Team work under Time Constraints*

Ala Avoyan†, Haoran He‡ and Kelin Lu§

February 13, 2024

Abstract

The existing literature has documented the advantages of teams as decision-making units across a wide array of environments. In this study, we explore the potential limits on such benefits. Specifically, we show that certain conditions, such as time constraints, can influence performance of teams, causing them to perform equally or even less effectively than individuals. Our findings indicate that under low time pressure, teams excel in coordination, achieving significantly higher efficiency compared to individuals. This result stems from teams' higher efforts and lower miscoordination. However, under high time pressure, teams fail to maintain their coordination and agreement-reaching advantages, performing on par with individuals. We investigate the underlying mechanisms driving the detrimental effect of time pressure on performance by analyzing communication content and estimating the experience-weighted attraction learning model. Taking the evidence together, we conclude that team's superior performance in coordination settings without time constraints can be attributed to open chat discussions fostering a shared understanding of the game.

JEL Classification: C73, C92, P41;

Keywords: team decision-making, time pressure, communication, coordination.

*We would like to thank David Cooper, Friederike Mengel, Kirby Nielsen, Daniela Puzzello, James Walker, Roberto Weber, and Alistair Wilson for their helpful comments and discussions. This paper also benefited from comments received by conference participants at the 2022 ESA North American meetings. Financial support from the Department of Economics, Indiana University, and the National Natural Science Foundation of China (Project Nos. 71973016 & 72131003) is gratefully acknowledged.

†Department of Economics, Indiana University, e-mail: avoyan.ala@gmail.com

‡Corresponding author: Business School, Beijing Normal University, e-mail: haoran.he@bnu.edu.cn

§Department of Economics, Huazhong University of Science and Technology, e-mail: kelinluecon@gmail.com

1 Introduction

Teamwork is a prevalent and vital aspect of decision-making in various contexts. Onuchic and Ray (2023) bring to light that in economics, co-authored papers make up over 70% of all published research, up from 20% in 1960. Taking a different perspective, Kim et al. (2022) argue that for most applications of game theory, each individual in a game has often been a team of players even if modeled as an individual decision maker (examples include spectrum auctions, R&D races, political parties, among others). Recognizing the ubiquity of team decision-making, a large strand of literature has investigated team decision-making compared to individual decision-making. Both theoretical and experimental literature have emphasized the benefits of team decision-making as it allows workers to combine their skills and knowledge (for the review of the literature, see Charness and Matthias (2012) and Kugler et al. (2012)).[1] In this paper, we experimentally examine the possible limits of such benefits, and we provide evidence that, under some conditions, teams may perform the same or worse than individuals.

Our research examines whether the superior performance of teams persists under time constraints, a dimension absent in the current team-related economic literature (see Section 2 for an extensive discussion). Specifically, we focus on decision-making in a coordination setting due to its significant impact and prevalence. Successful coordination is paramount in various organizational contexts, as coordination failures can lead to inefficiencies (Schelling, 1960; Arrow, 1974). Existing research has emphasized how teams can enhance coordination via various means (Feri et al., 2010; Chaudhuri et al., 2015; Sitzia and Zheng, 2019). Moreover, coordination environment often occurs under time restrictions imposed by client-imposed deadlines, emergencies, or natural disasters, highlighting the importance of considering time constraints within coordination contexts.

Do teams under high time pressure still maintain higher efficiency than individuals? Identifying the causal impact of time pressure on coordination using observational data presents significant challenges, as time pressure and degree of coordination efficiency can reversely determine each other or/and be jointly influenced by other unobserved factors. To address these difficulties, our study adopts an experimental methodology: we employ a 2 by 2 factorial design, varying the time allotted for decision-making (high vs. low time pressure) and the type of decision unit (individual vs. team). Teams consist of 3 individuals who act as one decision unit. Team members can communicate freely via a chat box before submitting an unanimous joint decision.

[1] Onuchic and Ray (2023) theoretically explore the tension that could arise in teamwork due to the loss of an individual's ability to clearly reveal personal ability and build reputation.

The potential implications of time pressure on team decision-making are not immediately evident. On the one hand, since individuals are more risk-seeking under time pressure (Kocher et al., 2013; Saqib and Chan, 2015) and strategic uncertainty is argued to be the main culprit of coordination failure, the risk-loving tendencies under time pressure could lead teams to coordinate *better* than teams under no such pressure. Similar result has been found for individuals—decision-makers under time pressure coordinate better than those without time pressure (Belloc et al., 2019; Poulsen and Sonntag, 2020). On the other hand, time pressure can lead teams to higher coordination failures and *worse* coordination. High time pressure might hinder team discussions, thus limiting opportunities for teaching and learning.[2] Importantly, understanding the impact of time pressure on coordination will shed light on the fundamental driving forces that contribute to higher coordination among teams compared to individuals in coordination games conducted without time constraints.

Our results show that under low time pressure, teams acting as decision units are significantly better at coordination than individuals. Specifically, under low time pressure, teams achieve 69% efficiency, while individuals under low time pressure reach 53% efficiency. Two underlying factors are found to drive teams' superior performance under low time pressure. First, teams choose considerably higher efforts than individuals. Second, teams reach lower degree of miscoordination than individuals.

Examining teams and individuals under high time pressure, we observe that time pressure wipes off the efficiency gains of teams relative to individuals. Teams under high time pressure reach 56% efficiency, which is not statistically distinct from the 49% efficiency reached by individuals under such pressure. This suggests that teams' better performance in coordination settings is contingent upon having sufficient time for making decisions. Further investigation into the factors behind this diminished performance reveals that it is not primarily attributed to a lack of teams' ambition to choose higher effort under time pressure. Instead, the key factor undermining team performance is identified as the increased likelihood of divergent effort choices among teams and the decreased likelihood of reaching consensus within teams.

To further understand why time pressure disrupts the efficiency gains of teams, we examine the chat log during team decision-making. Our evidence suggests that the lack of teaching and learning discussions under high time pressure results in loss of efficiency. To gain a more comprehensive understanding on the underlying mechanisms, we employ the experience-weighted attraction (EWA) learning model of Camerer and Ho (1999). The estimation reinforces some of our previous findings while revealing some new insights. We find that under low time pressure, teams exhibit heightened sensitivity to the potential payoff disparities across different actions

[2] See Section 4 for more thorough discussion.

compared to individuals. The heightened sensitivity enhances their probability of choosing the action most likely to yield the highest payoffs. Conversely, the differential sensitivity to the potential payoff disparities between teams and individuals diminishes under conditions of high time pressure. Overall, the EWA model estimation further clarifies the forces that drive the differences between teams and individuals with and without time pressure.

2 Literature Review

This study makes contributions to three distinct strands of literature. First, it builds upon the extensive experimental economics research focusing on team decision-making in scenarios characterized by low time pressure. While a comprehensive review of this vast literature is beyond the scope of our study, we highlight some key findings (refer to Charness and Matthias, 2012 and Kugler et al., 2012 for reviews). Compared to individuals, teams tend to be more competitive and less cooperative (see, for instance, Bornstein et al., 2002; Cason and Mui, 2019; Müller and Tan, 2013; Balafoutas et al., 2014; Nielsen et al., 2019). Furthermore, teams demonstrate higher levels of coordination success (Feri et al., 2010; Chaudhuri et al., 2015; Sitzia and Zheng, 2019), and align more closely with game-theoretical predictions, indicative of a higher degree of cognitive sophistication (Cason and Mui, 1997; Cooper and Kagel, 2005; Kugler et al., 2007; Luhan et al., 2009; Miller and Rholes, 2023). In many real-world markets and organizational settings, decision-making is inherently constrained by time. This aspect is particularly salient for teams due to intrinsic communication delays and other process-related constraints. We extend the existing literature by examining both team and individual decision-making under varying levels of time pressure.

Our 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).[3] More related to our work, Belloc et al. (2019) and Poulsen and Sonntag (2020) find that high time pressure increases individuals' coordination levels in a coordination game. Our study extends the literature of time pressure from an individual decision-making to a team decision-making environment—a commonplace for many settings in real life—in which more interaction and thus time for decisions

[3] 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 Piovesan and Wengström 2009; Rand et al. 2012). 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).

are expected to be needed.

Finally, this paper contributes to the literature on institutions that promote coordination. Studies have examined ways to aid successful coordination via various institutions, such as costly and costless communication (Van Huyck et al., 1993; Cooper et al., 1992; Charness, 2000; Blume and Ortmann, 2007; Brandts et al., 2015), commitment (Avoyan and Ramos, 2023), 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). This paper examines the effects of time constraints on coordination levels, with a particular focus on teams as institutional decision-making units.

3 Experimental Design

In this section, we outline the experimental setup, including description of the game, treatment conditions, choices of parameters, as well as details on implementation.

3.1 The Game

In each session, subjects are randomly divided into five decision units, each forming a group. These decision units can either consist of a single subject or a team of three subjects, depending on the individual or group treatment. Subjects engage in a minimum-effort game characterized by the following components: $(I, (E)_{i\in I}, (\pi_i)_{i\in I}))$, 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

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

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 provided within a group. 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.[4] In particular, every decision unit picking

[4] In our experiment, the number of decision units in a game can reduced to less than 5 if any teams fail to reach an agreement or decision units fail to submit decisions within the time constraint. Given such possibilities, each player choosing not to submit a choice (choosing $\emptyset$) is also an equilibrium, that is, the set of actions is $E \cup \{\emptyset\}$ and

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.[5]

Following the convention in literature, we describe the payoffs to subjects in a matrix form (see Table 1). The payoffs in the matrix are told to be a *per participant payoff* for each team member. That is, for instance, if a team chooses seven and the minimum effort in its group is 7, every member of the team will receive 130 points in that period, rather than splitting that 130 points by 3 team members. This approach keeps the individual marginal incentives constant throughout the individual and team treatments.

Table 1. Payoffs in the minimum-effort game

	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

3.2 Treatments

We employ four distinct treatments in our study, which we describe individually, starting with the individual treatments, followed by the team treatments.

Individual treatments Five subjects play the minimum-effort game for 20 periods. In each period, each subject is requested to choose a number from the feasible set, i.e., 1 to 7, independently. Each subject is 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.

In individual Low-Time-Pressure treatment (*I-LTP*, hereafter), subjects are given 3 minutes to make their decisions, while subjects in individual High-Time-Pressure treatment (*I-HTP*,

$\pi_i(\emptyset, e_{-i}) = 0$. We provide further information and discussion in section 3.2 below.

[5] There are a few exceptions though. 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 in Van Huyck et al. (1990), groups comprising of only two subjects with access to history of play from the previous period achieve high coordination rates.

hereafter) are given 30 seconds to make their decisions.[6]

Team treatments A group of 15 participants are randomly divided into 5 teams with 3 members each. The team assignment remains the same throughout a session. These 5 teams play a minimum-effort game for 20 periods. In each period, each team member is asked to submit a choice of team effort. A team reaches a joint team decision by unanimously agreeing on an identical number to be chosen by all team members. If different effort choices are submitted, no team decision is reached and this team is excluded from participating in the group minimum-effort game, and thus the team members who did not reach an agreement receives no payment in that period. In such cases, the minimum effort of a group is calculated from the remaining units that reach an agreement.

The experimental instructions do not specify how team members can reach a team decision. Instead, team members can communicate via an electronic open free-form chat, and each team member can enter a proposed choice for team's decision individually via their computer screen.[7] Subjects can freely communicate during chatting, although we ask them to refrain from revealing their identities and using abusive language.

In the Team Low-Time-Pressure treatment (*T-LTP*, hereafter), subjects can have access to the chat and decision screen for three minutes in each period. In contrast, the Team High-Time-Pressure treatment (*T-HTP*, hereafter) only allows access for 30 seconds.

Table 2 summarizes experimental conditions and the number of groups and subjects for each treatment.

Table 2. Summary of experimental design

Treatment	*Time Pressure*	*Teams*	*# Groups*	*# Subjects*
Individual LTP (*I-LTP*)	No	No	6	30
Individual HTP (*I-HTP*)	Yes	No	6	30
Team LTP (*T-LTP*)	No	Yes	6	90
Team HTP (*T-HTP*)	Yes	Yes	6	90

[6] Exceeding the time limits results in a no-choice outcome. However, no subjects in the individual treatments actually encountered this situation.

[7] We follow Feri et al. (2010) to have an electronic open free-form chat so that we have access to the chat logs for analysis. 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, such as effectively starting and 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, etc.

3.3 Parameter Choices

We chose to closely followed the parameters (i.e., number of periods, team and group sizes, payoffs structure and procedures), instructions, and protocol, as used in Feri et al. (2010), in hope to ensure that we can re-establish the their results that teams are better at coordination than individuals in our I-LTP and T-LTP treatment. As for modifications, while Feri et al. (2010). initially allotted subjects a two-minute time frame for reaching an agreement, we added one more minute (3 minutes in total) to make sure time pressure low enough in I-LTP and T-LTP treatments.

The rationale behind choosing 30 seconds for T-HTP treatment is two-fold. The first is to create enough time pressure. Indeed, the data reveals that teams with low time pressure requests an average of 54.22 seconds over 20 periods to submit their choices. The time constraint is even more sever for earlier periods, since teams spend an average of 69.82 seconds in the first ten periods and 99.8 seconds in the first period. As a comparison, the individuals with low time pressure only take on average 3.4 seconds to decide and submit their choice in each period. Appendix Figure A1 (g) presents how time to make a decision evolves over 20 periods. The second objective of choosing 30 seconds instead of a even shorter time frame is to ensure teams still have time to make decisions based on meaningful communication so that team choices are not purely random forced ones under time pressure. Our results shows that teams in T-HTP treatment still have a number of messages exchanged confirming that our choice of time frame while binding still allowed an exchange (see more details in Table 6).

3.4 Implementation

This experiment was conducted at Interdisciplinary Experimental Laboratory (IELab) at Indiana University (IU) during the Fall of 2021 and Spring of 2023, using software z-Tree (Fischbacher 2007). Subjects were recruited from the general undergraduate population via ORSEE recruitment system (Greiner 2015).[8] The instructions were read aloud, and the paper copies were distributed to all subjects. (Refer to Appendix C for instructions of the T-HTP treatment in the experiment.)[9] The experiment lasted approximately 45 minutes, and subjects earned an average payoff of $17, which included a $8 show-up fee. In the experiment, the payoffs in the game were denominated in points. Each point was converted to US dollars at the rate of 200 points to $1.

[8] Appendix Table A1 shows that 11 out of 12 comparisons of demographic characteristics support successful randomization (The only exception is that subjects in I-HTP treatment have higher GPA than subjects in I-LTP treatment).

[9] We used the instructions from Feri et al. (2010) and only modified the time allotted for decision making to ensure we replicated their findings.

4 Discussion regarding Predictions

Do teams under high time pressure still preserve higher efficiency than individuals? The answer is theoretically ambiguous. This is primarily because we do not have a conclusive answer as to why teams tend to achieve higher coordination rates. This section discusses possible implications of introducing time pressure on teams playing a coordination game by discussing theories of selection and experimental evidence from various studies. We consider three scenarios.

Beginning with the seminal work of Van Huyck et al. (1990), extensive experimental evidence has consistently pointed to the tendency of players converging towards risk-dominant (payoff-worst) equilibrium in coordination games.[10] Strategic uncertainty has been identified as the main culprit of the coordination failures and the convergence to risk-dominant equilibrium. It is plausible that, as teams tend to be more risk-taking than individuals (Bougheas et al. 2013), teams as decision units might diminish their sensitivity to strategic uncertainty compared to individuals in coordination games thereby leading to higher coordination. In this scenario, how do risk attitudes evolve when time pressure is introduced? Individuals become more risk-seeking under time pressure (e.g., Kocher et al., 2013; Saqib and Chan, 2015). Hence, if teams coordinate better than individuals due to reduced sensitivity to risk, time pressure should further push teams towards risk seeking behavior leading to even higher coordination rates for teams under time pressure.

An alternative theory of selection is Thomas C. Schelling's theory of focal points (Schelling (1960)). Schelling posits that in coordination situations, players may coordinate their actions by identifying a focal point within the game. Consequently, coordination games can be viewed as problems with discernible solutions. Following this selection theory, we can further apply theories contrasting group and individual performance in problem-solving scenarios. Lorge and Solomon (1955) posits that the probability of a team successfully reaching a solution hinges on the probability that at least one team member possesses the ability to solve the problem. Consequently, teams with multiple individual members are more likely to find solutions, given the increased chances of having a capable individual within a team. If team performance predominantly reflects the capabilities of the "best" individuals within teams, the introduction of time pressure might not necessarily be detrimental to team performance since it does not deteriorate performance of these "best" individuals. Indeed, findings from Belloc et al. (2019) suggest that

[10] The equilibrium selection problem arising from the multiplicity of equilibria in coordination 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. See, also, Carlsson and Van Damme (1993) where perturbation in payoffs leads the players to conform to risk-dominant 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).

individuals' coordination decisions in stag and hunt coordination games turn to be more efficient under time pressure.[11] Hence, if the decision-making in a team is predominantly guided by the most capable individual, and individuals tend to coordinate more efficiently under time pressure, then introducing time pressure should lead to higher coordination rates.

Some studies have posited that inter-team communication could be at the heart of team's superior performance. The ability to engage in discussions with fellow team members could lead to a better understanding of the game dynamics, as highlighted by Charness and Matthias (2012) in their extensive literature review. Additionally, there is compelling evidence, as demonstrated by Hyndman et al. (2012), that even in the absence of open chat, the presence of "teachers" within a team can facilitate improvement on overall outcomes. If inter-team interaction and synergies leads teams to outperform individuals, then the introduction of time pressure will likely restrict these discussions and hinder the teaching and learning processes among team members. Hence, if the collaborative synergy derived from team discussions is the underlying motivation for the better performance of teams, introducing high time pressure could prove detrimental to team performance.

In summary, our discussion has laid the groundwork for understanding the potential impact of time pressure on team performance in coordination games. The empirical findings presented in the next section have the potential to offer valuable insights not only into the overall effects of time pressure but also into the underlying mechanisms that contribute to the superior performance of teams.

5 Results

This section presents our primary findings, starting with comparisons across treatments using aggregate measures, followed by an analysis of various variables commonly examined in the literature. Subsequently, we present findings from examining inter-team communication to understand the potential mechanisms contributing to performance differences. Lastly, we estimate the experience-weighted attraction learning model to further investigate underlying mechanisms driving the main effects.

5.1 Main Results

We begin by focusing on a key measure of efficiency outcome—the normalized efficiency. It is defined 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

[11] Poulsen and Sonntag (2020) show that individuals perform similarly in pure coordination games, with and without time pressure. However, note that individuals achieve over 90% coordination without time pressure, leaving limited room to observe potential upward effects of time pressure on coordination.

that a subject can earn. The normalized efficiency measure captures the efficacy of different treatments relative to the best possible outcomes.[12] In Table 3, we present normalized efficiency across the four treatments examined in this study.[13]

Table 3. Efficiency levels

	Team		Individual
Low Time Pressure	69.23	$>^{***}$	53.46
	(20.38)		(13.59)
	$\vee^{***}$		$\sim$
High Time Pressure	55.67	$\sim$	48.71
	(22.26)		(3.30)

Note: (1) Each observation is determined by the average efficiency level of an individual or team over 20 periods, since the efficiency level is an outcome defined at these respective levels. Each treatment comprises 30 observations. (2) Standard deviation are presented in parentheses. (3) *** indicates statistical significance of Mann-Whitney two-sided tests at the 1% level.

The normalized efficiency reaches 69.23% in T-LTP treatment, significantly surpassing the 53.46% observed in I-LTP treatment ($p < 0.01$).[14,15] Such high level of efficiency in T-LTP is comparable to that of communication treatments in the literature. For instance, in Blume and Ortmann (2007) and Deck and Nikiforakis (2012), pre-play cheap-talk interaction improves coordination and boosts normalized efficiency to 69% and 71% from 34% and 44%, respectively. These findings reaffirm the consensus in the existing literature regarding the superior coordination abilities of teams compared to individuals in coordination games.

A closer examination of Table 3 reveals a curious pattern. Achieving the high efficiency in the T-LTP treatment appears to necessitate the of significant time pressure. When we introduce time pressure to teams, we observe a substantial decline in efficiency, plummeting to levels of individual treatment. Specifically, normalized efficiency reduces largely from 69.23% in T-LTP to 55.67% in T-HTP ($p < 0.01$) when teams face high time pressure. This findings domonstrate

[12] In essence, efficiency measures are linear transformations of payoff outcomes. However, the former outperforms the latter in a sense that it is adjusted for specific experimental payoff function, which facilitates comparisons with results from previous studies. For this reason, we focus on efficiency rather than payoff measures as the main outcomes. Appendix Table A2 provides results based on payoff measures, which are qualitatively identical to the results based on efficiency measures.

[13] For ease of comparisons across treatments, we focus on aggregate statistics and the overall treatment effects in this subsection, and we provide more details on variables of interest over the 20 periods in Appendix Figure A1.

[14] For normalized efficiency and other variables discussed later, such as effort, miscoordination, frequency of agreement, and decision time, the individual or team average across 20 periods constitutes a single observation, given the definition of these variables at individual or team level, with $n = 30$ for each treatment. In contrast, for minimum effort and effort deviation, the group average across 20 periods is considered as one observation, with $n = 6$ for each treatment.

[15] Throughout this section, Mann–Whitney two-sided tests are employed for comparisons across different treatments unless explicitly specified.

that teams outperform individuals in terms of efficiency, but only when they operate without binding time constraints, suggesting that when evaluating a policy involving teams one needs to take into account the possible presence of time constraints and their consequences.

Does time-pressure have the same effect on individuals? Table 3 show that the efficiency level of 53.46% in the I-LTP treatment is statistically indistinguishable from that of 48.71% in the I-HTP treatment, revealing time pressure at the level of our study does not significantly influence the efficiency levels in individual treatments. Our findings indicate that the effect of time pressure on decision-making processes vary significantly depending on whether individuals are operating independently or within a team context. It further reflects that team dynamics may introduce additional complexities and challenges, which do not manifest to the same extent in individual decision-making scenarios, leading team decision-makers to be more responsive to time pressure than individuals.

Overall, we find that the efficiency levels are statistically indistinguishable across teams with high time pressure, individuals with high and with low time pressure. It is worth noting that our intention is not to suggest that time pressure has no impact on individual decision-making. Rather, our results highlight that certain level of time pressure can produce differential effects when applied to individuals versus teams. We further consider two alternative efficiency measures to account for the importance of team disagreements on the entire group's performance. Appendix A.3.2 reports a detailed discussion of the alternative measures and highlights how teams under high time pressure may perform worse than individuals. Next, we turn to the mechanisms underlying the results presented above.

Mechanisms underlying the main results Recall the payoff function in the minimum-effort game, as described in equation (1). Reductions in payoffs and efficiency can stem from three sources. 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. Third, teams fail to reach an agreement. We investigate different measures for each effect to determine which one drives the overall differences in efficiency observed across various treatments.

Our findings reveals that the disparity is not driven by a lack of 'ambition' to exert efforts in the T-HTP treatment. In both T-LTP and T-HTP, most team members try to achieve higher overall efforts, reflecting similar levels of average and minimum effort. This observation is supported by similar levels of average and minimum effort in T-LTP and T-HTP, see Table 4, panel (1).

Teams under low time pressure have significantly smaller overall miscoordination as shown in panel (2) of Table 4. Miscoordination—measured as the difference between the five chosen

Table 4. Summary statistics

	T-LTP		T-HTP		I-LTP		I-HTP	
	Mean	St.Dev.	Mean	St.Dev.	Mean	St.Dev.	Mean	St.Dev.
Panel 1. Effort								
(a) Effort	4.309	2.275	4.518	2.150	2.600	1.336	2.335	0.489
(b) Minimum Effort	3.892	2.581	3.712	2.387	1.775	1.582	1.333	0.234
Panel 2. Coordination								
(c) Miscoordination	0.433	0.345	0.904	1.011	0.825	0.542	1.002	0.405
(d) Effort Deviation	0.356	0.260	0.807	0.677	0.927	0.346	1.046	0.157
Panel 3. Agreement								
(e) Frequency of Agreement	0.978	0.028	0.827	0.157	1.000	0.000	1.000	0.000
(f) Decision Time (second)	63.688	37.819	18.267	4.458	6.315	12.195	3.548	2.822

Note: (1) "Effort" refers to the chosen effort by teams or individuals. "Minimum Effort" denotes the lowest effort within a group of five teams or individuals. "Miscoordination" is defined as the absolute difference between a decision maker's effort and the group minimum, while "Effort Deviation" represents the standard deviation of efforts within the group. (2) For variables such as effort, miscoordination, frequency of agreement, and decision time, the individual or team average across 20 periods constitutes a single observation, given the definition of efficiency level at these respective tiers, with $n = 30$ for each treatment. In contrast, for minimum effort and effort deviation, the group average across 20 periods is considered one observation, with $n = 6$ for each treatment.

efforts from the actual minimum effort in each group—in T-LTP is only half of that in I-LTP and the difference is statistically significant ($p < 0.01$). Similarly, when we examine the average standard deviation of effort decisions within the group for a given period, teams in T-LTP exhibit less than half of the deviation in I-LTP ($p = 0.01$). However, imposing high time pressure tends to reduce teams' coordination level for both measures ($p = 0.081$ for miscoordination and $p = 0.127$ for effort deviation), while its impacts on both measures are minimal for individuals ($p > 0.1$ for both measures). Consequently, the difference in coordination levels between teams and individuals under high time pressure turns to be small ($p > 0.1$ for both measures). Therefore, our results show that teams only able to coordinate at higher levels of efficiency than individuals under low time pressure.

Recall how a team reaches an agreement. Team members have access to an open chat, and they can earn a non-zero payoff if they can agree on the same effort decision so that they as a team decision unit can participate in the group coordination. In panel (3) of Table 4, we present the frequency of agreement, highlighting how often teams can reach agreements in T-LTP and T-HTP, respectively. Teams under high time pressure exhibit a significant higher proportion of no agreements ($p < 0.01$), highlighting another reason behind diminished team performance over individuals under high time pressure. That is, time pressure hinders teams from reaching a consensus, leading to their exclusion from group coordination and resulting in financial losses.

Panel (3) of Table 4 further shows that imposing high time pressure significantly reduces decision time for teams ($p < 0.01$) but not for individuals ($p = 0.289$). Although decision time may not directly influence efficiency levels, it reflects the extent to which our experimental manipulation of time pressure affects individual and team decision-making heterogeneously. That is, time pressure constrains teams largely but does not impact individuals much.

Finally, we conduct a random-effect regression analysis, considering all previously mentioned measures as endogenous variables.[16] Standard errors are clustered at the group level, treating each group as an independent observation. The regression results, as presented in Table 5, are quantitatively in line with results from aforementioned non-parametric tests. Nevertheless, they exhibit enhanced statistical significance for group-level variables such as effort deviation and minimum effort while presenting diminished statistical distinction for some individual or team-level variables.[17]

Now, we are going to investigate the chat content to understand the differences leading to high levels of miscoordination and disagreement in T-HTP compared to T-LTP.

5.2 Chat content analysis

We categorize the chat content in T-LTP and T-HTP to identify possible differences in communication within teams arising from time constraints. For this purpose, we employed two research assistants (RA) to classify all messages into four different categories.[18] Our analysis focuses on the four distinct categories, each relates to a specific hypothesis concerning the mechanisms influencing effective team decision-making.

As discussed in Section 4, Hyndman et al. (2012) emphasize the significance of the presence of "teachers" in facilitating efficient play. Therefore, our first category captures messages related to teaching and learning about the game. The second category represents intentions of choice that lack instructional content, contrasting with the first category. These messages propose choices or counter proposed choices without providing explanations or clarifications. The third category includes messages that contribute to establishing common knowledge of proposed effort choices—a crucial aspect in coordination games (see Chen et al. 2021). The last

[16] The employment of the random-effect regression is due to the panel structure of the data. A Lagrange Multiplier test for random effect is executed to aid the decision between a random-effects regression and a straightforward OLS regression. For all regressions depicted in Table 5, the null hypothesis that there is no significant difference across units, i.e., no panel effect, is rejected.

[17] One might be concerned that the initial learning periods predominantly influence our findings. Nonetheless, the significance level of our results remains largely consistent, even upon the exclusion of the first one, two, or five periods (see Appendix Table A5, Table A6, and Table A7).

[18] The RAs were undergraduate and graduate students in the economics department at Indiana University who were not informed of the purpose of our study. Categories outlined in Table 6 had been ex-ante determined by the research team and provided to the RAs.

Table 5. Regression results

Dependent Variables	Efficiency	Frequency of Agreement	Decision Time (second)	Effort	Minimum Effort	Mis-coordination	Effort Deviation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
I-HTP	-0.048	-0.000	-2.767	-0.265	-0.442	0.177	0.119
	(0.054)	(0.000)	(1.958)	(0.534)	(0.612)	(0.148)	(0.145)
T-LTP	0.178*	-0.022***	57.373***	1.742*	2.117*	-0.368**	-0.571***
	(0.099)	(0.007)	(13.208)	(1.058)	(1.159)	(0.183)	(0.166)
T-HTP	0.022	-0.173***	11.952***	2.094**	1.968*	0.185	-0.091
	(0.094)	(0.028)	(2.346)	(0.960)	(1.095)	(0.291)	(0.288)
Period	0.029***	0.025***	-1.864**	-0.426***	-0.144**	-0.304***	-0.115***
	(0.009)	(0.009)	(0.865)	(0.059)	(0.062)	(0.048)	(0.044)
$Period^2$	-0.001**	-0.001***	0.048*	0.013***	0.005**	0.010***	0.003
	(0.000)	(0.000)	(0.028)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.368***	0.862***	19.067***	5.134***	2.623***	2.629***	1.768***
	(0.071)	(0.044)	(5.502)	(0.532)	(0.660)	(0.287)	(0.225)
Observations	2400	2400	2400	2283	475	2283	475
R^2	0.1565	0.1592	0.4228	0.2840	0.2673	0.1794	0.2366
Estimated differences							
(T-LTP) - (T-HTP)	0.156	0.152***	45.422***	-0.359	0.148	-0.554**	-0.480*
	(0.113)	(0.028)	(13.164)	(1.229)	(1.347)	(0.275)	(0.273)
(I-HTP) - (T-HTP)	-0.067	0.173***	-14.718***	-2.360***	-2.410**	-0.008	0.209
	(0.077)	(0.028)	(1.638)	(0.809)	(0.916)	(0.256)	(0.262)

Note: (1) Results reported in the table are derived from random effect linear regressions. Standard errors, clustered at the group level, are presented in parentheses. The reference group is I-LTP. (2) "Effort" represents chosen effort by each team or individual. "Minimum Effort" represents the minimum effort within a group. "Miscoordination" is defined as the absolute difference between a decision maker's chosen effort and the minimum effort within the same period. "Effort Deviation" is the standard deviation of efforts in the group. (3) *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

category contains inconsequential messages—those unrelated to the game, effort intentions, or strategies. These messages may indicate a level of group engagement in conversations beyond the game (see Chen and Chen 2011).

Table 6. Content analysis of chat messages

Message categories	Average no.		Frequency	
	T-LTP	*T-HTP*	*T-LTP*	*T-HTP*
C_1: Questions or explanations about the environment or payoff structure; answers to the questions	64.200***	19.533	0.384*	0.278
C_2: State or counter a proposed plan (no engagement similar to Category 1)	8.980***	27.933	0.054***	0.418
C_3: Agreeing with the proposed team strategy and stating intention to follow the plan	33.130***	12.550	0.198	0.188
C_4: Inconsequential content (such as saying hi)	60.933*	8.903	0.364*	0.129

Note: (1) The columns headed "Average no." represents the average number of messages in each category in T-LTP and T-HTP treatments, while the columns headed "Frequency" denotes the fraction of messages in each category relative to all messages in the two treatments. (2) The statistical analysis employs OLS regression, with the dependent variable being the average number or frequency of messages in each category, and the independent variable is a dummy variable signifying the treatments. Standard errors are clustered at the group level. (2) *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

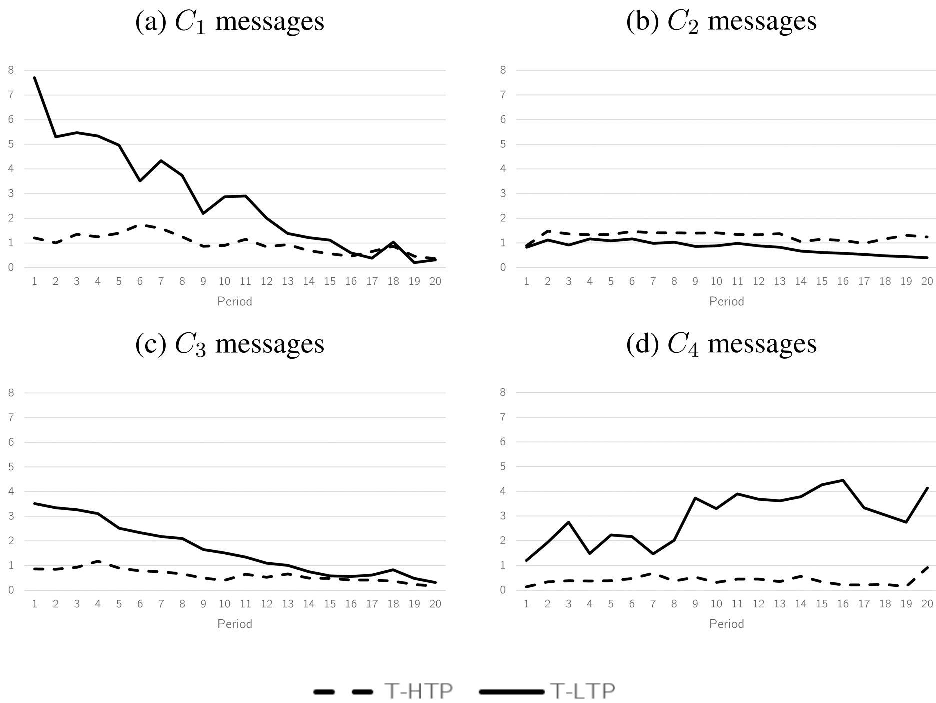
Table 6 presents the results of our content analysis, including the average number and frequency of messages within each category for both T-LTP and T-HTP treatments. Time pressure leads to a shift in the composition of team communication content. Specifically, teams in the T-LTP treatment exhibit a higher prevalence of C_1 messages, while teams in the T-HTP treatment tend to produce more C_2 messages, both in terms of the absolute number and frequency. Under high time pressure, the task of reaching a consensus becomes inherently more challenging for team members. Indeed, there is limited room for team members to engage in extensive discussions about the game's structure and optimal responses to other teams' prior decisions. Furthermore, C_3 messages involving reassurance, which can help establish common knowledge of effort choices among team members, are notably more frequent under low time pressure than under high time pressure. Taking into account the overarching results on performance, it is reasonable to speculate that discussions involving learning and reassurance constitute crucial components contributing to better performance of teams over individuals under low time pressure.

We proceed by taking a closer look at the use of messages in each category over the periods. Figure 1 illustrates the trend of the average number of messages across four categories over time in T-LTP and T-HTP treatments. One particularly noteworthy observation is the stark contrast in the dynamics of using teaching and learning messages (C_1 category) between the two treatments as shown in Figure 1a. Specifically, there is a large number of C_1 messages in early periods of T-LTP treatment. Then, it follows a pronounced decline in these messages gradually approaching levels similar to that observed in the T-HTP treatment with increase in period. This pattern aligns with an intuitive result— teaching and learning messages are pervasive at the early periods of the play, and their use declines as the team members have reached desired stable decisions. Similar dynamic pattern is observed for C_3 messages although the magnitude is weaker than that for C_1 messages. [19]

Note that the chat content analysis has two limitations. First, it only possible to be implemented in team treatments where an open chat exists. Second, although given the exogenous classification of the chat messages, one may still concern that the categorization is not objective enough. Therefore, we will further employ a structural estimation of a behavioral model, which is solely based on decisions over time, so that we can not only account for decision-making in all four team and individual treatments, but also focus on the calibrated parameters that provides vital insights into the behavioral mechanisms behind the aggregate results (see DellaVigna (2018)).

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

Figure 1: The average number of messages in each category over 20 periods.



5.3 Experience-weighted attraction learning model

This section introduces the experience-weighted attraction (EWA) learning model, based on which we try to provide a deeper understanding of the behavior of teams and individuals under various time pressure. The EWA learning model, developed by Camerer and Ho (1999), combines reinforcement and belief-based learning approaches.

During the course of EWA learning, strategies possess attraction levels that are updated based on two types of payoffs: (i) the actual payoffs provided by the chosen strategies, and (ii) the payoffs that unchosen strategies would have provided. These attraction levels are adjusted in each period based on the cumulative experience gained by the players. Ultimately, the attractiveness of a strategy influences the probability of it being chosen, with more attractive strategies being chosen more frequently.

An overview of the EWA learning model The players (individuals or team) are indexed by i, $i \in \{1, 2, \ldots, n\}$; each one has a strategy space $S_i = \{s_i^1, s_i^2, \ldots, s_i^m\}$. Let $S := S_1 \times S_2 \times \ldots \times S_n$, where s_i denotes a pure strategy of player i. There are eight pure strategies, i.e., $m = 8$, including choosing number 1 to 7 and doing nothing due to no agreement. In period t, player i's actual decision is 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

receiving 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 subsequent 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:

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

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.[20] 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 putting on foregone payoffs during the updating process.

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 $N(0)$.[21] Then, for each treatment and game, we estimate initial attractions as described by Ho et al. (2008).[22] The likelihood function to estimate is given by:

[20] 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.

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

[22] 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

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

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

EWA estimation results In Table 7, we present the estimates for $\lambda, \phi, \delta, \kappa$, and $N(0)$ for each treatment. First, a critical finding emerges when comparing teams and individuals respectively under different time pressure: teams under low time pressure exhibit significantly higher value of λ in comparison to their individual counterparts. Consequently, when teams and individuals face equal levels of attractions, teams are more inclined to select the strategy with the highest attraction, resulting in reduced miscoordination in *T-LTP* treatment. When high time pressure is imposed in *T-HTP* treamtment, the value of λ not only reduce but also becomes much more noisy compared to its value in *T-LTP* treatment (i.e., standard error increases more than 20 times). These changes cause difference in λ values between *T-HTP* and *I-HTP* treatments no longer significant, potentially accounting for the absence of better team performance under high time pressure.

Table 7. Parameter estimates of EWA learning model

	T-LTP	T-HTP	I-LTP	I-HTP				
	(1)	(2)	(3)	(4)	(1) v.s. (3)	(1) v.s. (2)	(2) v.s. (4)	(3) v.s. (4)
λ	4.769	4.313	2.824	2.697	***	#	#	#
	(0.180)	(4.008)	(0.456)	(0.846)				
ϕ	0.694	0.659	0.743	0.735	#	#	#	#
	(0.013)	(0.161)	(0.129)	(2.304)				
δ	0.631	0.001	0.628	0.625	#	**	#	#
	(0.042)	(0.259)	(0.040)	(0.789)				
κ	0.619	0.170	0.990	0.990	#	#	#	#
	(0.071)	(0.646)	(0.335)	(0.571)				
$N(0)$	1.111	2.902	0.292	0.168	***	***	***	#
	(0.018)	(0.348)	(0.186)	(0.586)				

Note: (1) λ refers to sensitivity to different attraction levels; ϕ captures depreciation of past attractions; δ denotes 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) # indicates non-significance at conventional statistical levels, while *,** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

This is equivalent to choosing initial attractions to maximize the likelihood of the first-period data for a value of λ derived from the overall likelihood-maximization. The initial attractions can be solved 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 other attractions as a function of λ and the frequencies $\tilde{f}^j$.

Further analysis unveils two contributing factors to the differences observed between T-LTP and T-HTP treatments. In the T-HTP treatment, teams display significantly larger values of $N(0)$ and an exceptionally small δ. This implies that in the process of updating strategy attractions, teams under high time pressure predominantly rely on their initial beliefs and pay little attention to the hypothetical payoffs from unchosen strategies. Consequently, the influence of these initial attractions remains pronounced for teams under high time pressure, relative to the incremental adjustments in attractions driven by actual payoffs. These EWA estimation results highlight how time pressure affect team behavior, especially providing further insights into the dynamic impact of time pressure over time.

6 Conclusions

This paper examines the influence of time pressure on team performance in a coordination setting and identifies the underlying factors driving this impact. Our primary finding reveals that time pressure significantly diminishes the efficiency gains of team decision-making compared to individual decision-making. We identify two sources of efficiency losses due to time pressure: teams under high time pressure fall into miscoordination more and reach less consensus compared to those under low time pressure. Analysis of inter-team chat log further reveals that teams under high time pressure are less inclined to involve into discussion related to learning and teaching about the payoff structure and other components of the environment. The structural estimation results based on the experience-weighted attraction learning model further highlight that teams under time pressure do to optimally utilize information from past periods.

A substantial body of work has compared team decision-making with that of individuals across various environments, typically under conditions of low time pressure. Our experiment sheds light on the potential limitations of such comparisons in a coordination environment. Our findings indicate that the differences between teams and individuals may not hold when decision making units operate under high time pressure. Our experimental results hold practical relevance for policy design within modern organizations. While there is a growing trend of assigning more work to team units, our findings highlight potential limitations of efficiency improvement from such practices. That is, teams may no longer be more efficient and could potentially be less efficient than individuals when tasks necessitate coordination among decision-making units and time constrained environment are imposed. Moreover, if unanimity is required to reach an agreement, as in our study, inefficiencies of team decision-making could be further exacerbated. Future research focusing on interaction between various agreement rules and time pressure may be able to identify better procedures for team decision-making under time pressure.

References

Alós-Ferrer, Carlos and Michele Garagnani, "The cognitive foundations of cooperation," *Journal of Economic Behavior & Organization*, 2020, *175*, 71–85.

Arrow, Kenneth J, *The limits of organization*, WW Norton & Company, 1974.

Avoyan, Ala and Joao Ramos, "A road to efficiency through communication and commitment," *American Economic Review*, 2023, *113* (9), 2355–2381.

Balafoutas, Loukas, Rudolf Kerschbamer, Martin Kocher, and Matthias Sutter, "Revealed distributional preferences: Individuals vs. teams," *Journal of economic behavior & organization*, 2014, *108*, 319–330.

Belloc, Marianna, Ennio Bilancini, Leonardo Boncinelli, and Simone D'Alessandro, "Intuition and deliberation in the stag hunt game," *Scientific reports*, 2019, *9* (1), 1–7.

Blume, Andreas and Andreas Ortmann, "The effects of costless pre-play communication: Experimental evidence from games with Pareto-ranked equilibria," *Journal of Economic theory*, 2007, *132* (1), 274–290.

Bornstein, Gary, Uri Gneezy, and Rosmarie Nagel, "The effect of intergroup competition on group coordination: An experimental study," *Games and Economic Behavior*, 2002, *41* (1), 1–25.

Bougheas, Spiros, Jeroen Nieboer, and Martin Sefton, "Risk-taking in social settings: Group and peer effects," *Journal of economic behavior & organization*, 2013, *92*, 273–283.

Bouwmeester, Samantha, Peter PJL Verkoeijen, Balazs Aczel, Fernando Barbosa, Laurent Bègue, Pablo Brañas-Garza, Thorsten GH Chmura, Gert Cornelissen, Felix S Døssing, Antonio M Espín et al., "Registered replication report: Rand, greene, and nowak (2012)," *Perspectives on Psychological Science*, 2017, *12* (3), 527–542.

Brandts, Jordi, David J Cooper, and Roberto A Weber, "Legitimacy, communication, and leadership in the turnaround game," *Management Science*, 2015, *61* (11), 2627–2645.

Camerer, Colin and Teck Hua Ho, "Experience-weighted attraction learning in normal form games," *Econometrica*, 1999, *67* (4), 827–874.

Caparrós, Alejandro, Esther Blanco, Philipp Buchenauer, Michael Finus et al., "Team Formation in Coordination Games with Fixed Neighborhoods," *Working Paper*, 2020.

Carlsson, Hans and Eric Van Damme, "Global games and equilibrium selection," *Econometrica: Journal of the Econometric Society*, 1993, pp. 989–1018.

Cason, Timothy N and Vai-Lam Mui, "A laboratory study of group polarisation in the team dictator game," *The Economic Journal*, 1997, *107* (444), 1465–1483.

_ and _ , "Individual versus group choices of repeated game strategies: A strategy method approach," *Games and Economic Behavior*, 2019, *114*, 128–145.

Cason, Timothy N., C Savikhin Anya, , and M. Sheremeta Roman, "Behavioral spillovers in coordination games," *European Economic Review*, 2012, *56* (2), 233–245.

Charness, Gary, "Self-serving cheap talk: A test of Aumann's conjecture," *Games and Economic Behavior*, 2000, *33* (2), 177–194.

_ and Sutter Matthias, "Groups make better self-interested decisions," *Journal of Economic Perspectives*, 2012, *26* (3), 157–76.

Chaudhuri, Ananish, Tirnud Paichayontvijit, and Tony So, "Team versus individual behavior in the minimum effort coordination game," *Journal of Economic Psychology*, 2015, *47*, 85–102.

Chen, Roy and Yan Chen, "The potential of social identity for equilibrium selection," *American Economic Review*, 2011, *101* (6), 2562–89.

_ , _ , and Yohanes E Riyanto, "Best practices in replication: a case study of common information in coordination games," *Experimental Economics*, 2021, *24* (1), 2–30.

Chen, Yan, Xin Li Sherry, Xiao Liu Tracy, and Shih Margaret, "Which hat to wear? Impact of natural identities on coordination and cooperation," *Games and Economic Behavior*, 2014, *84*, 58–86.

Cooper, David J and John H Kagel, "Are two heads better than one? Team versus individual play in signaling games," *American Economic Review*, 2005, *95* (3), 477–509.

Cooper, Russell, Douglas V DeJong, Robert Forsythe, and Thomas W Ross, "Communication in coordination games," *The Quarterly Journal of Economics*, 1992, *107* (2), 739–771.

Deck, Cary and Nikos Nikiforakis, "Perfect and imperfect real-time monitoring in a minimum-effort game," *Experimental Economics*, 2012, *15* (1), 71–88.

DellaVigna, Stefano, “Structural behavioral economics,” in “Handbook of Behavioral Economics: Applications and Foundations 1,” Vol. 1, Elsevier, 2018, pp. 613–723.

Devetag, Giovanna, “Precedent transfer in coordination games: An experiment,” *Economics Letters*, 2005, *89* (2), 227–232.

Engelmann, Dirk and Hans-Theo Normann, “Maximum effort in the minimum-effort game,” *Experimental Economics*, 2010, *13* (3), 249–259.

Feri, Francesco, Bernd Irlenbusch, and Matthias Sutter, “Efficiency gains from team-based coordination—large-scale experimental evidence,” *American Economic Review*, 2010, *100* (4), 1892–1912.

Fischbacher, Urs, “z-Tree: Zurich toolbox for ready-made economic experiments,” *Experimental economics*, 2007, *10* (2), 171–178.

Greiner, Ben, “Subject pool recruitment procedures: organizing experiments with ORSEE,” *Journal of the Economic Science Association*, 2015, *1* (1), 114–125.

Harsanyi, John C and Reinhard Selten, “A general theory of equilibrium selection in games,” *MIT Press Books*, 1988, *1*.

Ho, Teck H, Xin Wang, and Colin F Camerer, “Individual differences in EWA learning with partial payoff information,” *The Economic Journal*, 2008, *118* (525), 37–59.

Huyck, John B Van, Raymond C Battalio, and Richard O Beil, “Tacit coordination games, strategic uncertainty, and coordination failure,” *The American Economic Review*, 1990, *80* (1), 234–248.

_ , _ , and _ , “Asset markets as an equilibrium selection mechanism: Coordination failure, game form auctions, and tacit communication,” *Games and Economic Behavior*, 1993, *5* (3), 485–504.

Hyndman, Kyle, Erkut Y Ozbay, Andrew Schotter, and Wolf Ehrblatt, “Convergence: an experimental study of teaching and learning in repeated games,” *Journal of the European Economic Association*, 2012, *10* (3), 573–604.

Kessler, J, Hannu Kivimaki, and Muriel Niederle, “Thinking fast and slow: generosity over time,” *Preprint at http://assets. wharton. upenn. edu/˜ juddk/papers/KesslerKivimakiNiederle_GenerosityOverTime. pdf*, 2017.

Kim, Jeongbin, Thomas R Palfrey, and Jeffrey R Zeidel, "Games played by teams of players," *American Economic Journal: Microeconomics*, 2022, *14* (4), 122–157.

Kocher, Martin G, Julius Pahlke, and Stefan T Trautmann, "Tempus fugit: time pressure in risky decisions," *Management Science*, 2013, *59* (10), 2380–2391.

Krajbich, Ian, Björn Bartling, Todd Hare, and Ernst Fehr, "Rethinking fast and slow based on a critique of reaction-time reverse inference," *Nature communications*, 2015, *6* (1), 1–9.

Kugler, Tamar, E. Kausel Edgar, and G. Kocher Martin, "Are groups more rational than individuals? A review of interactive decision making in groups," *Wiley Interdisciplinary Reviews: Cognitive Science*, 2012, *3* (4), 471–482.

_ , Gary Bornstein, Martin G Kocher, and Matthias Sutter, "Trust between individuals and groups: Groups are less trusting than individuals but just as trustworthy," *Journal of Economic psychology*, 2007, *28* (6), 646–657.

Leland, Jonathan W and Mark Schneider, "Salience and strategy choice in 2× 2 games," *Games*, 2015, *6* (4), 521–559.

_ and _ , "A theory of focal points in 2× 2 games," *Journal of Economic Psychology*, 2018, *65*, 75–89.

Lorge, Irving and Herbert Solomon, "Two models of group behavior in the solution of eureka-type problems," *Psychometrika*, 1955, *20* (2), 139–148.

Luhan, Wolfgang J, Martin G Kocher, and Matthias Sutter, "Group polarization in the team dictator game reconsidered," *Experimental Economics*, 2009, *12* (1), 26–41.

Miller, Logan and Ryan Rholes, "Joint vs. Individual performance in a dynamic choice problem," *Journal of Economic Behavior & Organization*, 2023, *212*, 897–934.

Müller, Wieland and Fangfang Tan, "Who acts more like a game theorist? Group and individual play in a sequential market game and the effect of the time horizon," *Games and Economic Behavior*, 2013, *82*, 658–674.

Nielsen, Kirby, Puja Bhattacharya, John H Kagel, and Arjun Sengupta, "Teams promise but do not deliver," *Games and Economic Behavior*, 2019, *117*, 420–432.

Onuchic, Paula and Debraj Ray, "Signaling and discrimination in collaborative projects," *American Economic Review*, 2023, *113* (1), 210–252.

Piovesan, Marco and Erik Wengström, "Fast or fair? A study of response times," *Economics Letters*, 2009, *105* (2), 193–196.

Poulsen, Anders and Axel Sonntag, "Time Pressure and Focal Points in Coordination Games: Experimental Evidence," *Working Paper*, 2020.

Rand, David G, Joshua D Greene, and Martin A Nowak, "Spontaneous giving and calculated greed," *Nature*, 2012, *489* (7416), 427–430.

Recalde, María P, Arno Riedl, and Lise Vesterlund, "Error-prone inference from response time: The case of intuitive generosity in public-good games," *Journal of Public Economics*, 2018, *160*, 132–147.

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

Riedl, Arno, Ingrid MT Rohde, and Martin Strobel, "Efficient coordination in weakest-link games," *The Review of Economic Studies*, 2016, *83* (2), 737–767.

Rubinstein, Ariel, "A typology of players: Between instinctive and contemplative," *The Quarterly Journal of Economics*, 2016, *131* (2), 859–890.

Saqib, Najam U and Eugene Y Chan, "Time pressure reverses risk preferences," *Organizational Behavior and Human Decision Processes*, 2015, *130*, 58–68.

Schelling, Thomas C, "The strategy of conflict," *Cambridge, Mass*, 1960.

Sitzia, Stefania and Jiwei Zheng, "Group behaviour in tacit coordination games with focal points–an experimental investigation," *Games and Economic Behavior*, 2019, *117*, 461–478.

Spiliopoulos, Leonidas and Ortmann Andreas, "The BCD of response time analysis in experimental economics.," *Experimental economics*, 2018, *21* (2), 383–433.

Tinghög, Gustav, David Andersson, Caroline Bonn, Harald Böttiger, Camilla Josephson, Gustaf Lundgren, Daniel Västfjäll, Michael Kirchler, and Magnus Johannesson, "Intuition and cooperation reconsidered," *Nature*, 2013, *498* (7452), E1–E2.

Weber, Roberto A, "Managing growth to achieve efficient coordination in large groups," *The American Economic Review*, 2006, *96* (1), 114–126.

Yang, Chun-Lei, Zhang Boyu, Charness Gary, Li Cong, and W. Lien Jaimie, "Endogenous rewards promote cooperation," *Proceedings of the National Academy of Sciences*, 2018, *115* (40), 9968–9973.

Yang, Chun-Lei, Xu Mao-Long, Meng Juanjuan, and Tang Fang-Fang, "Efficient Large-Size Coordination Via Voluntary Group Formation: An Experiment," *International Economic Review*, 2017, *58* (2), 651–668.

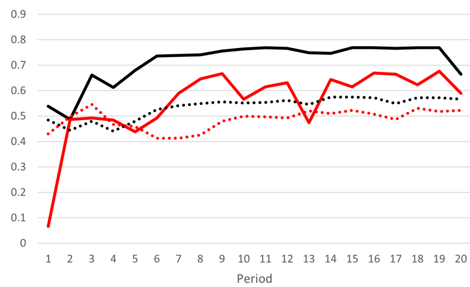
Appendix A Additional Figures and Tables

A.1 Dynamic effects

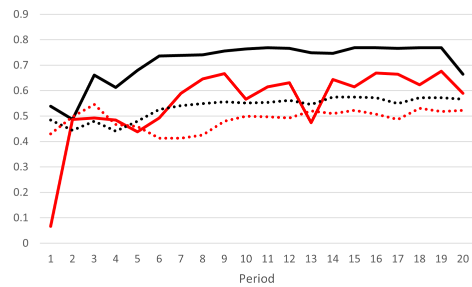
In this section, we present additional figures that present the dynamics of the measures presented in the main text. Figure A1 illustrates how normalized efficiency, effort, minimum effort, miscoordination, effort deviation, frequency of agreements and decision time change over 20 periods.

Appendix Figure A1: The dynamics of measures

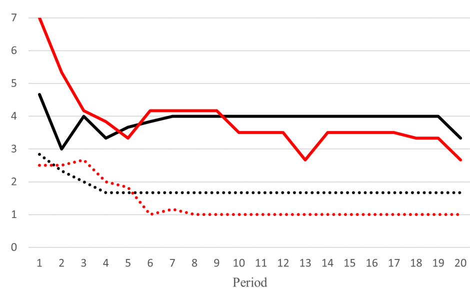
(a) Normalized Efficiency



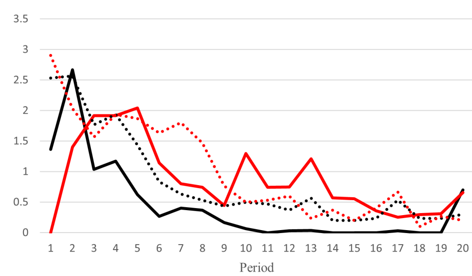
(b) Effort



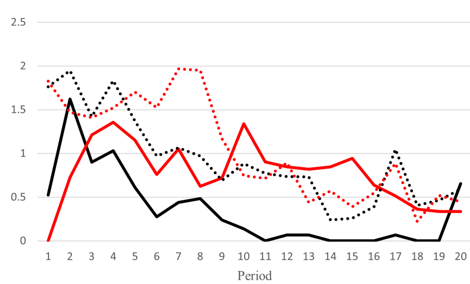
(c) Minimum Effort



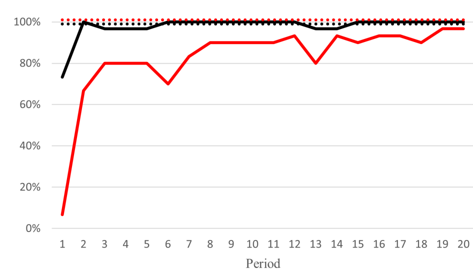
(d) Miscoordination



(e) Effort Deviation

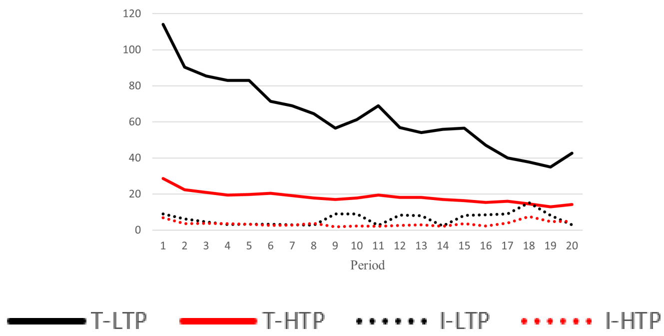


(f) Frequency of Agreements



Appendix Figure A1: The dynamics of measures (continued).

(g) Decision Time



Note: Normalized efficiency is defined as $\frac{Actual - Min}{Max - Min} \times 100\%$, 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. "Effort" is effort chosen by each team or individual as a decision maker. "Minimum Effort" represents the minimum effort within a group of five teams or individuals. "Miscoordination" is characterized as the absolute difference between a decision maker's chosen effort and the minimum effort in the group. "Effort Deviation" is indicative of the standard deviation of effort.

A.2 Analysis of Demographic Characteristics

In this section, we present an analysis of the demographic characteristics of participants across different treatments. Table A1 displays the results of OLS regressions, focusing on key variables such as gender, major, familiarity with game theory, and GPA.

Appendix Table A1. Demographic Characteristics

	Dependent variable:			
	%Female	%Econ Major	%Game Theory	%GPA
	(1)	(2)	(3)	(4)
I-HTP	-0.03	0.000	0.03	-0.21***
	(0.13)	(0.08)	(0.11)	(0.08)
T-LTP	-0.09	0.00	0.04	-0.13
	(0.11)	(0.06)	(0.09)	(0.10)
T-HTP	-0.09	-0.02	0.09	-0.17
	(0.11)	(0.06)	(0.09)	(0.15)
Observations	240	240	240	237
T-LTP vs. T-HTP	#	#	#	#
I-HTP vs. T-LTP	#	#	#	#
I-HTP vs. T-HTP	#	#	#	#

Notes: (1) The table reports the OLS regression, where the dependent variable in each column is the demographic characteristic indicated in column head. (2) Three dummy variables indicate that subjects were assigned to I-HTP, T-LTP, or T-HTP treatments, respectively, with I-LTP treatment as the reference group. (3) Three subjects do not report their GPA. (4) Standard errors are reported in parentheses. (5) The last three rows indicate whether there are statistical differences in the coefficients between the two treatments. (6) # indicates non-significance at conventional statistical level, while *** denotes statistical significance at 1% level.

A.3 Alternative efficiency measures

A.3.1 Payoffs

Table A2 mirrors Table 3 from the main text, except that payoffs are used in Table A2. As we can see, although the magnitudes represent the payoffs, the results are qualitatively identical to those shown in Table 3 .

Appendix Table A2. Payoffs

	Team		Individual
Low Time Pressure	90.00	$>^{***}$	69.50
	(28.75)		(17.67)
	$\vee^{***}$		$\sim$
High Time Pressure	72.37	$\sim$	63.32
	(28.94)		(4.29)

Note: (1) Each observation is determined by the average payoff level of an individual or team over 20 periods, since the payoffs is an outcome defined at these respective levels. Each treatment comprises 30 observations (n=30). (2) *** indicates statistical significance at the 1% level.

A.3.2 Adjusted Efficiency Measures

In our experimental environment, if some teams fail to reach an agreement and thus do not participate in producing output, only these teams per se rather than the entire group gets "punished." However, when a team fails to contribute to a group project in an organizational context, it may negatively affect performance of the entire group. Therefore, we consider two alternative measures to capture such effect. While team choices may be different if the protocol was in place, it is worth considering the effects especially since our adjustments do not affect incentives for the teams who fail to reach an agreement.

First, we calculate efficiency measure with shrinking output that shrinks the total output based on number of teams who failed to join production. Specifically, each remaining team member's output shrinks by $k \times 20\%$ if k teams fail to submit their decisions (a 20% reduction per group as five teams produce the group output), and members in the k teams achieve zero output. For instance, if two team fails to reach agreements, the rest can achieve 60% $(= 100\% - 2 \times 20\%)$ of the maximum output. The adjusted normalized efficiency measure thus incorporates the importance of team disagreements on the entire group's performance. This is just one type of output modification; certainly, there are other ways to alter the output, but the uniform reduction rule can be a natural starting point to report the results on efficiency levels.

When considering comparisons shown in the Appendix Table A3 all results are qualitatively identical with the results based on the normalized efficiency measure. However, it is worth noting that adjusted efficiency of T-HTP treatment is much lower than the original efficiency level ($p<0.01$, Wilcoxon signed-ranks two-sided test).

Appendix Table A3. Efficiency Levels with shrinking output

	Team		Individual
Low Time Pressure	68.33	$>^{***}$	53.46
	(20.02)		(13.59)
	$\vee^{***}$		$\sim$
High Time Pressure	49.52	$\sim$	48.71
	(21.31)		(3.30)

Note: (1) Each observation is determined by the average adjusted efficiency level of an individual or team over 20 periods, since the adjusted efficiency level is an outcome defined at these respective levels. Each treatment comprises 30 observations (n=30). (2) *** indicates statistical significance at the 1% level.

Second, we take a minimum-effort approach to calculate efficiency under the assumption that production is set to the lowest level observed among all teams, rather than just the ones who managed to reach an agreement. Specifically, if even one team fails to contribute, a zero score is assigned to every team rather than solely to the non-contributing team. This adjusted approach further accentuates the impact of team disagreement. The findings, as detailed in Table A4, reveal a marked decrease in team efficiency under conditions of high time pressure. Using this measure of efficiency with minimum output, teams perform significantly worse compared to individuals ($p<0.01$, as per the Wilcoxon rank-sum two-sided test).

Appendix Table A4. Efficiency Levels with minimum output

	Team		Individual
Low Time Pressure	67.41	$>^{***}$	53.46
	(20.15)		(13.59)
	$\vee^{***}$		$\sim$
High Time Pressure	33.46	$<^{***}$	48.71
	(23.21)		(3.30)

Note: (1) Each observation is determined by the average adjusted efficiency level of an individual or team over 20 periods, since the adjusted efficiency level is an outcome defined at these respective levels. Each treatment comprises 30 observations (n=30). (2) *** indicates statistical significance at the 1% level.

A.4 Robustness checks on regressions

In this section, we conduct robustness checks on the linear panel regression models by systematically dropping the first one, two, and five periods from the analysis. The objective is to assess the stability and consistency of the estimated coefficients across different specifications of the time periods considered in the analysis. Tables A5, A6, and A7 present the results of the regression analysis for each specification.

Appendix Table A5. Regression Analysis By Dropping the First One Period

	Dependent Variables						
	Efficiency	Frequency of Agreement	Decision Time (second)	Effort	Minimum Effort	Mis-coordination	Effort Deviation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
I-HTP	-0.047	0.000	-2.796	-0.281	-0.447	0.167	0.122
	(0.055)	(0.000)	(2.030)	(0.551)	(0.621)	(0.155)	(0.156)
T-LTP	0.185*	-0.009***	54.860***	1.803*	2.132*	-0.334*	-0.536***
	(0.099)	(0.003)	(13.353)	(1.086)	(1.180)	(0.181)	(0.171)
T-HTP	0.045	-0.133***	11.549***	2.123**	1.956*	0.209	-0.069
	(0.099)	(0.031)	(2.424)	(0.971)	(1.108)	(0.300)	(0.297)
Period	0.022**	0.007	-1.111	-0.387***	-0.096	-0.306***	-0.138***
	(0.009)	(0.005)	(0.899)	(0.060)	(0.068)	(0.054)	(0.053)
period^2	-0.001*	-0.000	0.018	0.012***	0.003	0.010***	0.003
	(0.000)	(0.000)	(0.031)	(0.002)	(0.003)	(0.002)	(0.002)
Constant	0.400***	0.948***	15.697***	4.905***	2.364***	2.627***	1.879***
	(0.073)	(0.026)	(5.599)	(0.584)	(0.704)	(0.332)	(0.280)
Observations	2280	2280	2280	2280	456	456	2199
R^2	0.1475	0.1034	0.4024	0.1353	0.2647	0.1566	0.2266
Estimated differences							
(T-LTP) - (T-HTP)	0.139	0.125***	43.311***	-0.323	0.175	-0.543**	-0.467*
	(0.117)	(0.031)	(13.306)	(1.242)	(1.364)	(0.278)	(0.279)
(I-HTP) - (T-HTP)	-0.092	0.133***	-14.346***	-2.403**	-2.403**	-0.043	0.191
	(0.083)	(0.031)	(1.697)	(0.811)	(0.924)	(0.263)	(0.271)

Note: (1) Results reported in the table are derived from the panel linear regressions with standard errors clustered at the group level, presented in parentheses. The base comparison group is I-LTP. (2) "Effort" represents chosen effort by each team or individual. "Minimum Effort" represents the minimum effort within a group. "Miscoordination" is defined as the absolute difference between a decision maker's chosen effort and the minimum effort in the group. "Effort Deviation" is the standard deviation of efforts within a group. (3) *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Appendix Table A6. Regression Analysis By Dropping the First Two Periods

	Dependent Variables						
	Efficiency	Frequency of Agreement	Decision Time (second)	Effort	Minimum Effort	Mis-coordination	Effort Deviation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
I-HTP	-0.053	0.000	-2.800	-0.276	-0.481	0.206	0.155
	(0.055)	(0.000)	(2.156)	(0.563)	(0.625)	(0.160)	(0.160)
T-LTP	0.192*	-0.009***	53.235***	1.860*	2.213*	-0.359**	-0.548***
	(0.100)	(0.003)	(13.719)	(1.130)	(1.203)	(0.178)	(0.172)
T-HTP	0.045	-0.122***	11.293***	2.156**	1.898*	0.280	-0.005
	(0.103)	(0.033)	(2.567)	(0.998)	(1.140)	(0.324)	(0.317)
Period	0.021***	0.006	-0.919	-0.339***	-0.064	-0.277***	-0.147***
	(0.008)	(0.005)	(1.107)	(0.065)	(0.054)	(0.051)	(0.048)
$Period^2$	-0.001*	-0.000	0.011	0.010***	0.002	0.009***	0.004*
	(0.000)	(0.000)	(0.041)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.407***	0.954***	15.055**	4.602***	2.183***	2.443***	1.907***
	(0.072)	(0.029)	(6.503)	(0.641)	(0.688)	(0.372)	(0.284)
Observations	2160	2160	2160	2160	432	432	2089
R^2	0.1588	0.0915	0.3867	0.2507	0.2698	0.1304	0.2205
Estimated differences							
(T-LTP) - (T-HTP)	0.147	0.113**	41.943***	-0.297	0.315	-0.640**	-0.543*
	(0.120)	(0.034)	(13.667)	(1.287)	(1.405)	(0.298)	(0.297)
(I-HTP) - (T-HTP)	-0.098	0.122***	-14.093***	-2.431***	-2.380**	-0.075	0.160
	(0.087)	(0.033)	(1.793)	(0.833)	(0.957)	(0.289)	(0.291)

Note: (1) Results reported in the table are derived from the panel linear regressions with standard errors clustered at the group level presented in parentheses. The base comparison group is I-LTP. (2) "Effort" represents chosen effort by each team or individual. "Minimum Effort" represents the minimum effort within a group. "Miscoordination" is defined as the absolute difference between a decision maker's chosen effort and the minimum effort in the group. "Effort Deviation" is the standard deviation of efforts within a group. (3) *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Appendix Table A7. Regression Analysis By Dropping the First Five Periods

	Dependent Variables						
	Efficiency	Frequency of Agreement	Decision Time (second)	Effort	Minimum Effort	Mis-coordination	Effort Deviation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
I-HTP	-0.068	-0.000	-3.340	-0.424	-0.656	0.231*	0.185
	(0.053)	(0.000)	(2.553)	(0.584)	(0.626)	(0.139)	(0.166)
T-LTP	0.194**	-0.004*	47.838***	1.999*	2.278*	-0.280**	-0.518***
	(0.098)	(0.003)	(14.455)	(1.175)	(1.218)	(0.129)	(0.160)
T-HTP	0.053	-0.107***	10.280***	2.139**	1.878	0.297	0.055
	(0.105)	(0.039)	(3.017)	(1.056)	(1.154)	(0.272)	(0.318)
Period	0.021**	0.007	0.044	-0.203***	-0.021	-0.217***	-0.159**
	(0.009)	(0.006)	(1.669)	(0.065)	(0.077)	(0.075)	(0.076)
Period^2	-0.001*	-0.000	-0.024	0.005**	-0.000	0.007**	0.004
	(0.000)	(0.000)	(0.060)	(0.002)	(0.003)	(0.003)	(0.003)
Constant	0.408***	0.943***	10.541	3.729***	1.961**	2.003***	1.944***
	(0.077)	(0.042)	(10.398)	(0.691)	(0.811)	(0.498)	(0.490)
Observations	1800	1800	1800	1800	360	360	1750
R^2	0.1746	0.0817	0.3327	0.1105	0.2917	0.0621	0.1636
Estimated differences							
(T-LTP) - (T-HTP)	0.141	0.102***	37.558***	-0.140	0.400	-0.576**	-0.573**
	(0.123)	(0.039)	(14.363)	(1.35)	(1.425)	(0.25)	(0.29)
(I-HTP) - (T-HTP)	-0.122	0.107**	-13.62***	-2.563***	-2.533	-0.066	0.131
	(0.092)	(0.039)	(1.971)	(0.885)	(0.969)	(0.255)	(0.293)

Note: (1) Results reported in the table are derived from panel linear regressions with standard errors, clustered at the group level, presented in parentheses. The base comparison group is I-LTP. (2) "Effort" represents chosen effort by each team or individual. "Minimum Effort" represents the minimum effort within a group. "Miscoordination" is defined as the absolute difference between a decision maker's chosen effort and the minimum effort in the group. "Effort Deviation" is the standard deviation of efforts within a group. (3) *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Appendix B The effects of the chat content

In this section, we investigate how different categories of chat messages in team treatments are associated with the likelihood of reaching an agreement and the chosen effort conditional on reaching an agreement. To do so, in Table C1, we report the estimation results from random effect linear regressions based on the sample from T-LTP and T-HTP treatments.

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 an indicator of periods in Columns (1) and (2). 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 per se shows the impact of an additional message in a given category on the outcomes of interest in T-HTP treatment, while the sum of coefficients of C_i and $C_i \cdot LTP$ shows that impact in T-LTP treatment.

In line with our previous results, Column (1) and Column (2) show that the teams in T-LTP are significantly more likely to reach an agreement than teams in T-HTP. Their effort number is similar to (if not smaller than) that of T-HTP, though the difference is not statistically significant.

Turning to the effects of chat content. We start by noting that the teaching and learning content (C_1) negatively associates with the likelihood of reaching agreements in T-HTP ($p < 0.01$). Indeed, under high time pressure, team members may not have time to discuss useful details such game structure, reasonable strategies, etc. If they spend time in such discussion, it will negatively associate with team's ability to reach an agreement. Such negative correlation disappears in LTP ($C_1 + C_1 \cdot LTP$, $p = 0.064$). In addition, the content involving reassurance (C_3) is related to rise in the likelihood of reaching an agreements in T-LTP ($C_3 + C_3 \cdot LTP$, $p = 0.007$) but not in T-HTP, suggesting that reassuring plays a role in reaching agreements under low time pressure. Proposing content has no significant correlation with agreement reaching in both T-HTP ($p = 0.517$) and LTP ($C_2 + C_2 \cdot LTP$, $p = 0.557$). Finally, turning to which type of messages relates to the effort chosen by teams, we find that the the content involving reassurance (C_3) negatively relates effort in T-LTP ($C_3 + C_3 \cdot LTP$, $p = 0.079$), and the irrelevant content (C_4) seems to reduce effort in T-HTP. It is worth noting that the inherently non-causal nature of this regression analysis, which may limit the precision and interpretability of these findings.

Appendix Table C1. Regression Analysis of Chat Content

	Agreement (1)	Effort (2)	Agreement (3)	Effort (4)
LTP	0.152***	-0.312	-0.015	-0.116
	(0.029)	(1.259)	(0.024)	(1.481)
C_1			-0.111***	0.123
			(0.012)	(0.124)
C_2			-0.007	0.040
			(0.011)	(0.098)
C_3			-0.008	-0.154
			(0.010)	(0.130)
C_4			-0.037	-0.260***
			(0.028)	(0.073)
$C_1 \times$LTP			0.111***	-0.100
			(0.012)	(0.124)
$C_2 \times$LTP			0.011	-0.118
			(0.013)	(0.165)
$C_3 \times$LTP			0.039***	0.024
			(0.013)	(0.147)
$C_4 \times$LTP			0.034	0.252***
			(0.028)	(0.073)
Period	0.051***	-0.253***	0.054***	-0.277***
	(0.014)	(0.096)	(0.013)	(0.090)
Period^2	-0.002***	0.007*	-0.002***	0.008**
	(0.001)	(0.004)	(0.001)	(0.004)
Constant	0.552***	6.289***	0.688***	6.493***
	(0.060)	(0.772)	(0.076)	(0.810)
Observations	1200	1083	1200	1083
R-squared	0.1623	0.0581	0.3218	0.0713

Note: (1) This table reports random effect 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 T-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.**