who did not participate in this training course. We are thus interested in identifying possible behavioural differences between trained and non-trained subjects, and seeing if a simple mechanism of exogenous training about coordination is efficient to achieve coordination at high effort levels. Our paper also contributes to the literature on coordination dynamics by providing evidence of the effect of individual and group weak-link incentives on effort provision and coordination, when subjects have to exert a real effort, rather than to choose their action. To our knowledge, Bortolotti et al. (2016) are the first and only one, until today, having implemented *Individual* and *Group Incentives* in a real-effort weak-link game.

Practically, the subjects have to count the number of ones in a table of 50 randomly selected ones and zeros. They have to resolve as many tables as possible in a given time period, by trying to attain individual performance targets (a minimum acceptable target, and a maximum ideal target) in terms of number of tables to resolve.[7] We normalize the cost-of-effort

[2] See also Croson et al. (2015) and Kopányi-Peuker et al. (2018).

[3] Attanasi et al. (2014, 2016) point out and confirm that subjective and objective social ties facilitate coordination in weak-link strategic situations.

[4] See also Fatas et al. (2006); Ishida (2006); Nalbantian and Schotter (1997); van Dijk et al. (2001); Riechmann and Weimann (2008).

[5] See also Chen and Chen (2011), Ciccarone et al. (2020) and Croson et al. (2008).

[6] A renovation site presents the weak-link property. Every craftsman has her own speciality and task to renovate a building. Their tasks are complementary to achieve an efficient final energy performance. Yet, when one of the craftsmen fails to efficiently execute her task, the buildings' final performance is (negatively) impacted. It thus depends on worst performance of all the craftsmen working on the renovation site.

[7] In the experiment, each subject is assigned two different targets. The goal is to mimic real working environment in which workers have tasks to execute. They can execute the minimum that has been required by their employer, or they can go further and perform their task even better. For example, a window installer can decide to "correctly" install a window, but she can also decide to install it in a air-tight way to increase the building's energy efficiency. Such tasks are often complementary with tasks of other co-workers. To continue our example, if not every co-worker achieves air-tightness, the potential energy performance of the building is decreased. We want the subjects to coordinate on the highest possible effort level. Thus,

across the subjects by scaling the targets to their actual individual abilities, in a first stage. Every subject thus has her own targets, and has to exert a substantial effort to attain the ideal target. In the *Individual treatment*, subjects experience no strategic uncertainty, and are paid according to their individual performance. In the *Group treatment*, subjects are randomly assigned in groups of three, which stay unchanged for the rest of the experience, except that trained subjects are assigned with other trained subjects, and the same is done for non-trained subjects. They are paid according to a weak-link payment function, that is, the worst performance exerted by all the members of their group. Every group member thus receives the same payment. Equal than in "standard" weak-link games, subjects experience strategic uncertainty.

The results of the experiment are mixed because of the lack of observations. Indeed, an important caveat regarding our results on the difference between trained and non trained subjects is the small sample of trained craftsmen that showed up (only nine subjects). Keeping this shortcoming in mind, the results suggest that trained subjects coordinate at higher effort levels than non-trained subjects, when facing an individual-based incentive. However, when facing a group-based incentive, non-trained subjects seem to "catch up" trained subjects in terms of coordination level, while these latter subjects do not significantly increase their performance level. This result suggests that offering a group-based incentive to subjects who have previously been trained on coordination, does not yield higher coordination levels. Yet, when enforcing the subjects to play sequentially with a given amount of time for the entire group (i.e., time constraint), trained subjects playing before the last one in the group, seem to adopt a self-restricting strategy, so that they perform significantly worse than when facing an individual-based incentive. It seems that the possibility of not achieving efficient coordination causes them stress. Hence, trained subjects voluntarily target lower performance levels to have the certainty to reach a sufficient high performance, so that the last member in the sequence order has enough time to reach her acceptable target. Such a strong effect of time constraint is not visible on the coordination behavior of non trained subjects. Finally, our results suggest that the tested incentives have different impacts on the subject groups' worst performance levels. Indeed, individual-based incentives may be better suited for trained subjects to achieve the highest average worst performance, whereas group-based incentives seem to be more efficient to increase non-trained subjects' worst performance. However, we must take these results with caution given the very low sample of trained participants.

The rest of the paper is structured as follows. Experimental design Section describes the experimental design. Results Section exposes descriptive statistics and the empirical results. Finally, in Discussion and concluding remarks Section we conclude after a discussion of our results.

assigning them only one target corresponding to the highest level may not permit to determine whether the subject is willing to achieve the best possible performance, or just the acceptable one.

Experimental design

The experiment consists of a real-effort game played repeatedly. Following Abeler et al. (2011) and Marchegiani et al. (2016), in all periods, subjects are confronted with a tedious and focus-demanding task, which consists of counting the number of ones in tables composed by 50 randomly placed ones and zeros. This task does not require any prior knowledge, and performance is easily measurable. Furthermore, there is little learning possibility and effort is costly. It ensures that the subjects all have the same utility by participating to this task. Throughout the experiment, subjects are randomly assigned to a group of three players having the same exogenous training on coordination. The groups are fix until the end of the session and it is not possible for a subject to know the identity of the other group members. During the experiment, subjects accumulate payoffs in ECU, with the conversion rule $100\,ECU = 1$ euro. Detailed instructions are read out loud by the experimenter before starting each stage, to ensure that the game's description is common information. Subjects have the possibility to simultaneously read these instructions on paper and ask any question out loud to the experimenter before beginning a stage. The instructions are available in the Appendix.

The individual productivity elicitation Before starting the repeated game, we introduce an individual productivity elicitation phase (Part 1 in the attached instructions) in order to set individual production targets. After a short (unpaid) training of two minutes, subjects have five minutes to count as many tables as possible. Subjects are offered a pure piece-rate compensation scheme of 10 ECU per correct table. The number of correct tables is used to design a feasible contractual effort in subsequent parts of the experiment, but subjects are not informed about this. As in Marchegiani et al. (2016) and Cosaert et al. (2019), this phase permits to normalize the cost-of-effort for the task across players by scaling the *individual performance targets*, assigned in the repeated real-effort game, to the subjects' actual abilities.

The repeated real-effort game The subjects then play a real-effort game with the same task, that is, to count the number of ones in tables. There are successively three stages of different time length. In Stages 1 and 2 (respectively Parts 2 and 3 in the attached instructions), subjects execute the task during five rounds of two minutes each. The main difference between both, is the incentive given to the subjects. Instead of being paid piece-rate as in the previous phase, subjects are successively offered an individual-based (in Stage 1) and a group-based (in Stage 2) incentive. In Stage 3 (Part 4 in the attached instructions), the subjects also face a group-based incentive, but they do not play simultaneously. As we expose below in the presentation of the incentives, in Stage 3, they are given six minutes for the entire group, and the sequence of their intervention is exogeneously imposed.

Subjects are assigned two different individual targets they have to attain in terms of number of correct tables. These targets are set individually following the productivity elicitation and subjects are asked to reach at least the (1) *acceptable performance target*, denoted $P_i^{acceptable\,target}$ (corresponding to 90% of their individual productivity), and at best the (2) *ideal performance target*, denoted $P_i^{ideal\,target}$ (corresponding to 110% of their individual productivity). Subjects are not made aware about how their targets are determined, nor that every participant has different targets. This prevents for strategic behavior during the productivity elicitation phase. We justify the 10% discount rate on the acceptable target by the tiredness that can result after repeating the task over and over. The ideal target, however, is voluntarily determined to be more difficult to achieve. Only very motivated subjects would thus try to attain it after having reached the acceptable target.

Assigning subjects two different targets has two goals. First, workers can execute the minimum that is required by their employer, or they can go further and perform their task even better. We want the subjects to coordinate on the highest possible effort level. Thus, assigning only one target corresponding to the highest level may not permit to determine whether the subject is willing to achieve the best possible performance, or just the acceptable one. Second, by introducing two performance targets (acceptable and ideal), we can make the following observations. When a subject executes her task until reaching her acceptable performance target $P_i^{acceptable\,target}$, it might indicate that she is willing to coordinate on an acceptable high effort level. However, when she goes further by reaching her ideal performance target $P_i^{ideal\,target}$, it might indicate that she is willing to coordinate on an even higher effort level, that is, an ideal very high effort level. In other words, she wants to coordinate on a common goal with the other group members.

Individual-based and group-based incentives. In Stage 1, subjects' payoffs are determined according to an individual-based incentive. The *Individual Incentive* for subject i in Stage 1, denoted π_i^{S1} is defined as follows:

$$\pi_i^{S1} = F + B \cdot \frac{Correct\,Tables_i}{P_i^{acceptable\,target}} \quad (1)$$

where $Correct\,Tables_i$ is the number of correctly counted tables by subject i, that is, the individual performance. We fix $F = 100$ and $B = 800$, namely, low fixed payment F, and high incentives B to coordinate at high effort levels (Cooper et al., 2018). The higher the individual performance, the higher the gain. In Stage 2, subjects also successively play five rounds of two minutes, but in each round, their payoffs were determined according to a group-based incentive. This incentive introduces a weak-link mechanism in order to induce subjects to coordinate on the highest effort level. The payoffs for a subject i in Stage 2 is defined as follows:

$$\pi_i^{S2} = F + B \cdot \min_{i \in 1,2,3} \left[\frac{Correct\,Tables_i}{P_i^{acceptable\,target}} \right] \quad (2)$$

In Stage 3, subjects face the same group-based incentive (2). However, they do not play five rounds of 2 minutes each, but instead, execute the task during three periods of 6 minutes each. The six minutes are however assigned to the entire group, and subjects have to play sequentially with an enforced sequence. In each period, subjects have a different playing sequence. Subjects have to reach at least $P_i^{acceptable\,target}$. Once attained, a button appears on the screen to hand over to the next group member at any moment. In case they continue until maximum $P_i^{ideal\,target}$, the handing over occurs automatically. This stage of the experiment has the particularity to indirectly enforce the task chronology (and thus their coordination) among subjects. It is thus very important for the subjects to be attentive to give the last player enough time to reach her target. Otherwise, every group member would be impacted by receiving a low payment. Hence, the design of Stage 3 adds a time constraint, which results in a severe "punishment" for the entire group, if not considered and respected. This time constraint also adds pressure on the subjects to work quickly to achieve their target.

Procedures Subjects were actual craftsmen working, among other, on energy renovations in the Region Grand Est in north-eastern France. They were recruited by the means of coordinators of renovation platforms located in the entire Region. They were invited to assist to an information meeting organized by the Region, where they were told that they could also participate in an economic experiment. The experiment was conducted with mobile devices (tablets) of the Laboratory of Experimental Economics of Strasbourg (LEES), using the software EconPlay.[8]

A total of 36 craftsmen participated in two different sessions. The sessions were organized in different cities, the first one taking place in Saint-Dié-des-Vosges in October 2018, with 27 non-trained (to coordination) craftsmen (denoted NT hereafter). The subject group with trained craftsmen (T) was tested in a session organized in Sélestat in December 2018, with unfortunately only 9 subjects showing up. Thus, these subjects participated to the same session. One session lasted one hour and a half, including time for instructions and the post-experience questionnaire. Trained craftsmen were trained through the *DORéMI* energy renovation training course, which stands for "Operational Device for the Energy Renovation of Individual Houses".[9]

The entire panel is composed of 9% of women, and 91% of men, who are, on average, between 41 and 50 years old. There is no significant difference between trained and non-trained subjects in terms of revenue. Table A.1 in the Appendix presents detailed descriptive statistics about the sample of

[8] econplay.fr.

[9] The program *DORéMI* started in 2011. It is a public-private partnership supported by the French Regional councils that aims at facilitating and structuring renovation projects. It is based on a three-days training during which participating craftsmen are taught technical, economic and financial tools to better coordinate their work with other craftsmen. Trainings are organized periodically in several Regions and craftsmen are free to participate or not.

craftsmen.

Results

Figure 1 displays, for both NT and T groups, the average number of correct tables during the productivity elicitation phase, and we observe no significant difference between both groups ($Z = -1.079$, p-value $= 0.281$).[10] It is thus possible to compare their performance in the three Stages of the experiment.

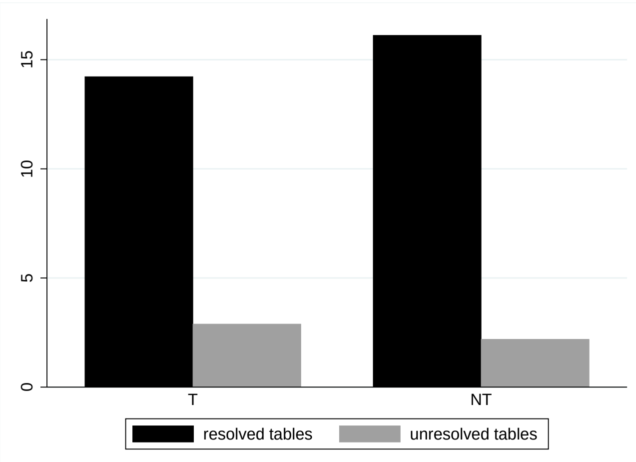


Figure 1. Average number of correctly and wrongly resolved tables in the elicitation phase

In order to assess the individual performance during the Stages, we define two individual performance indicators based on the targets. $PerfIndicator_i^{acceptable}$ and $PerfIndicator_i^{ideal}$ denote the percentage of a target, acceptable or ideal respectively, that is achieved by the subjects. Recall that in our experiment, the period ends automatically once a subject attains her ideal target. Hence, $PerfIndicator_i^{ideal}$ cannot be superior to 100%, contrary to $PerfIndicator_i^{acceptable}$. Table 1 shows the average performance indicators for both groups of subjects and according to the type of incentives (stages), namely *Individual-based Incentive* (I), *Group-based Incentive* (G) or *Group-based Incentive with time constraints* (G + t.c.). It also indicates the average worst group performances throughout the stages.[11]

On average, both subject groups perform better than their acceptable target, but do not achieve their ideal target. T subjects perform better than NT subjects when facing an individual-based incentive, and this is true for all five periods of **I** (stage 1, as displayed on Figure 2). This is also true for both types of performance, and the difference is statistically significant ($PerfIndicator_i^{acc.}$: $Z = 4.548$, p-value $= 0.000$; $PerfIndicator_i^{ideal}$: $Z = 2.011$, p-value $= 0.044$). It thus seems that training about coordination may have an effect on how subjects are willing to coordinate on higher effort levels. However, this result must be mitigated by the small number of trained subjects in our sample.

Performance indicator	**I** (Stage 1)	**G** (Stage 2)	**G + t.c.** (Stage 3)
Trained to coordination (T)			
$\overline{PerfIndicator}_{acceptable}$	142.4 %	142.8 %	138.9 %
$\overline{\min\left[PerfIndicator_i^{acceptable}\right]}$	117 %	112.2 %	112.6 %
$\overline{PerfIndicator}_{ideal}$	90.9 %	90.9 %	88.3 %
$\overline{\min\left[PerfIndicator_i^{ideal}\right]}$	79.9 %	77.5 %	74.3 %
Not trained to coordination (NT)			
$\overline{PerfIndicator}_{acceptable}$	121.9 %	131.8 %	130.5 %
$\overline{\min\left[PerfIndicator_i^{acceptable}\right]}$	100 %	113.7 %	110.6 %
$\overline{PerfIndicator}_{ideal}$	84.2 %	90.2 %	90.1 %
$\overline{\min\left[PerfIndicator_i^{ideal}\right]}$	68.7 %	79.5 %	76.3 %

I: *Individual-based incentive*, G: *Group-based incentive*, t.c.: *time constraint*.

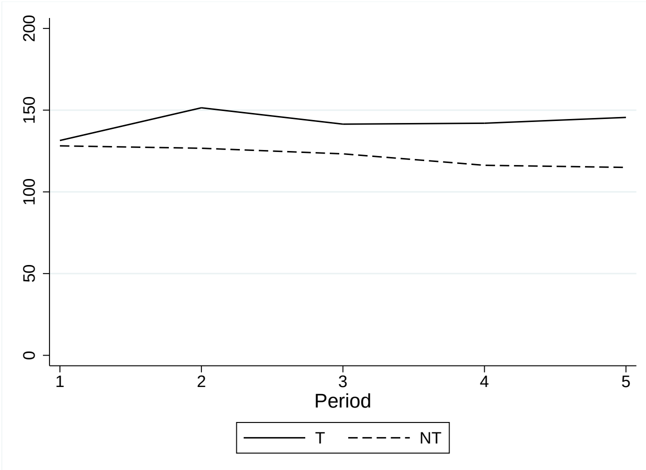
Table 1. Summary of average acceptable, ideal and worst group performances of T and NT when facing different incentives

In Stage 2 of the experiment (**G**), subjects are confronted with group-based incentives. In Table 1 and Figure 3, we do not see much difference between T and NT subjects. However, when comparing **I** and **G**, we note that NT subjects' average performance increases a lot compared to individual-based incentive. This important effect on NT subjects' performance is such that both groups' coordination levels seem to end up being more or less confounded, especially with regard to the ideal target. NT subjects coordinate at significantly higher effort levels with respect to their targets, when given a group-based incentive ($PerfIndicator_i^{acc.}$: $Z = -2.575$, p-value $= 0.010$; $PerfIndicator_i^{ideal}$: $Z = -2.726$, p-value $= 0.006$). On the contrary, we observe that T subjects do not significantly perform better with a group-based, than with an individual-based incentive ($PerfIndicator_i^{acc.}$: $Z = 0.070$, p-value $= 0.945$; $PerfIndicator_i^{ideal}$: $Z = -0.263$, p-value $= 0.793$). Interestingly, it seems that having been trained, leads to an already high level of performance, such that the group-based incentive does not impact coordination behaviour. Here again, we cannot exclude the possibility that this result is driven by the small number of observations.

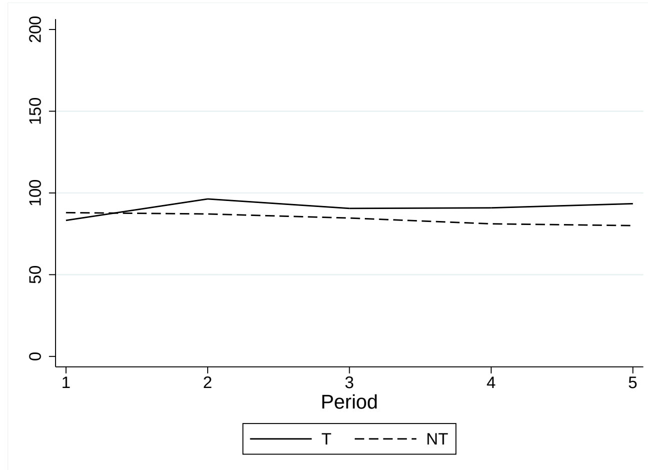
Finally, in the last stage of the game (**G + t.c.**), subjects are confronted with a group-based incentive with time constraint. As for Stage 2, we notice that there is no clear "domination" from one group of subjects to the other (see

[10] Unless specifically noted, we report the significance levels of a two-sided Wilcoxon-Mann-Whitney rank-sum test. Since we do not have normally distributed data and very small sample sizes (for our sample of trained subjects), this nonparametric test is recommended. Also, the Wilcoxon-Mann-Whitney test assigns a rank regardless of the group to which the value belong so that the large difference in sample sizes will not affect the test. However, this inequality lowers the power of the test compared to a test with the same total sample, but equal group sizes.

[11] Recall that the worst group performance is actually the minimum $PerfIndicator_i^{acceptable}$ of a group.



(a) $PerfIndicator_i^{acceptable}$



(b) $PerfIndicator_i^{ideal}$

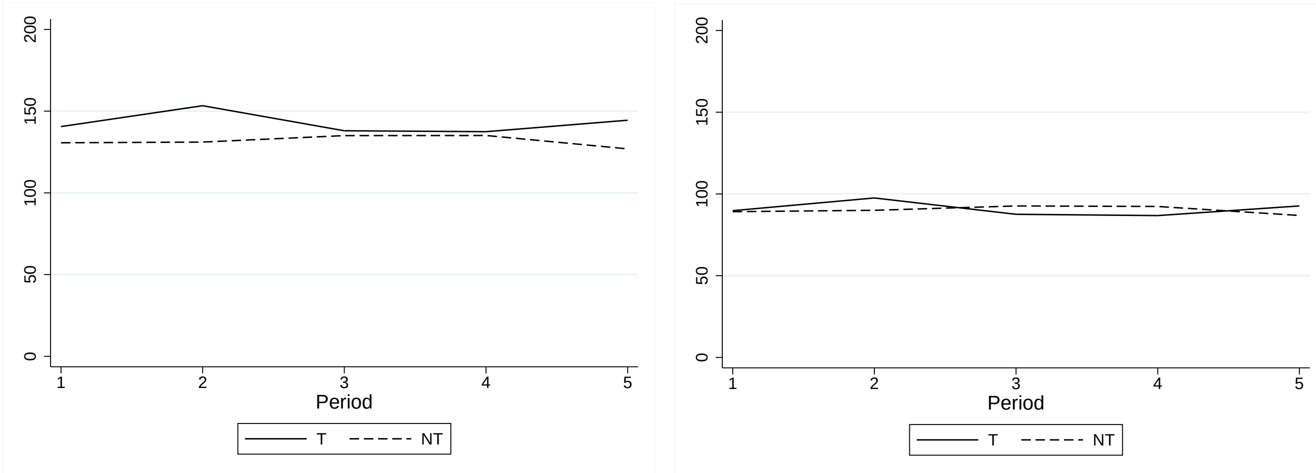
Figure 2. Evolution of subjects' average performance throughout the five periods of facing an individual-based incentive (Stage 1)

Table 1 and Figure 4). There is, on average, no significant difference between T and NT subjects' coordination performance, when playing sequentially, while facing a group-based incentive ($PerfIndicator_i^{acc.}$: $Z = 1.368$, p-value $= 0.171$; $PerfIndicator_i^{ideal}$: $Z = -0.659$, p-value $= 0.510$).

However, it is important to notice that these results do not take into account the sequence order in which the subjects intervene. The average performances, given the sequence order, and with respect to subjects' acceptable and ideal targets, are summarised in Figure 5. A first observation is that, when playing in the 3^{rd} position, T subjects achieve 100% of their ideal target. This is, on average, not the case when playing simultaneously. We indeed find that there is a significant difference of T subjects' coordination performance towards reaching their *ideal* target ($PerfIndicator_i^{ideal}$: $Z = -2.157$, p-value $=$ 0.031). This is not the case towards reaching their *acceptable* target ($PerfIndicator_i^{acc.}$: $Z = -1.219$, p-value $= 0.223$), and for NT subjects, who perform significantly equally than without time constraint, i.e., Stage 2 ($PerfIndicator_i^{acc.}$: $Z = -0.810$, p-value $= 0.418$; $PerfIndicator_i^{ideal}$: $Z = -1.386$, p-value $= 0.166$). Regarding the effect of time constraint on T subjects, we observe that, while there is no significant difference between those intervening at the first and second position ($PerfIndicator_i^{acc.}$: $Z = 0.139$, p-value $= 0.889$; $PerfIndicator_i^{ideal}$: $Z = 0.226$, p-value $= 0.821$), the last player to intervene performs significantly better than the first two players (1^{st} vs. 3^{rd}: $PerfInd_i^{acc.}$: $Z = -1.74$, p-value $= 0.082$; $PerfInd_i^{ideal}$: $Z = -2.840$, p-value $= 0.005$; 2^{nd} vs. 3^{rd}: $PerfInd_i^{acc.}$: $Z = -2.011$, p-value $= 0.044$; $PerfInd_i^{ideal}$: $Z = -2.842$, p-value $= 0.005$).

These findings are interesting, but it is important to keep in mind that they are obtained with only 3 groups of 3 trained subjects. Econometric results presented in the next section will then be also useful to explore the effects mentioned here. However, these results seem to indicate that time constraint may affect T subjects' coordination performances. A possible mechanism may be the stress felt by T subjects intervening before the last one. As they seem to be more sensitive than NT subjects towards high and successful coordination, the possibility to *not* achieve efficient coordination causes them stress. As a response strategy, we notice that they censor themselves by voluntarily targeting a lower performance level, and thus having the *certainty* to reach a sufficient high performance (even if lower than what they could have reached with more individual time), to leave the last member enough time to reach her acceptable target. This observation is supported by the fact that T subjects perform significantly worse (when not the last player) when facing a group-based incentive with time constraint, than when facing an individual-based incentive ($PerfIndicator_i^{acc.}$: $Z = 1.977$, p-value $= 0.048$; $PerfIndicator_i^{ideal}$: $Z = 2.220$, p-value $= 0.026$).

Regarding NT subjects, we find that they do not perform significantly better when being the last member to intervene, than when not (1^{st} vs. 3^{rd}: $PerfInd_i^{acc.}$: $Z = -1.091$, p-value $= 0.275$; $PerfInd_i^{ideal}$: $Z = -1.132$, p-value $= 0.258$; 2^{nd} vs. 3^{rd}: $PerfInd_i^{acc.}$: $Z = -1.315$, p-value $= 0.189$; $PerfInd_i^{ideal}$: $Z = -1.518$, p-value $= 0.129$). Yet, when playing as the first or second member, we observe that NT subjects do *not* perform significantly better, than when facing an individual-based incentive ($PerfIndicator_i^{acc.}$: $Z = -1.042$, p-value $= 0.297$; $PerfIndicator_i^{ideal}$: $Z = -1.348$, p-value $= 0.178$). *Without* time constraint, this was however the case. Nevertheless, they also do *not* significantly perform worse *with*, than *without* time constraint ($PerfIndicator_i^{acc.}$: $Z = 1.065$, p-value $= 0.287$; $PerfIndicator_i^{ideal}$: $Z = 0.604$, p-value $= 0.546$). Hence, in a first place, time constraint seems to put a certain pressure on players intervening before the last one. Yet, in a second place, it becomes clear that it does not significantly alter the efficiency of giving NT subjects a group-based, instead of an individual-based incentive. Note that when considering



(a) $PerfIndicator_i^{acceptable}$ **(b)** $PerfIndicator_i^{ideal}$

Figure 3. Evolution of subjects' average performance throughout the five periods of facing a group-based incentive *without* time constraint (Stage 2)

the average performance of all the group members, we find that NT subjects perform significantly better with the group-based (*with* time constraint), than with the individual-based incentive ($PerfIndicator_i^{acc.}$: $Z = -1.987$, p-value $= 0.047$; $PerfIndicator_i^{ideal}$: $Z = -2.400$, p-value $= 0.016$).

Econometric analysis

In order to verify the validity of our results, we perform an econometric analysis where we explain the performance (either acceptable or ideal) with our treatment variable and a series of controls.

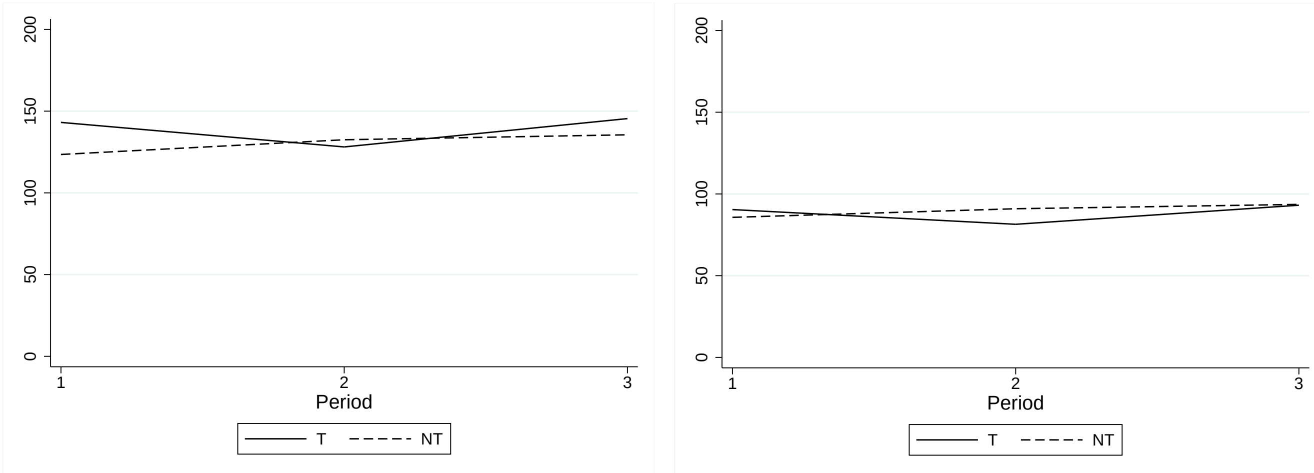
In Table 2, we apply a multiple linear regression analysis by running different model specifications.[12] The dependent variable is either $PerfIndicator_i^{acc.}$ or $PerfIndicator_i^{ideal}$ and we are interested in the effect of being trained (T), facing invidual (I) or group incentives (G) and the interaction of these (T * I and T * G). The control variables included in the model specifications are the dummy variables *Age>40* (Age$>40 = 1$ if the subject is more than 40 years old, and 0 otherwise), *Men* (Men = 1 if the subject is a man, and 0 otherwise), and *High education* (High education = 1 if the subject has a diploma higher than high-school, and 0 otherwise).

In columns (1) and (2) of Table 2, we compare the individual-based and the group-based incentives *without* time constraint, for T and NT respectively. This corresponds to data collected during Stages 1 and 2 of the experiment. As stated above, when facing an individual-based incentive, T subjects perform significantly better towards coordinating at their acceptable target than NT subjects (about 20 points higher performance in column 1). This result needs however to be moderated, as this difference is not significant towards reaching their ideal target (column 2), contrary to the results of the non-parametric analysis. Comparing both incentive types, with regard to T and NT subjects respectively, we see that NT subjects perform significantly better when given a group-based, than an individual-based incentive. This is true for both acceptable and ideal performance, the effect is about 9 points and 6 points of higher performance respectively. Moreover, we see that T subjects do not perform significantly differently when facing a group-based (*without* time constraint), than when facing an individual-based incentive. This confirms the fact that the exogenous training followed by NT subjects may play a role in T subjects' coordination behaviour, and that adding a group-based incentive does not lead them towards even higher coordination levels.

Table 2 also shows specifications comparing the group-based incentive *with* time constraint, with the individual-based, and the group-based incentive *without* time constraint, for T and NT subjects respectively. Given the previous results, we, however, distinguish between the case where subjects play only the first and the second sequence order (columns 3 and 4), and the case were all the sequence orders are considered (columns 5 and 6) in the group-based incentive *with* time constraint.

On the one hand, when considering all the sequence orders (columns 5 and 6), the econometric analysis confirms our non-parametric results. In this case, T subjects do not perform significantly worse when facing a group-based incentive *with* time constraint, than when given an individual-based or a group-based incentive *without* time constraint. On the contrary, NT subjects *do* coordinate at significantly higher levels when given a group-based incentive *with* time constraint, than an individual-based incentive. On the other hand, when considering only the first two sequence orders (columns 3 and 4), we can confirm the fact that NT subjects do not perform

[12] A Tobit regression model that takes into account the censored nature of the dependent variables (they cannot be lower than 0, and are bounded at 100 in the case of ideal performance) gives similar results. The results are available upon request.



(a) $PerfIndicator_i^{acceptable}$ **(b)** $PerfIndicator_i^{ideal}$

Figure 4. Evolution of subjects' average performance throughout the three periods of facing a group-based incentive *with* time constraint (Stage 3)

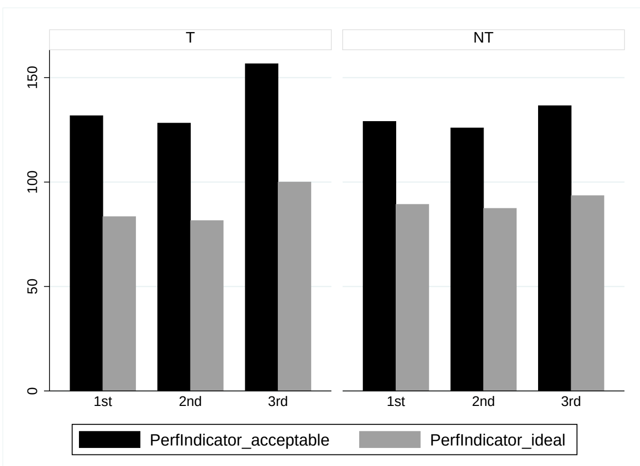


Figure 5. Subjects' average performance according to their sequence order

significantly better with the group-based incentive *with* time constraint, than with the individual-based incentive, and that they also do not perform significantly worse when facing a group-based incentive *with* time constraint, than *without* time constraint. Furthermore, we see that T subjects perform significantly worse towards reaching their ideal target, when given a group-based incentive *with* time constraint, than when given an individual-based incentive. However, this result turns out to be moderated, as they do not perform significantly better towards reaching their acceptable target. This result shows that time constraint retains T subjects to work until reaching their ideal target, so that they prefer to target a lower coordination level. Nevertheless, they do *not* stop before reaching at least their acceptable target. Even though they adopt a self-restricting strategy, as explained in the previous subsection, coordination at a level representing a "good" quality work, seems to remain important to them.

Discussion and concluding remarks

Coordinating incentives and efforts within a group of workers constitutes an important area of research (Gibbons and Roberts, 2012). This is particularly the case when the individual effort is not perfectly observable or when coordination across workers constitutes an important part of the production process. In this case, agency theory tends to recommend the use of team-based performance payoffs (Larkin et al., 2007). In this paper, we present an experiment where subjects played a real-effort weak-link game. The aim of the study is to analyze the coordination capacity of *ex-ante* trained and non-trained (to coordination) craftsmen, when facing individual-based and a group-based incentives *without* and *with* time constraint (with weak-link payment). A particularity of the experiment is the introduction of individual performance targets (a minimum acceptable, and a maximum ideal target) subjects had to achieve.

The small number of trained subjects having participated in the experiment (9), compared to the number of non-trained subjects (27), constitutes an important limitation of the study. The reason for this small number, is the difficulty to mobilize them simultaneously in a given location, as only around 200 craftsmen were trained through this particular training course (Dorémi) at the time of the experiment, in the entire Grand Est Region, in northeastern of France. It would however be interesting to conduct a further session with trained subjects, to increase the possibility of external validation of the results.

Keeping this limitation in mind, our results suggest that trained subjects coordinate at significantly higher effort levels than non-trained subjects, when facing an individual-based incentive. However, when facing a group-based incentive,

Treatments:	I & G (Stages 1 & 2)		I, G &G + t.c. (Stages 1,2 & 3 excl. 3rd sequence)		I, G &G + t.c. (Stages 1,2 & 3)	
Dep. Var.:	PerfInd$^{acc.}$	PerfInd^{ideal}	PerfInd$^{acc.}$	PerfInd^{ideal}	PerfInd$^{acc.}$	PerfInd^{ideal}
	(1)	(2)	(3)	(4)	(5)	(6)
T	21.50*	6.771	3.086	-6.116	9.096	-1.887
	(2.45)	(1.47)	(0.29)	(-1.25)	(0.98)	(-0.53)
I			-5.612	-4.200	-8.644*	-5.905*
			(-1.26)	(-1.36)	(-2.66)	(-2.58)
G	9.892**	6.015**	4.281	1.815	1.249	0.110
	(3.03)	(3.16)	(0.77)	(0.52)	(0.33)	(0.05)
T * I			17.99	12.59#	12.13	8.461
			(1.68)	(1.94)	(1.42)	(1.64)
T * G	-9.515	-6.038	8.475	6.551	2.618	2.423
	(-1.34)	(-1.45)	(0.89)	(1.12)	(0.37)	(0.56)
Age$>$ 40	3.157	-0.0850	-0.319	-2.406	0.318	-2.015
	(0.47)	(-0.03)	(-0.05)	(-0.79)	(0.05)	(-0.68)
Men	7.631	2.835	8.793	3.518	9.331	3.834
	(1.23)	(0.67)	(1.51)	(1.00)	(1.56)	(1.15)
High education	-1.743	-1.540	-2.512	-2.091	-2.441	-1.987
	(-0.21)	(-0.45)	(-0.32)	(-0.67)	(-0.31)	(-0.66)
Constant	120.6***	84.48***	127.5***	89.62***	130.3***	91.11***
	(18.84)	(19.78)	(32.25)	(34.20)	(29.62)	(34.36)
N	350	350	420	420	455	455
R^2	0.076	0.036	0.069	0.043	0.068	0.038

t-statistics in parentheses. # $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2. Determinants of performance in I, G and G+t.c.

non-trained subjects appear to "catch up" trained subjects in terms of coordination level, while these latter subjects do not significantly increase their performance level compared to when given an individual-based incentive. This suggests that proposing a group-based incentive to subjects who have previously been trained on coordination, does not yield higher overall coordination levels. Indeed, their enhanced sensitivity to successful and efficient coordination (that is, their optimist beliefs about coordination), seems to be a sufficiently strong mechanism to incentivize towards coordinating at high effort levels. This corroborates the findings of Cooper et al. (2018), who suggest that assigning a high performance pay to "optimists", increases the probability of high and successful coordination. These results also confirm previous findings in strategic management that show that workers'output is greater under team-based incentives than under individual incentives (Ost, 1990; Rankin, 2004). The fact that, in our experiment, trained subjects were aware about their team members' same training, reinforced their trust in the coordination capacity of the other members, and may explain the realization of this result. Similarities of workers' background have been found to be a driver of improved performance (Krishnan et al., 1997). Yet, an unexpected result when enforcing the subjects a sequential game (with a group-based incentive) with a given amount of time for the entire group (i.e., time constraint), is that, differently from non-trained subjects, trained subjects playing before the last one in the group, perform significantly worse than the last player. By adopting a self-restricting strategy, they would perform significantly worse than when facing an individual-based incentive. As the possibility to *not* achieve efficient coordination causes them stress, trained subjects voluntarily target lower performance levels (than their real ability), to have the certainty to reach a sufficiently high performance, so that the last member in the sequence order has enough time to attain her acceptable target. Such a strong (and negative) effect of time constraint is not visible on the coordination behaviour of non-trained subjects. Indeed, they perform significantly better with a group-based, than with an individual-based incentive, whether they have to play simultaneously or sequentially.

In hand of the results presented in this paper, imposing a time constraint when subjects have to intervene sequentially (i.e., attributing delay penalties to the entire team when coordination on high performance levels has failed in a given time), does not seem to be an efficient solution to incentivize towards successful coordination. This is particularly the case for subjects having participated in a training on coordination. However, taking part in training courses on coordination, although time demanding and expensive, is a very efficient alternative measure to group-based incentives. Though, this latter incentive is very efficient to increase performance of subjects who have npt participated in a training course on coordination. Group contracts may thus be a good solution, cheaper (with regard to time and money) than a training, to incentivize towards efficient coordination. However, when working in an environment presenting the weak-link property, our results indicate that it may be more efficient to assign group-based incentives (*with* or *without* time constraint) to non-trained subjects, and individual-based incentives to trained subjects. This result is in contradiction with the one presented by Bortolotti et al. (2016), who find that group-based incentives are as effective as individual-based incentives. Considering non-trained subjects (as it is the case in other studies), we observe that worst performance is significantly lower with individual-based, than with group-based incentives.

Acknowledgments

Helpful comments and suggestions from the editor Giuseppe Attanasi and two anonymous referees are gratefully acknowledged.

References

Abeler, J., A. Falk, L. Goette, and D. Huffman (2011). Reference Points and Effort Provision. *The American Economic Review 101* (2), 470.

Attanasi, G., R. Dessi, F. Moisan, and R. D. (2017). Public goods and future audiences: acting as role models? *TSE Working Paper 17-860*.

Attanasi, G., A. Hopfensitz, E. Lorini, and F. Moisan (2014). The effects of social ties on coordination: conceptual foundations for an empirical analysis. *Phenomenology and the Cognitive Sciences 13*(1), 47–73.

Attanasi, G., A. Hopfensitz, E. Lorini, and F. Moisan (2016). Social connectedness improves co-ordination on individually costly, efficient outcomes. *European Economic Review 90*(C), 86–106.

Blume, A. and A. Ortmann (2007). The Effects of Costless Pre-Play Communication: Experimental Evidence from Games with Pareto-ranked Equilibria. *Journal of Economic Theory 132*, 274–290.

Bornstein, G., U. Gneezy, and R. Nagel (2002, October). The effect of intergroup competition on group coordination: an experimental study. *Games and Economic Behavior 41*(1), 1–25.

Bortolotti, S., G. Devetag, and A. Ortmann (2016). Group incentives or individual incentives? A real-effort weak-link experiment. *Journal of Economic Psychology 56*(C), 60–73.

Brandts, J. and D. J. Cooper (2006). A Change Would Do You Good .... An Experimental Study on How to Overcome Coordination Failure in Organizations. *The American Economic Review 96*(3), 669–693.

Chaudhuri, A., S. Graziano, and P. Maitra (2006). Social learning and norms in a public goods experiment with inter-generational advice. *The Review of Economic Studiesl 73*(2), 357–380.

Chaudhuri, A., A. Schotter, and B. Sopher (2009). Talking Ourselves to Efficiency: Coordination in Inter-Generational Minimum Effort Games with Private, Almost Common and Common Knowledge of Advice. *The Economic Journal 119*(534), 91–122.

Chen, R. (2017). Coordination with endogenous groups. *Journal of Economic Behavior & Organization 141*, 177–187.

Chen, R. and Y. Chen (2011). The Potential of Social Identity for Equilibrium Selection. *American Economic Review 101*(6), 2562–2589.

Chen, Y., S. X. Li, T. X. Liu, and M. Shih (2014). Which hat to wear? Impact of natural identities on coordination and cooperation. *Games and Economic Behavior 84*, 58–86.

Ciccarone, G., G. Di Bartolomeo, and S. Papa (2020). The rationale of in-group favoritism: An experimental test of three explanations. *Games and Economic Behavior 124*(C), 554–568.

Cooper, D. J., C. A. Ioannou, and S. Qi (2018). Endogenous incentive contracts and efficient coordination. *Games and Economic Behavior 112*, 78–97.

Cooper, R., D. DeJong, R. Forsythe, and T. Ross (1992). Communication in Coordination Games. *The Quarterly Journal of Economics 107*(2), 739–771.

Cosaert, S., M. Lefebvre, and L. Martin (2019). Earnings and work time targets in effort provision tasks: a revealed preference analysis. *Mimeo*.

Croson, R., E. Fatas, T. Neugebauer, and A. J. Morales (2015). Excludability: A laboratory study on forced ranking in team production. *Journal of Economic Behavior & Organization 114*(C), 13–26.

Croson, R., M. Marks, and J. Snyder (2008). Groups work for women: Gender and group identity in the provision of public goods. *Negotiation Journal 24*(4), 411–427.

Fatas, E., T. Neugebauer, and J. Perote (2006, June). Within-Team Competition In The Minimum Effort Coordination Game. *Pacific Economic Review 11*(2), 247–266.

Gibbons, R. and J. Roberts (2012). *The Handbook of Organizational Economics*. Number 9889 in Economics Books. Princeton University Press.

Harrison, G. W. and J. A. List (2004, December). Field Experiments. *Journal of Economic Literature 42*(4), 1009–1055.

Ishida, J. (2006, March). Team Incentives under Relative Performance Evaluation. *Journal of Economics & Management Strategy 15*(1), 187–206.

Kopányi-Peuker, A., T. Offerman, and R. Sloof (2018). Team production benefits from a permanent fear of exclusion. *European Economic Review 103*(C), 125–149.

Krishnan, H. A., A. Miller, and W. Q. Judge (1997). Diversification and Top Management Team Complementarity: Is Performance Improved by Merging Similar or Dissimilar Teams? *Strategic Management Journal 18*(5), 361–374.

Larkin, I., L. Pierce, and F. Gino (2007). The psychological costs of pay-for-performance: implications for the strategic payoff of employees. *Strategic Management Journal 33*(10), 1194–1214.

Marchegiani, L., T. Reggiani, and M. Rizzolli (2016). Loss averse agents and lenient supervisors in performance appraisal. *Journal of Economic Behavior & Organization 131*, 183–197.

Nalbantian, H. R. and A. Schotter (1997, June). Productivity under Group Incentives: An Experimental Study. *American Economic Review 87*(3), 314–341.

Ost, E. (1990). Team-Based Pay: New Wave Strategic Incentives. *Sloan Management Review 31*(3), 19.

Rankin, F. (2004). Coordinating Effort under Team-Based and Individual Incentives: An Experimental Analysis. *Contemporary Accounting Research 21*(1), 191–222.

Riechmann, T. and J. Weimann (2008). Competition as a coordination device: Experimental evidence from a minimum effort coordination game. *European Journal of Political Economy 24*(2), 437–454.

Riedl, A., I. M. T. Rohde, and M. Strobel (2016). Efficient Coordination in Weakest-Link Games. *The Review of Economic Studies 83*(2), 737–767.

Schotter, A. and B. Sopher (2003, June). Social Learning and Coordination Conventions in Intergenerational Games: An Experimental Study. *Journal of Political Economy 111*(3), 498–529.

van Dijk, F., J. Sonnemans, and F. van Winden (2001, February). Incentive systems in a real effort experiment. *European Economic Review 45*(2), 187–214.

Van Huyck, J. B., R. C. Battalio, and R. O. Beil (1990). Tacit Coordination Games, Strategic Uncertainty, and Coordination Failure. *The American Economic Review 80*(1), 234–248.

Weber, R., C. Camerer, Y. Rottenstreich, and M. Knez (2001). The Illusion of Leadership: Misattribution of Cause in Coordination Games. *Organization Science 12*(5), 582.

APPENDIX: Instructions of the experiment (translated from French)

General information

Thank you for participating in this experiment on decision-making. In this experiment, your earnings depend on your decisions and those of other participants. We therefore ask you to read these instructions carefully, they should allow you to fully understand the experiment. All of your decisions are anonymous. You will never enter your name on the computer. You will indicate your choices on the tablet in front of which you are sitting.

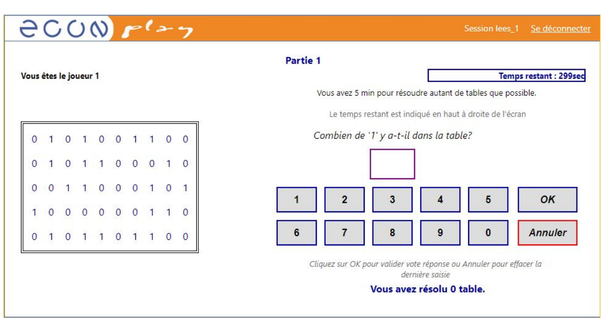
From now on we ask you not to talk. If you have a question, please raise your hand and an experimenter will come and answer in private. It is strictly forbidden to communicate with another participant during the experiment. If you do not respect this rule you will be excluded from the experiment and from any payment.

Throughout the experiment, you will be part of a group made up of 3 players randomly chosen by the computer: you and 2 other players. You cannot know the identity of the other members of your group, just as no member of your group can know your identity. You also do not know the constitution of the other groups. Your group will remain the same throughout the experiment.

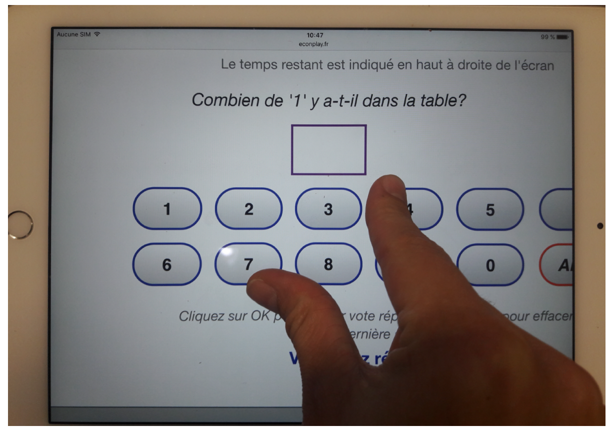
The experiment will be subdivided into 4 parts. Please start by reading the instructions for the first part carefully. You will receive the instructions for the other parts of the experiment before starting them. In each part, your earnings are counted in ECU (currency specific to the experiment). At the end of the experiment your total earnings accumulated during the 4 parts will be converted into euros at the following rate: 100 ECU = 1 euro. The earnings in euros that you have earned will then be paid in cash.

Part 1

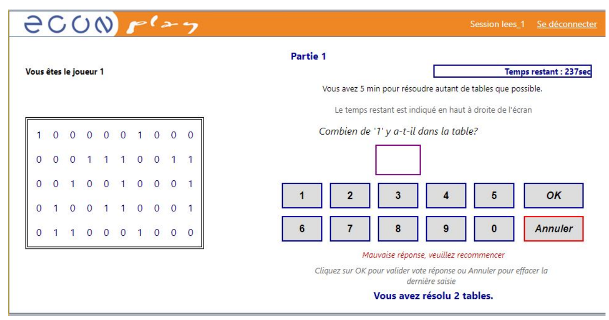
During Part 1, your task is to count the number of 1 present in a series of tables composed of 0 and 1. You have 5 minutes, or 300 seconds, to resolve as many tables as possible. The game is presented in the following way:



On the screen you will find a table containing zeros and ones. You have to enter the number of ones into the box on the right side of the screen. You do not need to press the empty box before typing the numbers: the entry will be made directly using the numeric keys. To validate your answer, you must press “OK”. If you want to modify your answer, you have to press “Cancel”, then retype your answer using the numeric keys. The remaining time is displayed as a countdown in seconds at the top right of the screen. If you see that by clicking twice on the screen, you have zoomed, you can at any time zoom in by sliding 2 fingers in a pinch movement on the screen, as shown in the following photo:



If your input is wrong, an error message will appear as shown in the following screenshot:



You will then have two additional trials to enter the correct number into the table. If you fail three times, a new table will be generated. The number of correctly counted tables is displayed at the bottom right of the screen. Note that you will not be penalized if you make a mistake. Only the number of correctly counted tables will be taken into account.

Keep in mind that the countdown for the 5-minutes starts as soon as the first table is displayed.

At the end of the 5 minute period, a screen will display the number of tables that you have correctly counted, as well as your earnings for that period.

You will receive 10 ECU per counted table. If you have, for example, correctly counted 5 tables, your gain will be 50 ECU:

$$Gain\, P1 = 5 \cdot 10 = 50\, ECU$$

The earnings from this game will be paid to you at the end of the experiment.

Before starting Part 1, you will have a 2-minute practice phase, to familiarize yourself with the game and how the tablet works. This phase will not be paid.

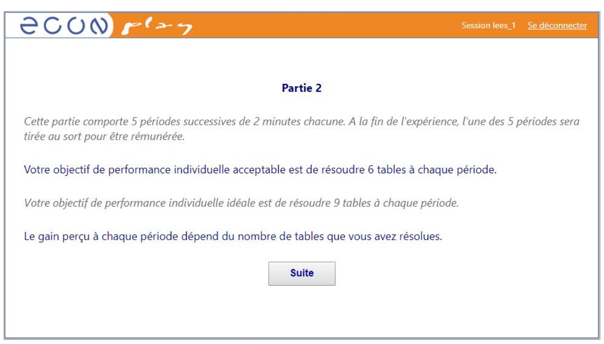
Part 2

In Part 2, your task is again to count the number of 1 present in tables composed of 0 and 1. You are still a member of the same group of 3 individuals.

Part 2 is divided into 5 periods of 2 minutes, or 120 seconds, each. Unlike Part 1, your earnings depend on the achievement of the targets assigned to you. In fact, two targets will be given to you:

1. ACCEPTABLE individual performance target
2. IDEAL individual performance target

To help you to understand the difference between these two targets, let us see a concrete example. Imagine a carpenter on a renovation site. The acceptable target represents the fact that the carpenter correctly installed the new window. The ideal target represents the fact that the carpenter has placed her window in such a way that it can allow to reach the level of waterproofing, i.e., it has the minimum air required to reach a LCB (Low Consumption Building) level. In practice, you must at least reach your acceptable goal, but reaching your ideal goal allows you to contribute to reaching the LCB level. The acceptable target will therefore always be lower than the ideal target. Your targets to be achieved will be communicated to you at the beginning of Part 2, as shown below. Your targets may be different than on this screenshot.



Your earnings during each 2-minute period are determined by your individual performance and are calculated as follows:

$$Gain\,P2 = 100 + 800 \cdot \frac{Resolved\ Tables}{ACCEPTABLE\ target}$$

For example, if you are asked to solve 4 tables to reach your acceptable target, and to solve 6 tables to reach your ideal target. If you solve 3 tables during the game period, you have reached $\frac{3}{4}$ (or 75 %) of your acceptable target and your earnings for this period are

$$Gain\,P2 = 100 + 800 \cdot \left(\frac{3}{4}\right) = 700\,ECU$$

If on the contrary, you solve 4 tables, you have fulfilled 100% your acceptable target and your earnings are

$$Gain\,P2 = 100 + 800 \cdot \left(\frac{4}{4}\right) = 900\,ECU$$

Likewise, if you solve 5 tables (125% of your acceptable goal) your earnings are

$$Gain\,P2 = 100 + 800 \cdot \left(\frac{5}{4}\right) = 1100\,ECU$$

Achieving your ideal target does not affect your earnings. However, if you had, still in the same example, managed to solve 6 tables (150% of your acceptable target), you have fulfilled your two targets, acceptable and ideal, and your earnings for this period are

$$Gain\,P2 = 100 + 800 \cdot \left(\frac{6}{4}\right) = 1300\,ECU$$

In the game, you cannot go beyond your ideal target. When you reach the number of resolved tables that meet this target, the game period ends, and the results are displayed. A page will display the following information:

1. The number of tables to be resolved to reach your acceptable target;
2. The number of tables to be resolved to reach your ideal target;
3. The number of tables that you have counted correctly during the game period;
4. The percentage of tables resolved in relation to your acceptable target;
5. The percentage of tables resolved in relation to your ideal target;
6. Your earnings for this period (in ECU).

Your earnings for Part 2 will be drawn randomly from the 5 game periods that you will play. You therefore only win one win over 5 games.

Part 3

Part 3 is similar to Part 2. You will play 5 periods of 2 minutes each. However, your earnings for each period will be calculated differently than in Part 2.

In Part 2, your earnings depend only on your individual performance during each period of play. In Part 3, your earnings also depend on the individual performance of the other members of your group. More precisely, they depend on the individual performance of the group member who performed the lowest compared to her target of acceptable individual performance. The earnings of the three group members are identical and are calculated like this:

$$Gain\,P3 = 100 + 800 \cdot (Lowest\ achievement\ of\ acceptable\ target)$$

Let us take an example. You have reached your acceptable goal, that is 100 %, the 2nd group member has reached 125 % of her acceptable goal, and the 3rd group member has reached 75 % of her acceptable goal. The gain of each member of your group will be the same:

$$Gain\,P3 = 100 + 800 \cdot 75\% = 700\,ECU$$

If, on the other hand, you have reached 50% of your acceptable target, the 2nd member of the group has reached 140% of her acceptable target, and the 3rd member of the group has reached 90% of her acceptable target, the gain of each member of your group will be as follows:

$$Gain\,P3 = 100 + 800 \cdot 50\% = 500\,ECU$$

The gain that you will win for Part 3 will be drawn from among the 5 game periods that you will play. You therefore only win one win over 5 games.

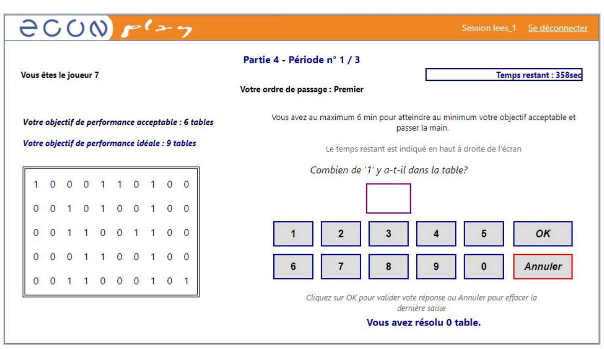
Part 4

Your earnings in Part 4 will be calculated in the same way as in Part 3. The game will be the same as in all previous games.

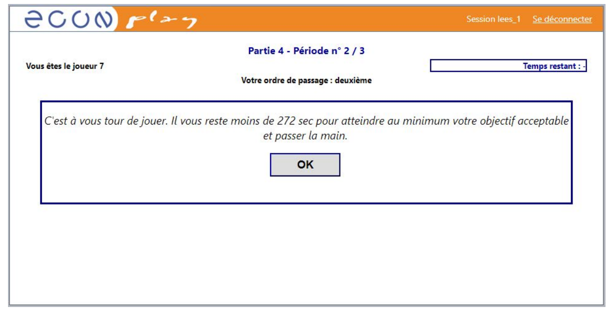
The change in Part 4 is that you will take turns to play the game within the group of which you are a part. More precisely, the game will consist of 3 periods of 6 minutes, or 360 seconds, each.

During each period, one of the group members will start first and have, as before, the objective of achieving at least her acceptable target. She can then continue to try to reach her ideal target. As soon as she reaches her acceptable target, she can hand over to the next player. On the other hand, if she wishes, she can continue until she reaches her ideal target and then automatically hand over to the next player.

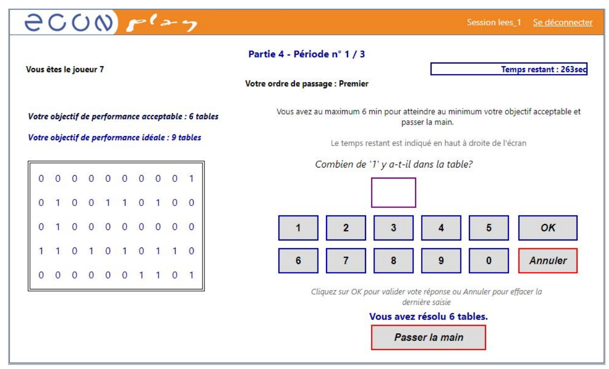
The 360 seconds available in this period are for the whole group. The number of seconds used by a player is no longer available for the following ones. The time remaining out of the total of 360 seconds is displayed at the top right. At the time of playing, the running-order for the period is indicated to you on the screen. Your order is determined temporarily. If you are the 1^{st} player to play, the game will start immediately as shown in the following screenshot:



If you are the 2^{nd} or the 3^{rd} to play, the time remaining to play will be specified on a screen. except before you start playing. On the following screenshot, for example, player 7's running-order is 2^{nd} in the second period. She has 272 seconds left to play from the moment she presses OK. This means that the 1^{st} member of the group has already played for $(360 - 272 =)$ 88 seconds before him.



If you are the 1^{st} or the 2^{nd} player in running-order, as soon as you reach your acceptable target, a "Pass Hand" button appears at the bottom right of the screen as shown in the following screenshot:



You then have the choice either to pass the hand to the next player so that she can start playing, or to continue playing until you reach your ideal target. If you decide to continue, you can still hand over at any time.

Keep in mind that your earnings are calculated as in Part 3 and depend on the lowest individual performance of the group. It is therefore important to give sufficient time to the players who will play after you.

Let's take an example. You reach 100 % of your acceptable target in 125 seconds and decide to hand over to the next player. Then, the second player reaches her acceptable target but decides to continue playing. She decides to pass the hand when she has reached 110 % of her acceptable target, after 200 seconds of play. There is then $(360 - 125 - 200 =)$ 35 seconds at the last player to play. She then reaches 40% of her acceptable target with the remaining 35 seconds. The group's weakest individual performance is therefore 40%. The gain of each player is then

$$Gain\,P4 = 100 + 800 \cdot 40\% = 420\,ECU$$

The gain that you will win for Part 4 will be drawn from among the 3 game periods that you will play. So you only earn for one game over 3 games.

APPENDIX: Additional tables

	T	NT
N	9	27
Sex:		
Female	0	3
Male	9	24
Age:		
20-30	1	1
30-40	1	5
40-50	5	11
50-60	2	9
60-70	-	1
Education:		
Primary	1	1
Lower secondary	4	14
Upper secondary	2	2
Bachelor	2	8
Master		2
Occupational status:		
Self-employed	6	21
Wage-earner	3	6
Main skills:		
Carpentry	3	4
Electricity	3	3
Plumbing and heating	1	10
Isolation	-	7
Painting and plastering	2	3

Table A.1. Sample descriptive statistics