TEAMS, TIME PRESSURE, AND COORDINATION*

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Abstract

Team decision-making is often conducted under looming deadlines, where time constraints affect team communication and, consequently, team decisions. This study examines teams' ability to communicate and reach an agreement under time pressure in a coordination game and consequent performance. We find that teams are significantly better at coordination compared to individuals in the absence of time constraints. Teams under time pressure still target more efficient equilibria than individuals if they reach an agreement. However, disagreements are frequent, and teams no longer exhibit less miscoordination than individuals. Consequently, time pressure near entirely wipes out the gains from teams making decisions instead of individuals. Finally, we investigate the underlying mechanisms driving the detrimental effect of time pressure on performance by analyzing communication content and applying the experience-weighted attraction learning model.

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1 Introduction

In economics and specifically in an organizational context, agents are often required to coordinate their actions. For instance, the success of a project in an organization involves coordination among several work units. Unfortunately, coordination failures are pervasive, which can lead to considerable inefficiencies (Schelling, 1960; Arrow, 1974). Moreover, coordination failure traps all involved in unsatisfactory situations, even though outcomes preferred by all are not only possible but would also be stable if ever reached. One institution that the literature has identified to promote successful coordination is team decision-making: teams are remarkably better at achieving efficient outcomes and avoiding miscoordination in games with multiple equilibria (Feri et al., 2010; Chaudhuri et al., 2015; Sitzia and Zheng, 2019). Therefore, organizations could stimulate a high exertion of effort and facilitate coordination by assigning jobs to teams instead of individuals.

Teams frequently need to coordinate their decisions under looming deadlines in organizations and other real-world settings. This may be because they have other tasks requiring attention or they face various constraints, such as external deadlines promised to clients or internal managerial deadlines. Furthermore, time pressure is particularly relevant for team decisions: a team's good performance could require sufficient time for discussion, especially because of possible inherent conflict present among different individual preferences. Strikingly, though, when examining team performance in coordination games and in other settings, the economics studies have only focused on environments without time constraints.[1] We narrow this gap by introducing high time pressure into team decision-making in a coordination game.

This paper investigates how time pressure affects team performance in a coordination game and whether teams under high time pressure still preserve higher efficiency than individuals. To address these questions, we conduct an experiment, which builds on the setup of Feri et al. (2010) to first replicate and establish their main finding: teams acting as decision units are better at coordinating compared to individuals. Then, we introduce time pressure on groups to observe the effects on overall performance as well as team communication. The experiment has three between-subject treatments. In the individual treatment (*IND*), five individuals interact in a coordination game for 20 periods. In each period, each individual has to choose an effort level from the feasible set independently from the other individuals, and they are given 3 minutes to decide. In the two team treatments, we set up teams of three members who can freely communicate via chat box prior to submitting a single decision. Teams under low time pressure treatment

[1] Several studies examine individual decision-making under time constraints. We refer to the lack of studies focusing on the effects of time pressure when teams act as decision units.

(*LTP*) are given 3 minutes to communicate and reach an agreement. Thereafter, we introduce time pressure in teams to observe its effects on overall performance and team communication: the teams under high time pressure (*HTP*) are given 30 seconds to reach an agreement.

Before moving to the results, we discuss the possible effects of time pressure on team coordination. On the one hand, studies have demonstrated that individuals become more risk-seeking under time pressure (Kocher et al., 2013; Saqib and Chan, 2015). And since strategic uncertainty is argued to be the main culprit of coordination failure, the possible risk-loving behavior could lead teams under time pressure to perform better than teams under no such pressure. This result would be similar to how individuals under time pressure coordinate better than without the time pressure (Belloc et al., 2019; Poulsen and Sonntag, 2020). However, on the other hand, high time pressure could hinder the team discussion, thus reducing the teaching/learning, possibly leading to higher coordination failures.[2] Whether time pressure will result in an increase or decrease in coordination will also inform us of the underlying primary driving forces that result in higher coordination in teams vs. individuals in coordination games without time pressure.

Our results first replicate and establish the main effects demonstrated by Feri et al. (2010) that teams acting as decision units are better at coordination than individuals. Specifically, teams under low time pressure reach more efficient outcomes than individuals: teams earn significantly higher payoffs than individuals. This result is due to two underlying forces. First, teams under low time pressure choose considerably higher efforts than individuals. Second, teams under low time pressure exhibit a lower degree of miscoordination than individuals. In other words, individuals within the group often choose more distinct actions.

Turning to teams under high time pressure, we find that high time pressure wipes off the efficiency gains of teams compared to individuals. Although teams under high time pressure choose higher efforts than individuals, they still achieve similar payoffs. This effect is driven by two channels. First, teams under high time pressure are no longer better at avoiding miscoordination than individuals. Second, teams under time pressure reach agreement less often than teams under low pressure. To further explore teams' loss of efficiency from high time pressure, we consider a new payoff measure that incorporates the effect of team disagreements into the entire group's performance. We find that teams' performance under high time pressure can be even lower than that of individuals.

To further understand why time pressure breaks the efficiency improvement of teams, we examine the chat log during the team decision-making. In *LTP* treatment, we find that team members use their time to ask questions about the environment and payoff structure and clarify the best strategy for the team. However, the communication is more to the point under high

[2] See Section 3 for more thorough discussion.

time pressure: the team members state their intended efforts and seldom engage in teaching and/or learning practices. Additionally, messages involving reassurances, which could establish common knowledge of effort choice among team members, appear three times less often in *HTP* than in *LTP* treatment.

Finally, we employ the experience-weighted attraction (EWA) learning model of Camerer and Ho (1999) to gain further understanding of behavior across teams under varying time pressure and individuals. We estimated relevant parameters in the model using our data. The estimation strengthens some of our previous results while revealing some new effects. Interestingly, the speed of convergence is the highest in individual treatment, highlighting fast convergence to equilibrium, although to the payoff-worst (risk-dominant) one. Furthermore, the weight placed on foregone payoffs in the updating process is lowest in the *HTP* treatment, emphasizing the lack of learning from feedback. Overall, the EWA model provides further clarification of the forces that drive the differences between teams and individuals and between teams under different time pressure.

The findings in the paper suggest that organizations wherein teams are under considerable time pressure may not benefit from team decision-making and might even be substantially inefficient. Furthermore, if teams perform at similar levels as individuals under time pressure, there is higher cost and thus no need to have teams doing what one individual can accomplish. Our results further reveal the importance of the established rules for reaching an agreement. If a unanimity rule is required to reach an agreement instead of a majority rule, for example, the inefficiencies could be even more damaging. Further research with varying agreement rules could highlight the best institution in environments with high time pressure. Moreover, it might be fruitful to investigate how time pressure interacts with different forms of communication, such as restricted communication or alternative team structure, such as having a leader in a team.[3]

This study primarily relates and contributes to three strands of literature. First, it relates to the extensive literature on team decision-making. The literature is vast, and while we are not attempting to review it here, we highlight the major findings (see Charness and Matthias, 2012 and Kugler et al., 2012 for reviews of the literature). Compared with individuals, teams are generally more competitive and less cooperative (see, e.g., Bornstein et al., 2002; Cason and Mui, 1997, 2019; Kugler et al., 2007; Luhan et al., 2009; Müller and Tan, 2013; Balafoutas et al., 2014; Nielsen et al., 2019). Studies have also shown that teams achieve higher coordination success than individuals in coordination games, even without added competition (Feri et al.,

[3] On the one hand, having a leader with high decision power could reduce the rate of disagreements. However, it is unclear whether such a leader would consider the team discussion enough to reach better outcomes than individuals do, especially under time pressure. On the other hand, having a weak leader who only serves as a democratic representative may not help the team under high time pressure.

2010; Chaudhuri et al., 2015; Sitzia and Zheng, 2019). Team decision-making in real-world is often undertaken under time constraints. Nevertheless, the experimental economics literature on team decisions has only focused on the settings without considering time constraints.[4] This paper narrows this gap by introducing high time pressure into team decision-making in a coordination game.

The paper is also related to the literature on time pressure. The literature focuses on how time constraints influence individuals' preferences and choices (for an overview, see Spiliopoulos and Andreas, 2018). For example, individuals tend to be more risk-seeking under higher time pressure (e.g., Kocher et al., 2013; Saqib and Chan, 2015). Studies have also examined whether pro-social behavior is intuitive and whether people are more likely to behave selfishly under time pressure (e.g., Piovesan and Wengström, 2009; Rand et al., 2012; Tinghög et al., 2013; Recalde et al., 2018; Kessler et al., 2017). Finally, Belloc et al. (2019) and Poulsen and Sonntag (2020) found that high time pressure makes individuals at least equally cooperative in pure coordination games, if not more cooperative. Our study extends the literature of time pressure from an individual decision-making to a team decision-making environment, which is more interactive and commonplace for some settings in real life.

Finally, this study also contributes to the literature on institutions that promote coordination. Economists have addressed ways to promote successful coordination via various institutions, such as costly (Van Huyck et al., 1993) and costless (Cooper et al., 1992; Charness, 2000; Blume and Ortmann, 2007; Brandts et al., 2015) communication, commitment (Avoyan and Ramos, 2022), teams as decision units (Feri et al., 2010; Chaudhuri et al., 2015), between-group competitions (Bornstein et al., 2002; Riechmann and Joachim, 2008), endogenous and fixed neighborhood or group formation (Riedl et al., 2016; Yang et al., 2017; Caparrós et al., 2020), voluntary reward (Yang et al., 2018), gradual group size growth (Weber, 2006), social identities (Chen and Chen, 2011; Chen et al., 2014), and transfer of learning across games (Devetag, 2005; Cason et al., 2012). To the best of our knowledge, this study is the first to examine how time pressure affects coordination levels when decision-making units are teams.

2 Experimental Design

The experiment has a between-subject design with three different treatments. Two of the three treatments closely follow the instructions and procedure of Feri et al. (2010) in order to examine their main result, which is that teams are better at coordinating compared to individuals. The

[4] Some studies in behavioral accounting have examined team decision-making under time pressure for intellectual tasks, such as writing plans (Van der Kleij et al., 2009), and audit engagement for a given client (Arnold et al., 2000).

third treatment adds time pressure on teams.

In each session, the participants are randomly divided into five decision units forming a group (the decision unit is either a single subject or a team of 3 subjects depending on whether it is an individual or a group treatment). Then, each group plays the minimum-effort game described as follows.

Consider the following game: $(I, (E)_{i \in I}, (\pi_i)_{i \in I}))$, where $I = \{1, 2, ..., 5\}$ is a set of decision units; $E = \{1, 2, ..., 7\}$ is a finite set of effort levels available to each unit i; and $\pi_i(\mathbf{e})$ is the payoff for each unit i given the strategy profile $\mathbf{e} \in \mathbf{E}$, where $\mathbf{e} = (e_i)_{i \in I}$ and $\mathbf{E} = \prod_{i \in I} E$. The payoff function is given by

$$\pi_i(\mathbf{e}) = a + b \cdot \min_{j \in I} e_j - c \cdot e_i, \tag{1}$$

where a, b, and c are real, nonnegative constants. In particular, the parameters used in the experiment are $a = 60$, $b = 20$, and $c = 10$. Note that the payoff decreases with higher choice of effort and increases with minimum effort. Let $\bar{e}$ ($\underline{e}$) be the highest (lowest) element of E and let $\bar{\mathbf{e}}$ ($\underline{\mathbf{e}}$) be the profile for which all units choose $\bar{e}$ ($\underline{e}$).

The game described above has multiple equilibria.[5] In particular, every decision unit picking the same effort level is an equilibrium. All these equilibria are ranked, from the payoff-worst (risk-dominant) in which all decision units choose $\underline{e}$ to payoff-best (payoff-dominant) in which all decision units choose $\bar{e}$ (Harsanyi and Selten 1988). Beginning with Van Huyck et al. (1990), numerous studies have shown that subjects typically converge to risk-dominant equilibrium.[6]

Following the convention in literature, in this experiment, we describe the payoffs to subjects in the matrix form (see Table 1). The payoffs in the matrix are a *per participant payoff* for each team member. That is, for instance, if a team chooses seven and the minimum effort in the group is 7, every member of the team will receive 130 points in that period. The proceeds do not get split between the 3 team members. This approach keeps the individual marginal incentives constant throughout the individual and team treatments.

Individual treatment (*IND*) In this control treatment, five subjects play the minimum effort game for 20 periods. In each period, each subject had to choose a number from the feasible

[5] Note that the description of the game above is that of the standard minimum effort game. For the team treatments, the game has a stage prior to the group decision making stage and the size of the group changes according to the outcomes of the first stage. Additionally, given the time constraint, the set of actions is $E \cup \{\emptyset\}$ and $\pi_i(\emptyset, e_{-i}) = 0$. Each player choosing not to submit a choice (choosing $\emptyset$) is an equilibrium.

[6] There are some exceptions; for example, Engelmann and Normann (2010) find that the higher the share of Danish subjects in a group, the higher the minimum-effort levels. In addition, groups comprising of only two participants with access to select history from the previous period achieve high coordination rates in Van Huyck et al. (1990).

	Smallest number chosen in the group						
Own Number	7	6	5	4	3	2	1
7	130	110	90	70	50	30	10
6		120	100	80	60	40	20
5			110	90	70	50	30
4				100	80	60	40
3					90	70	50
2						80	60
1							70

Table 1: Payoffs in the minimum-effort game

set, i.e., 1 to 7, independently. Subjects were given 3 minutes to make their decision. Each participant was informed about the own payoff and the minimum number in the group after each period. Subjects get paid according to equation (1) based on their own effort choice and the minimum effort in their group.

Low time pressure team treatment (*LTP*) A group of 15 participants are randomly divided into 5 teams with 3 members each. The team assignment remains the same throughout the session. These 5 teams play a minimum effort game for 20 periods. In each period, each team member is asked to submit an effort choice. The team is asked to arrive at a joint team decision by agreeing on a single number to be chosen by all team members. If different numbers are entered, the team receives no payment in the period and they are excluded from the calculation of payoff in the group.[7] Note that subjects do not get feedback regarding the minimum number in their group when they do not make a decision or if their team does not reach an agreement in that period.

The experimental instructions do not specify how team members should arrive at a team decision. Instead, each team member must enter the team's decision individually on their computer screen. Team members can communicate via an electronic open free-form chat[8] for 3 minutes.[9] The chat is unrestricted; subjects can freely communicate (we ask subjects to refrain from revealing their identities and using abusive language).

[7] Specifically, the minimum effort of the group is calculated from the units that reach an agreement.

[8] We follow Feri et al. (2010) and have an electronic open free-form chat that ensures that we have access to the chat logs that we can later analyze. Alternatively, the communication can be implemented by restricting it to actions only or using face-to-face (FTF) communication, which is less cumbersome than typing on a keyboard. However, FTF communication raises more implementation challenges, for instance, effectively cutting off the discussion at the exact time, the difficulty of transcribing the communication ex-post, and having all five teams in separate rooms to avoid teams hearing each other.

[9] Feri et al. (2010) initially provided subjects with 2 minutes to reach an agreement. We added an additional minute to ensure there is low time pressure in this treatment.

High time pressure team treatment (*HTP*) *HTP* treatment is identical to *LTP* treatment with one exception, i.e., the teams are only allowed to interact for 30 seconds instead of 3 minutes. We chose 30 seconds to create a binding time constraint yet provide reasonable time for interaction.[10]

Table 2 summarizes all the treatments and the corresponding number of subjects, groups, and sessions involved.

Treatment	*Time Pressure*	*Teams*	*# Subjects*	*# Groups*	*# Sessions*
Individual (*IND*)	No	No	30	6	3
Low time pressure (*LTP*)	No	Yes	90	6	6
High time pressure (*HTP*)	Yes	Yes	90	6	6

Table 2: Experimental design summary

All of the experimental sessions were conducted at Interdisciplinary Experimental Laboratory (IELab) at Indiana University (IU) during the Fall of 2021, using the software z-Tree (Fischbacher 2007). Subjects were recruited using the ORSEE recruitment program (Greiner 2015) from the general undergraduate population.[11] The instructions were read aloud, and the paper copies were distributed to all subjects. (Refer to Appendix C for instructions of the high time pressure treatment (*HTP*) in the experiment.) The experiment lasted approximately 45 minutes, and subjects earned, on average, a payoff of $17, which included a $8 show-up fee. In the experiment, the payoffs in the game were denominated in points. Each point is converted to US dollars at the rate of 200 points to $1.

3 Theoretical considerations and predictions

This section briefly reviews equilibrium selection theories and discusses theories that may act as the driving forces behind superior team performance compared to individuals. We then hypothesize the effects of time pressure on the mechanisms to prepare for the discussion of experimental results in the following section.

To better understand the possible effects of time pressure on teams' performance, we ought

[10] The rationale behind choosing 30 seconds is two-fold. The first is to create time pressure. Indeed, the data reveals that teams in *LTP* engage in discussion for an average of 54.22 seconds over 20 periods. The constraint is even more binding for earlier periods, given that teams engage in conversation for an average of 69.82 seconds in the first ten periods and 99.8 seconds in the first period. As a comparison, the individuals in *IND* treatment only take 3.4 seconds to make a decision and submit their choice in each period. (Appendix Figure A3 presents the dynamics of the time to make a decision over 20 periods.) The second objective of choosing 30 seconds instead of, for example, 10 seconds is to ensure teams still have time to conduct meaningful conversations under time pressure. We do find that teams in *HTP* treatment have an adequate number of messages exchanged in our data (see more details in Section 4.2).

[11] The demographic characteristics are balanced across treatments, see Appendix Table A1.

to first discuss the root causes of teams reaching higher coordination rates. The coordination games have an inherent problem arising from the multiplicity of equilibria. The equilibrium selection in such games has proven to be one of the most elusive challenges in economics and of game theory in particular. Prevalent selection criteria introduced in Harsanyi and Selten (1988) are the payoff- and risk-dominance.[12]

Starting with Van Huyck et al. (1990), extensive experimental evidence has highlighted the convergence of play to risk-dominant (payoff-worst) equilibrium, and strategic uncertainty has been identified as the main culprit of such coordination failures. Separate research has compared the effects of teams making decisions to those of individuals. One common finding is that teams act in a more risk-taking manner compared to individuals (Bougheas et al. 2013). It is possible that when teams play as decision units in a coordination game, increased risk-taking behavior dampens the sensitivity toward strategic uncertainty and consequently pushes the group away from risk-dominant equilibrium towards the payoff dominant one. The current question is, what happens to risk attitudes when time pressure is introduced? Studies have demonstrated that individuals become more risk-loving under time pressure. Therefore, we could observe that teams under time pressure perform better than teams under no such pressure.[13]

Another selection theory that has received considerable attention and has been extensively examined is the theory of focal point by Schelling (1960). Thomas C. Shelling proposes that players facing a coordination situation might be able to coordinate their behavior by finding a focal point of the game. Hence, coordination games can be interpreted as problems with solutions. Therefore, we can apply theories of group vs. individual performances in problems.

Lorge and Solomon (1955) theoretically assess the superior team performance versus that of individuals in problem-solving. Under their primary model, the probability of a group reaching a solution is the probability that at least one team member can solve the problem. Consequently, the larger the team, the better the team's chances of solving the problem. If the team performance is simply the performance of the "best" able individual in the team, time pressure might not be detrimental. Furthermore, according to Belloc et al. (2019), individuals under time pressure are more likely to choose an efficient strategy in stag and hunt game, which is similar to a

[12] See, also, Carlsson and Van Damme (1993) where perturbation in payoffs leads the players to conform to risk-dominance equilibrium in a 2×2 coordination game. For selection based on salience of own payoffs, refer to Leland and Schneider (2015) and Leland and Schneider (2018).

[13] Some studies have reasoned that cooperation is a more intuitive choice by showing that subjects who choose quickly (have lower response time) are more likely to choose cooperative action than others who take longer to come to a decision (see Rand et al. 2012). This reasoning would also lead us to conjecture that we will observe higher coordination in our *HTP* treatment compared to the *LTP* treatment. However, follow-up papers put significant doubt on the "social heuristic hypothesis" that people are intuitively cooperative, see Krajbich et al. (2015), Recalde et al. (2018), Rubinstein (2016), Tinghög et al. (2013), Kessler et al. (2017), Bouwmeester et al. (2017), and Alós-Ferrer and Garagnani (2020).

two-player and two-action minimum effort game.[14] Therefore, if the most able person is leading the decision-making in the team and individuals tend to coordinate more under time pressure, then again, we would observe higher team performance under time pressure.

Are all theories predicting higher coordination rates with teams under time pressure? The experimental literature has theorized that inter-team communication is critical for the performance differences between teams and individuals. It seems that the ability to discuss the game with group members often leads to a better understanding of the game.[15] Even without the presence of open chat, there is evidence that the presence of "teachers" leads to better overall outcomes (Hyndman et al. 2012). Introducing time pressure will reduce the discussion and impede teaching and learning from team members. Therefore, the high-time pressure could be detrimental to team performance if synergies from the discussions in a team are the root cause of the group's superior performance.

4 Results

This section presents the main results of the paper. First, we compare low time pressure and individual treatments to evaluate and replicate the existing results in the literature. Second, we examine how teams under high time pressure fare to individuals and teams under low time pressure. Then, we examine the effects of time pressure on inter-team communication to shed light on the possible mechanisms leading to differences caused by time pressure. Finally, we analyze our data using the experience-weighted attraction learning model to clarify further the driving forces underlying the main effects.

Table 3 presents an overview of the primary data for all 20 periods. Figure 1 presents the measures from Table 3 over 20 periods.

4.1 Comparisons of various outcomes across treatments

The average overall payoff in points reached in *LTP* treatment (92.65) is significantly higher (robust rank order test) than in individual treatment (69.50). Similarly, normalized efficiency[16] is significantly higher in *LTP* treatment than *IND* treatment—*LTP* treatment reaches 71% efficiency, compared to 44% of *IND* treatment (Table 3, Panel A). Such high efficiency in *LTP* treatment is on par with communication treatments in the literature. For instance, in Blume and

[14] Poulsen and Sonntag (2020) show that individuals perform similarly in a pure coordination game with and without time pressure. However, it is worth noting that the individuals reach more than 90% coordination without time pressure, thereby leaving little room to show any possible upward effects of time pressure on coordination.

[15] Charness and Matthias (2012) provide an excellent literature review.

[16] Following the literature, we calculate normalized efficiency as *Normalized Efficiency* $= \frac{Actual - Min}{Max - Min} \times 100\%$, where $Actual$ is the average amount earned in a treatment, and Min (Max) is the average minimum (maximum) possible amount that a subject can earn.

Ortmann (2007) and Deck and Nikiforakis (2012), cheap-talk pre-play interaction improves coordination and boosts normalized efficiency to 69% and 71% from 34% and 44%, respectively. The normalized efficiency in individual and team treatments in Feri et al. (2010) are 66% and 86%, respectively. While the magnitudes of the results do not match the ones in the current paper, the direction and differences are similar.[17] The efficiency increase from introducing teams without time pressure in Feri et al. (2010) and the current paper is by 20 and 27 percentage points, respectively.

Given the payoff function in the minimum-effort game, equation (1), reductions in payoffs and efficiency can result from two forces. First, subjects choose effort lower than the payoff dominant effort level. Second, subjects miscoordinate and select different efforts that lead to a wasted cost of choosing higher effort levels. We investigate different measures for each effect to determine which one drives the difference in payoffs observed between *LTP* treatment and *IND* treatment. The teams under low time pressure choose higher effort levels than individuals, whether we examine the minimum effort, average effort, or frequency of the highest effort (Table 3, Panel B).[18] Meanwhile, teams under low time pressure have significantly smaller overall miscoordination. Table 3, Panel B presents three different indicators for this statement. Miscoordination—measured as the difference between the five chosen efforts from the actual minimum effort in each group—is significantly lower in LTP, and so is the average standard deviation of decisions within the group for a given period. Additionally, the frequency of perfect coordination—all decision units choosing the same effort—is significantly higher in *LTP* treatment compared to *IND* treatment. Finally, the index "adjustment" measures the absolute differences between a decision-maker's effort in period t and the minimum in period $t-1$. Row (I) in Table 3 shows that there is more "adjustment" going on in the *IND* treatment implying that teams in *LTP* settle quicker than individuals. Hence, whether we look at overall coordination or other measures considered in Feri et al. (2010), the results are in line with their findings, thereby leading us to the following statement.

Result 1 *Teams under low time pressure reach higher payoffs than individuals. This is due to increases in the minimum effort chosen and overall better coordination on any effort, not just the efficient effort.*

It should be noted that the robust rank order test used in Table 3, middle column section, does not account for the correlation of observations from the same group. Consequently, to

[17] Feri et al. (2010) results on baseline levels of coordination in a standard minimum-effort game are higher than similar other papers. With groups of 6 subjects, Deck and Nikiforakis (2012) and Avoyan and Ramos (2022) baseline treatments reach 44% and 48% efficiency, compared to 66% of Feri et al. (2010) with groups of 5 subjects.

[18] See Figure A1 and Figure A2 in the Appendix A for the distribution of minimum effort and effort in all three treatments. Figure A2 reports the dynamics of minimum effort for all groups in all three treatments.

Table 3: Comparisons of various outcomes across treatments

	IND [1]	*LTP* [2]	*HTP* [3]	Robust rank order test [1] vs. [2]	[1] vs. [3]	[2] vs. [3]	Test based on clustered errors [1] vs. [2]	[1] vs. [3]	[2] vs. [3]
Panel A									
(a) Average Overall Payoff	69.50	92.65	72.37	***	*	***	*	#	#
(b) Normalized Efficiency	43.98	71.27	55.67	***	***	***	**	#	#
(c) Average Payoff with Agreement	69.50	94.70	87.54	***	***	***	*	#	#
(d) Average Real Output	69.50	91.45	64.38	***	#	***	#	#	*
Panel B									
(e) Average Minimum Effort	1.78	3.89	3.70	***	***	#	*	*	#
(f) Average Effort	2.60	4.34	4.50	***	***	#	#	*	#
(g) Frequency of Efficient Effort	0.07	0.37	0.39	***	***	#	#	**	#
Panel C									
(h) Miscoordination	0.83	0.43	0.88	***	*	***	*	#	#
(i) Perfect Coordination	0.24	0.67	0.48	***	***	***	***	#	#
(j) Average Standard Deviation	0.93	0.36	0.81	***	**	***	**	#	#
Panel D									
(k) Frequency of Agreement	NA	0.98	0.83	NA	NA	***	NA	NA	***
(l) Adjustment	0.80	0.33	0.40	***	***	#	**	*	#

Note: (1) *Miscoordination* is defined as the average of the absolute difference between a decision maker's number and the minimum in the same period. *Perfect coordination* is defined as the fraction of periods where all five decision-makers choose the same number. *Average standard deviation* is the standard deviation of decisions within the group for a particular period. *Adjustment* is defined as the average of the absolute difference between a decision maker's own number and the minimum in the previous period. (2) We conduct OLS regressions with the errors clustered at the group level. (3) Statistical significance levels: # $p > 0.1$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

account for any possible effects of such correlation, we conduct more conservative analyses by clustering the errors at the group level.[19] We will adhere to this conservative rule as our primary statistical tool. The results discussed above qualitatively remain similar but are less statistically distinct.

Having established that teams under low time pressure outperform individuals in coordination, we now turn our attention to teams under high time pressure versus individuals. Panel B in Table 3 reveals that teams under high time pressure have a higher average minimum effort, average effort, and frequency of efficient effort. Nonetheless, Panel C in Table 3 tells a different story. Teams in *HTP* are no longer more successful than individuals at avoiding miscoordination. *HTP* treatment leads to similar miscoordination and standard deviation levels as *IND* treatment, but higher levels of perfect coordination. Taken together, the average overall payoff

[19] Table A2 in the appendix provides the full regression results.

in points reached in *HTP* treatment (72.37) is similar to *IND* treatment (69.50) (Table 3 Panel A).

Recall how a team comes to an agreement. Team members have access to an open chat, and before the allotted time has elapsed, team members have to enter the same effort to participate in the group production and earn a non-zero payoff. Panel D in Table 3 presents the frequency of agreement, highlighting how often teams reach an agreement by the set deadline in *LTP* and *HTP*. Teams under high time pressure have a significant amount of no agreements, especially in the first few periods (Table 3 Panel D and Figure 1(k)). Nevertheless, once the teams reach an agreement, they still seem to coordinate at a high level, reaching an average of 87.54 points compared to 94.70 points in *LTP* treatment (Table 3 Panel A, Average Payoff with Agreement).

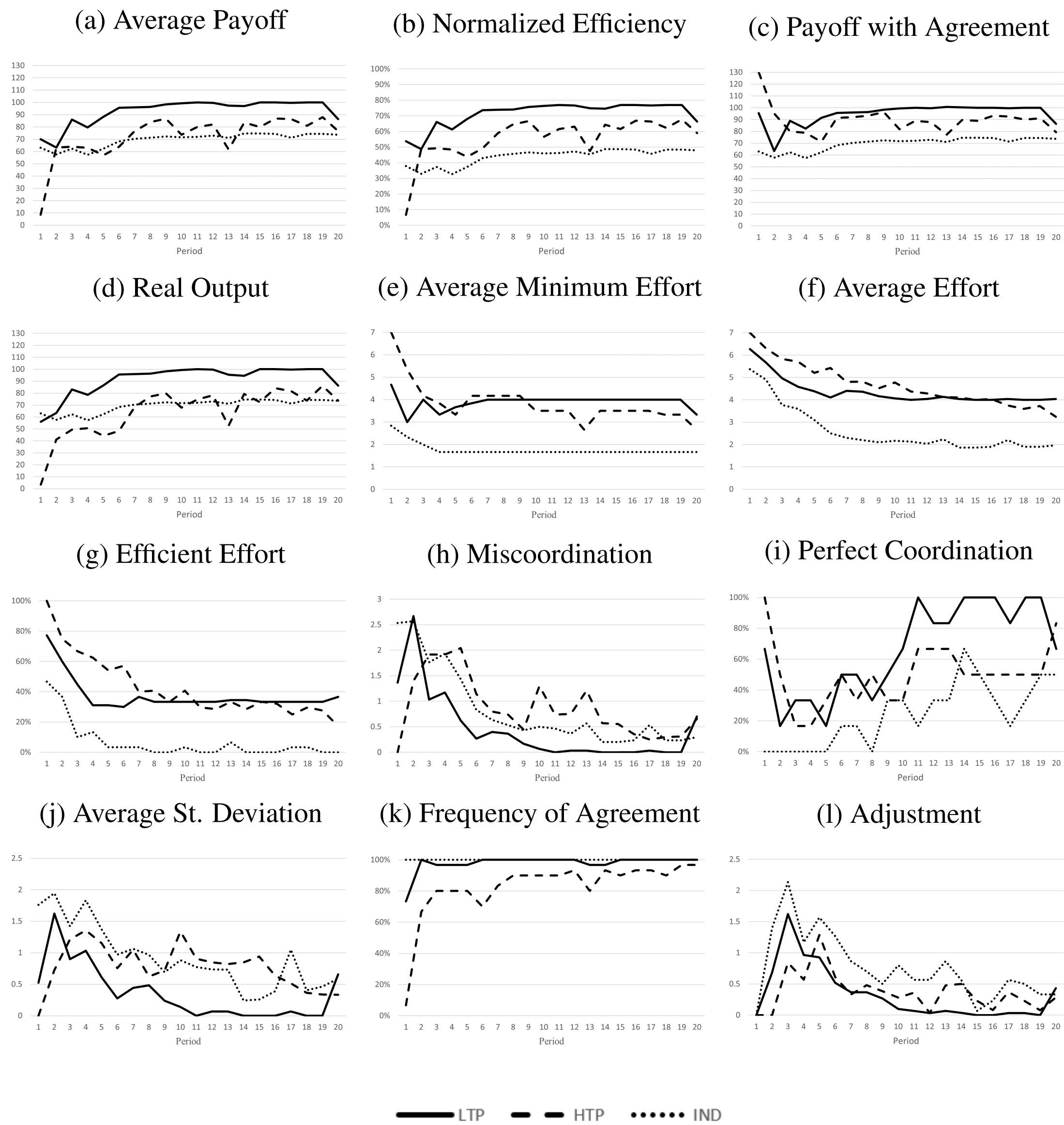
Result 2 *Teams under high time pressure reach similar payoffs as individuals. This result is driven mainly by similar levels of miscoordination in* HTP *and* IND *as well as the high frequency of no agreement in* HTP *treatment. However, teams under time pressure reach higher average minimum effort, average effort, and higher frequency of efficient effort than individuals.*

Real output of the group In our experimental environment, the group does not get "punished" if some teams fail to reach an agreement and thus do not participate in the production of the output. One can easily imagine that this assumption might be amiss in an organizational context.[20] If a team does not contribute to the entire group's project, this can negatively affect the group's performance. Therefore, we consider a new measure, *real output*, to capture the effect of no agreements. We assume that each team member's output shrinks by $20\% \cdot k$ if k teams fail to submit their decision (20% reduction per group as there are five teams involved in the production of the group output). That is, if one team fails to reach an agreement, the rest of the teams can achieve 80% of the maximum output. This altered output production incorporates the importance of team disagreements and their effects on the entire group's performance.[21] Row (d) in Panel A of Table 3 presents the results. If we consider the reduction in production due to the failure of teams to reach an agreement, the output in *HTP* treatment is even lower than in an individual case. While the difference is statistically insignificant, the real output provides us a glimpse into how detrimental time pressure can be. High enough time constraints can lead to lower output levels in groups with teams compared to individuals. This result highlights the importance of considering the time pressure while contemplating employing teams instead of individuals to aid coordination.

[20] We follow this rule since it is present in Feri et al. (2010) and we build our design based on their procedures.

[21] This is one type of output modification; certainly, there are other ways to alter the output, but the uniform reduction seems a natural place to start. Additionally, we are changing the rule ex-post, taking subjects' choices as given. If we implemented this change in the lab, adding this rule could alter effort choices. Nonetheless, this exercise provides the first evidence of how detrimental team disagreements can be.

Figure 1: The dynamics of measures



4.2 Team communication under low and high time pressure

This section attempts to open the "black box" of decision-making within teams by examining the chat content. For this purpose, we employed two research assistants (RA) to classify all messages into four categories.[22] The first category captures teaching and learning about the game. Even in the absence of free-form open chat, studies have found how vital "teachers" can be in leading the group to efficient play (e.g., see Hyndman et al. 2012). The second category

[22] The RAs were undergraduate and graduate students in the economics department at Indiana University. Categories outlined in Table 4 had been ex-ante determined by the research team and provided to the RAs.

represents intentions of choice that do not involve any teaching/learning as in the first category. These messages propose choices or counter the proposed choice without explanation or clarification. The third category captures messages that could help establish common knowledge of proposed effort choices (common knowledge of the environment is crucial in coordination games, see Chen et al. 2021). Finally, the last category is "empty" messages, i.e., messages unrelated to the game, intentions about efforts, or strategy.

After RAs were provided with written instructions on how to code the chat messages, they then assigned each message a category type. To create a single variable for each category and subject, we average the entries of the two coders. The final value of the variable for a specific category would be 0, 0.5, or 1, if none, one and both coders classified that entry in that category. We follow these procedures for content analysis, which have been used in the literature; for example, see Cooper and Kagel (2005). Table 4 documents the results. We first note that team members often used the messaging system, especially those under low time pressure. Indeed, on average, teams under low time pressure sent 167 messages for 20 periods of interaction, whereas teams under high time pressure sent 69 messages.

Focusing on the content of the messages, we find that time pressure significantly changes the composition of team communication content. For example, teams in *LTP* treatment have more Category 1 messages both in total and frequency. Conversely, teams in *HTP* treatment have more Category 2 messages in terms of total number and frequency. In a time-constrained situation, reaching an agreement is already challenging for team members. There is limited space for team members to discuss the structure of the game and how to respond optimally to other teams' past decisions. In addition, messages involving reassurance that could establish common knowledge of effort choice among team members are present significantly more often under low time pressure than high time pressure. Given the overall results on performance, we can speculate that discussions involving learning and reassurance are relevant components in the superior performance of teams over individuals without time pressure.

Table 4: Content analysis of chat messages

	Average		Frequency	
Message Categories	*LTP*	*HTP*	*LTP*	*HTP*
C_1: Questions or explanations about the environment and payoff structure; answers to the questions	64.200**	19.533	0.384*	0.278
C_2: State or counter a proposed plan (no engagement in teaching/learning practices as in Category 1)	8.98***	27.933	0.054***	0.418
C_3: Agreeing with the proposed team strategy and reassuring to follow the plan	33.13**	12.550	0.198	0.188
C_4: Irrelevant content (such as saying hi)	60.933*	8.903	0.364*	0.129

Note: (1) Average represents the average number of messages in each category and in each team. Frequency refers to the fraction of messages in each category out of all messages in that treatment. The significance levels. (2) The statistical analysis is OLS regression, where the dependent variable is the number of each type of category or the frequency of each category. The independent variable is a dummy variable that indicates the treatments. The standard errors are clustered at the group level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Result 3 *Under high time pressure, team members state their intended efforts and are less* *likely to engage in teaching/learning. Teams under time pressure are also less likely to send reassuring messages and agree to the proposed choice.*

Next, we take a closer look at the use of messages in each category over the 20 periods of play. Figure 2 presents the average number of messages in 4 categories over time in two team treatments. The most notable pattern in Figure 2a shows a dramatic difference in teaching/learning messages in the two treatments - the decline pattern of the teaching/learning (C_1-category) messages in *LTP* and gradually approaching that of *HTP* near the end of the repetitive play. This is corresponding to the decrease in miscoordination and increase in perfect coordination over periods in *LTP* treatment, respectively, as shown in Figures 1h and 1i. Therefore, the corresponding patterns across Figure 2a and Figures 1h and 1i suggest that teaching/learning messages are important and impactful at the early periods of the play, and their use declines as the team members have reached desired stable decisions.[23] The lack of teaching/learning messages in the early periods might explain the lower level of perfect coordination in the *HTP*.

(a) The number of C_1 messages

(b) The number of C_2 messages

(c) The number of C_3 messages

(d) The number of C_4 messages

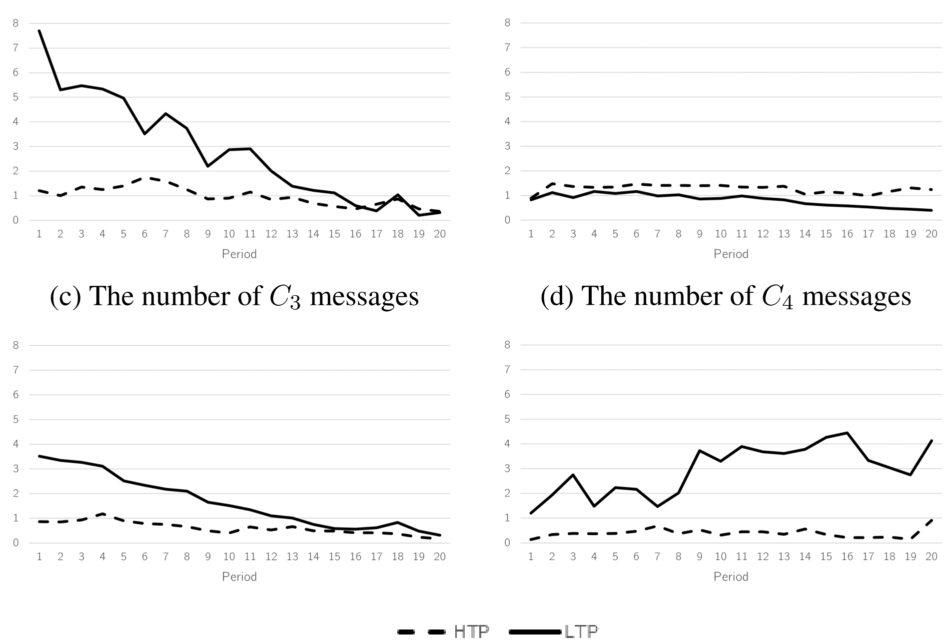


Figure 2: The average number of messages in each category over 20 periods.

[23] See Appendix B for regression analyses of the effects of chat content on the likelihood of reaching an agreement and the agreed effort.

4.3 Experience-weighted attraction learning model

In this section, we employ the experience-weighted attraction (EWA) learning model developed by Camerer and Ho (1999) to gain further understanding of behavior between teams under varying time pressure and individuals.[24] EWA learning model was introduced to integrate reinforcement and belief-based approaches to learning.

In EWA learning, strategies have some attraction levels, which are updated based on two payoff types: (i) the payoffs that the strategies actually provided; (ii) the payoffs that unchosen strategies would have provided. These attraction levels are adjusted each period according to the number of periods that have passed and the amount of experience that players have accumulated. Finally, there is a mapping from attractions to strategies into the probabilities of choosing these strategies. Intuitively, the mapping is such that more attractive strategies are more frequently employed.

A brief account of EWA learning model The players (either individual or team) are indexed by i, $i \in \{1, 2, \dots, n\}$; each one has a strategy space $S_i = \{s_i^1, s_i^2, \dots, s_i^m\}$. Let $S := S_1 \times S_2 \times \dots \times S_n$, where s_i denotes a pure strategy of player i. There are eight pure strategies i.e., $m = 8$, including 1 to 7 and no agreement. In period t, player i's actual decisions denoted as $s_i(t)$ and the relevant order statistic (the minimum effort in the group) is denoted by $z(t)$. The payoff function is $\pi_i\left(s_i^j, z_t\right) \in \mathbb{R}$, which is the payoff i receives for playing s_i^j given the relevant order statistic $z(t)$.

For unit i strategy j in period t has a numerical attraction $A_i^j(t)$, which determines the probability of choosing strategy j in period $t+1$ by the following logistic function:

$$P_i^j(t+1) = \frac{e^{\lambda A_i^j(t)}}{\sum_{k=1}^{m} e^{\lambda A_i^k(t)}}.$$

The parameter λ captures players' sensitivity toward differences among attraction levels. That is, if $\lambda = 0$, the differences are completely ignored and strategies are chosen randomly with equal probability. As λ increases, probabilities of choosing each strategy converge to the ones in the best response function in which the strategy with the highest attraction is selected. These attraction levels are adjusted each period according to the following equation:

$$A_i^j(t) = \frac{\phi N(t-1) A_i^j(t-1) + \left(\delta + (1-\delta) I\left(s_i^j, s_i(t)\right)\right) \hat{\pi}_i\left(s_i^j, z(t)\right)}{N(t)},$$

[24] The classification of the chat messages is based on an exogenous set of categories that could be thought of as fairly subjective. Therefore, we also conduct a structural estimation of a behavioral model. Focusing on the calibrated parameters provides vital insights into the behavioral mechanisms behind the aggregate results (see DellaVigna (2018)).

where $N(t)$ is a weight on the past attractions following the updating rule $N(t) = \phi(1-\kappa) \times N(t-1) + 1$. The parameter ϕ is interpreted as the depreciation of past attractions, $A(t)$, the degree to which players realize other players are adapting. The parameter κ determines the growth rate of attractions, which is also related to the convergence of play.

$I(\cdot,\cdot)$ is an indication function, which is equal to zero if $x \neq y$ and one if $x = y$. $\hat{\pi}_i\left(s_i^j, z(t)\right)$ is the actual payoff $\pi_i\left(s_i(t), z(t)\right)$, when $s_i^j = s_i(t)$ and it is the foregone payoffs otherwise.[25] Variables $N(t)$ and $A_i^j(t)$ have initial values $N(0)$ and $A_i^j(0)$, respectively, reflecting pregame experience. The parameter δ determines the weight put on foregone payoffs during the updating process.

EWA estimation The maximum likelihood method is used to estimate model parameters. To ensure model identification, we impose necessary restrictions on the following parameters: $\lambda, \phi, \kappa, \delta$, and $N(0)$.[26] Then, for each treatment and game, we estimate initial attractions as described by Ho et al. (2008).[27] The likelihood function to estimate is then given by:

$$L(\lambda, \phi, \delta, \kappa, N(0)) = \prod_{i=1}^{6}\prod_{j=1}^{5}\left[\prod_{t=1}^{20} P_i^{s_{i,j}(t)}(t)\right].$$

In Table 5, we report the estimates from each treatment for parameters $\lambda, \phi, \delta, \kappa$, and $N(0)$ in the EWA model. First, the most crucial finding when comparing *LTP* treatment and *IND* treatment is that teams under low time pressure have a significantly larger λ than individuals.

[25] When teams do not reach an agreement, they are not informed about the other teams' decision; thus, the forgone payoff from unchosen strategies are unknown. Here, we apply the method proposed by Ho et al. (2008)—using the average payoff of the set of possible foregone payoffs conditional on others' strategies to estimate the foregone payoff from unchosen strategies.

[26] Following Camerer and Ho (1999), we have $\lambda \in [0, \infty], \phi, \delta, \kappa, \in [0, 1]$, and $N(0) \in \left[0, \frac{1}{1-(1-\kappa)\phi}\right]$.

[27] A typical approach in the literature is to estimate initial attractions (common to all players) from the first period of actual data. Formally, define the first-period frequency of strategy j in the population as f^j. Then initial attractions are recovered from the equations

$$\frac{\mathrm{e}^{\lambda A^j(0)}}{\sum_k \mathrm{e}^{\lambda A^k(0)}} = f^j, j = 1, \ldots, m.$$

This is equivalent to choosing initial attractions to maximize the likelihood of the first-period data, separately from the rest of the data, for a value of λ derived from the overall likelihood-maximization. The initial attractions can be solved for, as a function of λ, by

$$A^j(0) - \frac{1}{m}\sum_j A^j(0) = \frac{1}{\lambda}\ln\left(\tilde{f}^j\right), j = 1, \ldots, m,$$

where $\tilde{f}^j = f^j / \left(\Pi_k f^k\right)^{1/m}$ is a measure of relative frequency of strategy j. Following Ho et al. (2008), we fix the strategy j with the lowest frequency to have $A^j(0) = 0$ (which is necessary for identification) and solve for the other attractions as a function of λ and the frequencies $\tilde{f}^j$.

As a result, if teams and individuals face equal attractions, teams are more likely to choose the strategy with the highest attraction. This leads to less miscoordination in the *LTP* treatments.

Table 5: Parameter estimates of EWA learning model

	IND	*LTP*	*HTP*	Comparisons		
	[1]	[2]	[3]	[1] vs. [2]	[1] vs. [3]	[2] vs. [3]
λ	2.824	4.769	4.313	**	#	#
	(0.456)	(0.180)	(4.008)			
ϕ	0.743	0.694	0.659	#	#	#
	(0.129)	(0.013)	(0.161)			
δ	0.628	0.631	0.001	#	*	*
	(0.040)	(0.042)	(0.259)			
κ	0.990	0.619	0.170	#	#	#
	(0.335)	(0.071)	(0.646)			
$N(0)$	0.292	1.111	2.902	**	**	**
	(0.186)	(0.018)	(0.348)			

Note: (1) λ is sensitivity to different attraction levels; ϕ captures depreciation of past attractions; δ is the weight placed on forgone payoffs; κ is growth rate of attractions that relates speed of convergence; $N(0)$ is the strength of initial attractions. (2) Numbers in parentheses indicate standard errors. (3) For statistical analysis, we conduct a z-test; the significance levels are: # $p \geq 0.1$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

We identify two factors that could explain the differences between team treatments. The teams in *HTP* have a significantly larger $N(0)$ and an extremely small δ. That is to say, in the process of updating attractions of strategies,' teams under high time pressure primarily focus on their initial thoughts and do not take into account the hypothetical payoffs from unchosen strategies. Moreover, the effect of the initial attractions persists for teams under high time pressure, relative to incremental changes in attractions due to actual payoffs.

Result 4 *According to the EWA learning model, teams under low and high time pressure have a higher sensitivity to the differences among attractions than individuals. Teams under high time pressure pay less attention to the payoffs of unchosen strategies than individuals and teams under low time pressure.*

5 Discussion and concluding remarks

This paper examines the effects of time pressure on teams' overall performance in a coordination setting, and we identify the driving forces of arising differences. The main result is that time pressure nearly wipes off the efficiency gains arising from team decision-making compared with individuals. Two distinct sources are underlying the inefficiencies under time pressure: first, teams often fail to reach an agreement under a time constraint, and second, teams under high time pressure have similar miscoordination levels as individuals. The inter-team chat log also reveals that teams under high time pressure are less likely to update strategies via asking questions, learning, and teaching about the payoff structure and other components of the environment.

Our experimental results are relevant for policy design in modern organizations. Although there is an increasing trend of assigning more work to team units, our results identify the limitations of efficiency improvement. When tasks require coordination among decision-making units and the environment is under sufficiently tight time constraints, teams are no longer more efficient and potentially less efficient than individuals. In addition, if a unanimous agreement is required to reach an agreement, as in the current paper, the inefficiencies could be even further damaging. Further research focusing on various agreement rules can examine the overall performance and highlight better procedures under time pressure.

Extensive work has been conducted comparing a team's decision-making with that of an individual in numerous environments. These studies are typically performed under low time pressure. Our experiment sheds some light on the possible limitation of such implementation in a coordination environment. Our results show that the differences between teams and individuals in coordination games no longer hold when we place units under high time pressure. While there are apparent reasons why low time pressure is usually considered in the literature, it may not be such an innocuous assumption. The results in this paper suggest the need to examine whether extensively documented differences across teams and individuals remain the same under time constraints.

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Appendix A Additional Tables and Figures

Appendix Table A1: Demographic characteristics

	Dependent variable:			
	% Female	% Econ Major	% Game Theory	GPA
	(1)	(2)	(3)	(4)
LTP	-0.09	0.00	0.04	-0.13
	(0.11)	(0.06)	(0.09)	(0.10)
HTP	-0.09	-0.02	0.09	-0.17
	(0.11)	(0.06)	(0.09)	(0.15)
Observations	210	210	210	209
LTP v.s. HTP	#	#	#	#

Notes: (1) The table reports the OLS regression, where the dependent variable is the demographic characteristic indicated in each column. (2) Two dummy variables indicate that subjects were assigned to LTP or HTP treatments, respectively. (3) One subject did not report their GPA. (4) Standard errors are reported in parentheses. (5) LTP v.s. HTP row indicates whether there are statistical differences in the coefficients between the two treatments. (6) Statistical significance levels: $\# \ p > 0.1$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table A2: Comparisons of various outcomes across treatments

Panel A	Average Overall Payoff	Normalized Efficiency	Average Payoff with Agreement	Average Real Output
	(a)	(b)	(c)	(d)
LTP	23.15*	0.27**	25.20*	21.95
	(12.99)	(0.10)	(12.81)	(13.05)
HTP	2.87	0.12	18.04	-5.12
	(12.34)	(0.10)	(13.72)	(12.54)
Observations	1800	1800	1683	1800
LTP v.s. HTP	#	#	#	*

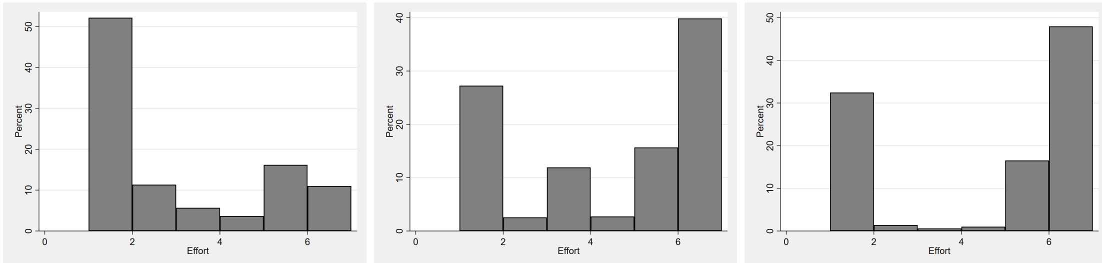
Panel B	Average Minimum Effort	Average Effort	Frequency Of Efficient Effort
	(e)	(f)	(g)
LTP	2.12*	1.74	0.30
	(1.16)	(1.07)	(0.18)
HTP	1.93*	1.90	0.32**
Observations	355	1683	1683
LTP v.s. HTP	#	#	#

Panel C	Miscoordination	Perfect Coordination	Average Standard Deviation
	(h)	(i)	(g)
LTP	-0.39*	0 .44***	-0.57**
	(0.18)	(0.10)	(0.17)
HTP	-0.05	0.24	-0.12
	(0.31)	(0.14)	(0.29)
Observations	1683	1775	355
LTP v.s. HTP	#	#	#

Panel D	Frequency of Agreement	Adjustment
	(k)	(i)
LTP		0 .47**
		(0.16)
HTP	-0.15***	-0.40*
	(0.03)	(0.20)
Observations	1200	3747
LTP v.s. HTP	#	#

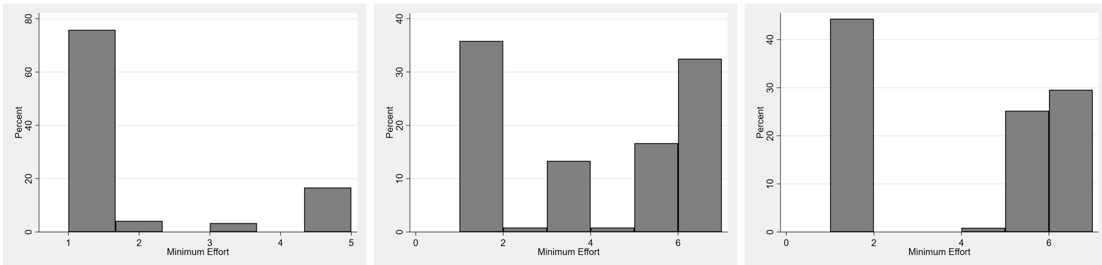
Notes: (1) This table reports the full regression results of Table 3. The dependent variable is indicated in the column title. *Miscoordination* is defined as the average of the absolute difference between a decision maker's number and the minimum in the same period. *Perfect coordination* is defined as the fraction of periods where all five decision-makers choose the same number. *Average standard deviation* is the standard deviation of decisions within the group for a particular period. *Adjustment* is defined as the average of the absolute difference between a decision maker's own number and the minimum in the previous period. (2) Two dummy variables indicate that subjects were assigned to LTP or HTP treatments, respectively. Note, the Frequency of Agreement variable is only applicable for LTP and HTP treatments only. (3) LTP v.s. HTP row indicates whether there are statistical differences in the coefficients between the two treatments. (4) Standard errors are reported in parentheses. (5) Statistical significance levels: $\# \ p > 0.1$, $^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

(a) IND (b) LTP (c) HTP

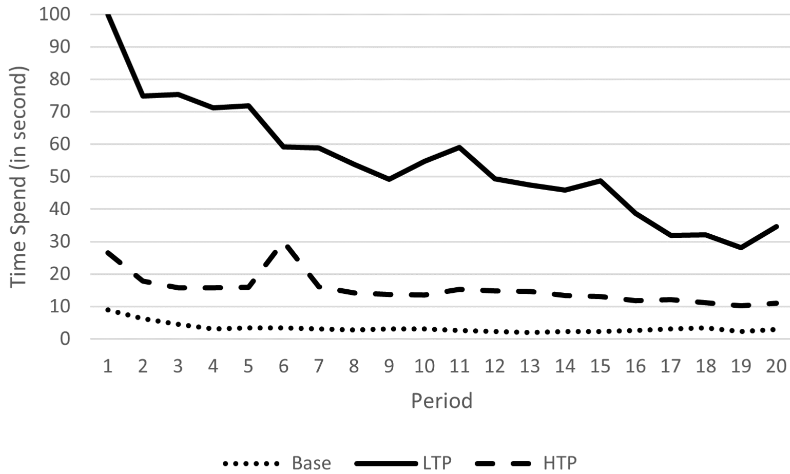


Appendix Figure A1: Distribution of effort in various treatments

(a) IND | (b) LTP | (c) HTP

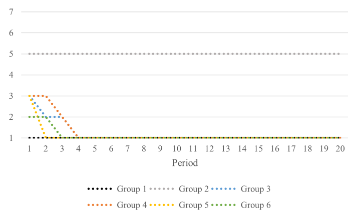


Appendix Figure A2: Distribution of minimum effort in various treatments

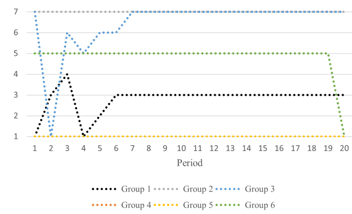


Appendix Figure A3: The dynamics of time spend (in seconds) to make a decision

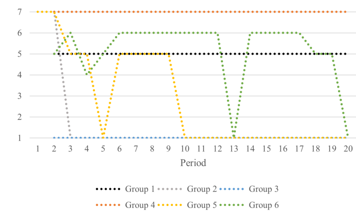
(a) IND



(b) LTP



(c) HTP



Appendix Figure A4: The dynamics of minimum effort for all groups

Appendix B The effects of the chat content

In this section, we investigate how different types of chat content are related to the likelihood of reaching an agreement and the chosen effort conditional on reaching an agreement. To do so, in Table 4, we report the estimation results from OLS regressions based on the sample from the two team-decision treatments. It should be noted that the regression only provides the correlation interpretation, not causal inference.

The dependent variable is reaching an agreement in Columns (1) and (3) and the chosen effort in Columns (2) and (4). Regarding independent variables, we include a dummy for *LTP* treatment and a period indicator in Columns (1) and (2), which replicate the results in Section 4. For example, compared to high time pressure, low time pressure leads to a higher likelihood of reaching an agreement, although it does not result in a higher effort. We include additional variables in Columns (3) and (4). C_i indicates the number of messages in category i and their interactions with the treatment variable. Thus, the coefficient of C_i shows the impact of an additional message in a given category on the outcomes of interest in *HTP* treatment, while the sum of coefficients of C_i and C_i $*$ *LTP* shows the impact on *LTP* treatment.

The first thing to note is that, in line with our previous results, the teams in *LTP* are significantly more likely to reach an agreement than teams in *HTP*. Their effort number is similar if not smaller than that of *HLP*, though the difference is not statistically significant. Turning to the effect of chat content. We start by noting that the teaching/learning content (C_1) negatively associates with the likelihood of teams in *HTP* to reach an agreement (t-test, $p < 0.001$). Indeed, under high time pressure, team members may not have time to discuss the game's structure. If they do, it will probably harm the team's ability to reach an agreement in the first place. Such negative correlation with reaching an agreement disappear in *LTP* (t-test for $C_1 + C_1$ $*$ *LTP*, $p = 0.149$). In addition, the content involving reassurance (C_3) is related to rise in the likelihood of teams reaching an agreement in *LTP* (t-test for $C_3 + C_3$ $*$ *LTP*, $p = 0.035$) not in *HTP*. Proposing content has no significant correlation with agreement reaching in both HTP (t-test, $p = 0.441$) and LTP (t-test for $C_2 + C_2$ $*$*LTP*, $p = 0.107$). Finally, turning to which type of messages relates to the effort number chosen by the team. We find that the teaching/learning content (C_1) actually negatively relates the effort number for teams in *LTP* (t-test for $C_1 + C_1$ $*$ *LTP*, $p = 0.024$). This indicates that more team discussion on game structure actually relates to a risk-dominant strategy.[28]

[28] We also find that the irrelevant content (C_4) seems to reduce the effort number of teams in *HTP*, we think the measurement error could cause it for content classification or the correlation between some unobservable variables given the regression is not a strictly causal analysis.

Appendix Table B1: Regression Analysis of Chat Content

	Agreement (1)	Effort (2)	Agreement (3)	Effort (4)
C_1			-0.11***	-0.36
			(0.00)	(0.21)
C_2			-0.01	0.35
			(0.01)	(0.29)
C_3			-0.01	-0.21
			(0.01)	(0.36)
C_4			-0.05	-0.40**
			(0.04)	(0.14)
C_1*LTP			0.11***	0.25
			(0.01)	(0.22)
C_2*LTP			0.02	-0.7
			(0.01)	(0.40)
C_3*LTP			0.03**	0.26
			(0.01)	(0.40)
C_4*LTP			0.05	0.32*
			(0.04)	(0.16)
Period	0.01***	-0.10***	0.01***	-0.12***
	(0.00)	(0.03)	(0.00)	(0.03)
LTP	0.15***	-0.24	-0.01	0.39
	(0.03)	(1.26)	(0.02)	(1.74)
Constant	0.69***	5.67***	0.86***	5.96***
	(0.04)	(0.74)	(0.04)	(1.14)
Observations	1200	1083	1200	1083
R-squared	0.13	0.05	0.28	0.12

Note: (1) This table reports OLS coefficient estimates. Standard errors are clustered at the group level. (2) For dependent variables, "Agreement" is the dummy variable indicating whether the team unit reaches an agreement in a given period, and "Effort" reports the joint team decision in a given period. For independent variables, "LTP" is the dummy variable indicating whether low time pressure treatment, C_i indicates the number of messages in category i. (3) * , **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Appendix C Instructions for HTP

Welcome to the experiment!

Funds have been provided to run this experiment. Money you earn will be paid to you in cash at the end of the experiment. The entire session will take place through computer terminals. Please, do not talk to other participants and do not use your personal electronic devices.

Number of periods and decision-making units

- This experiment has **20 periods**.
- There will be **units of 15 participants each**. You will only interact with members of the unit to which you are assigned throughout the whole experiment. Neither during nor after the experiment will you be informed of the identities of other members in your unit.

Teams

- Within each unit there will be **teams of 3 subjects each**. That means that each unit will have **5 teams**. Teams will stay together for the entire experiment.
- Members of a given team will have to agree on **a single decision for the whole team**. To do so, members can exchange messages for **30** seconds through an instant messaging system at the bottom of their screens. As soon as you press "Return" after having written a message, it will be visible on the two other members' screens. You are allowed to send any message you like, except for those revealing your identity and except for using abusive language.
- If a team has agreed on a joint decision, each member must enter this decision on his/her screen. Note that a team that does not manage to enter a joint decision at that stage **will not get any payoff for the respective period**. If one team within a unit fails to enter the identical decision of all three members, then this team will not be considered in the determination of the outcome for the other teams.

Sequence of actions within a period

- **Choosing a number**
  Each team has to choose a single **number** from the set {1, 2, 3, 4, 5, 6, 7}. Teams have to decide independently of other teams. After all teams have entered their numbers, you will be informed about the smallest number chosen by any team in your unit (including your own team).
- **Period payoff**
  Your payoff (in Points) depends on your own number (i.e., the number of your team) and the smallest number chosen by any team within your unit. The **payoffs for each member** of a team are given in the following table.

Payoff table (for each team member)

Your number	Smallest number in unit						
	7	**6**	**5**	**4**	**3**	**2**	**1**
7	130	110	90	70	50	30	10
6		120	100	80	60	40	20
5			110	90	70	50	30
4				100	80	60	40
3					90	70	50
2						80	60
1							70

- **Total earnings**
  The earnings of each period are accumulated and exchanged at the end of the experiment as follows: **200 Points = $1.** Each participant will receive their total earnings privately. In addition to your earnings from the experiment, you will receive **a show-up fee of $8.**