Focality is intuitive - Experimental evidence on the effects of time pressure in coordination games

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February 2019

Focality is Intuitive - Experimental Evidence on the Effects of Time Pressure in Coordination Games

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February 23, 2019

Abstract

We experimentally examine the effects of varying time pressure in a coordination game with a label salient focal equilibrium. We consider both a pure coordination game (payoff symmetry) and a battle of the sexes game with conflict of interest (payoff asymmetry). In symmetric games, there are no effects of time pressure, since the label-salient outcome is highly focal regardless of how much time subjects have to decide. In asymmetric games, less time results in greater focality of the the label-salient action, and it becomes significantly more likely that any coordination is on the focal outcome.

Keywords: Coordination game; focal point; time pressure; response times; social heuristics hypothesis; experiment.

JEL Classification: C70; C72; C92.

1 Introduction

Coordination games capture many important economic situations, such as market entry, macroeconomic policy coordination, choice of product standards, contract agreement, as well as everyday life situations such as when and where to meet someone else. Coordination situations have multiple equilibria, hence strategic uncertainty, and so it is not a priori obvious exactly how coordination can be ensured. There is consequently a risk of coordination failure (see Devetag and Ortmann, 2007; Van Huyck et al., 1997).

An important conjecture is that players may be able to achieve a high degree of coordination by coordinating their beliefs and actions on a *focal point* (Schelling, 1960). We use this term to denote a payoff irrelevant aspect or feature of the game that can help the players coordinate. Examples of such focal points include past behavior, a convention, a shared culture, and the framing

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of options and payoffs (see Crawford et al., 2008; Isoni et al., 2013; Lewis, 1969; Parravano and Poulsen, 2015; Poulsen et al., 2016; Schelling, 1960; Sugden and Zamarrón, 2006; Sugden, 2011).[1]

In this paper, we experimentally consider how the power of a focal point in a coordination game is affected by an arguably fundamental economic aspect, namely *time available* for thinking and deciding what to do. We exogenously vary how much time is available, and thus impose varying degrees of *time pressure* on the decision makers. It seems highly economically relevant to study time pressure in coordination games. In real life, decision makers often need to coordinate their decisions, but have varying time available to contemplate what to do; this may be due to them having other tasks that require attention, or to various technological constraints (for example, the need to avoid excessive fines for a delayed project start).

The existing literature has found that time pressure affects behavior in a variety of economic domains (see Spiliopoulos and Ortmann, 2018, for a recent survey). It leads to more imitation in Cournot oligopoly settings (Buckert et al., 2014), increases risk aversion (Ben Zur and Breznitz, 1981; Kocher et al., 2013), slows down convergence and leads to lower payoffs in the beauty contest game (Kocher and Sutter, 2006). Time pressure also results in lower choice quality in multi-cue decision problems (Zakay and Wooler, 1984; Rothstein, 1986), and leads to fewer agreements and higher rejection rates in bargaining situations (Carnevale and Lawler, 1986).

Most relevant to our study, increased time pressure has also been found to change the way people reason, from a rational 'thinking through everything in detail' towards more heuristic choice strategies (Payne et al., 1996; Ordonez and Benson III, 1997). That is, under time pressure, decision makers turn to simple rules and focus on specific (salient) aspects of a choice problem rather then processing all information available. Our ex ante hypothesis was that this would also be the case in interactive coordination games. There is a growing experimental literature studying how time pressure affects decisions (see next section for more details), but we are - as far as we know - the first to study the impact of varying time pressure on the power of focal points in coordination games.

In our experiment two randomly matched subjects play a tacit simultaneous-move one-shot coordination game, where each player chooses between two options, called 'A' and 'B'. Each player choosing A is an equilibrium, as is both choosing B. We consider two payoff conditions. In the *payoff symmetric* coordination game (also known as a 'pure coordination game') the players are indifferent between coordinating on A or on B, but A is more *label-salient* than B, due to A being the first letter in the alphabet. This makes the (A,A) equilibrium more *focal* than (B,B). We therefore expect that there would be more coordination on A than on B, as has been verified in previous work (see Crawford et al., 2008; Isoni et al., 2013; Parravano and Poulsen, 2015).

Our main focus however is on *payoff asymmetric* games with conflict of interest, of the 'battle of the sexes' type (see e.g. Crawford et al., 2008), where again both (A,A) and (B,B) are equilibria (there is also an equilibrium in mixed strategies), but each player now prefers a different equilibrium. Intuitively,

[1] More generally, a focal point refers to any feature, payoff-based or not, that makes an equilibrium of the game attractive (see for example Schelling, 1960; Isoni et al., 2014; Galeotti et al., 2018).

considerations based on *payoff salience* (each player desiring to get his or her highest payoff) now interfere with the label salience of A. Previous research have found that the focality of label salience is much weaker in asymmetric than in symmetric games (see Crawford et al., 2008; Isoni et al., 2013, 2014; Parravano and Poulsen, 2015).

Our central research question is: Does more severe time pressure weaken or strengthen the focality of the (A,A) equilibrium? We had an ex-ante hypothesis, that the power of label salience, and hence the focality of (A,A), will be stronger when there was less rather than more time available. Moreover, if the increase in the focality of (A,A) is sufficiently strong, it might even be possible that overall coordination and welfare is higher the less time people had to decide.

These hypotheses were in turn based on an underlying conjecture that focality is primarily intuitive – players will initially notice, and spontaneously and instinctively wish to act on focality. If they had little time to decide, focality would consequently be the main driver of behavior. If on the other hand players have plenty of time available, they tend to become more guided by payoff-based considerations, and this would weaken the power of the focal point. Our conjecture is similar to the so-called social heuristics hypothesis (SHH, see Rand et al., 2012, 2014; Rand, 2016), a leading explanation of findings on reasoning processes and response times in social dilemmas and other games (see Rand, 2016). In fact, our conjecture for coordination games can be regarded as applying and suitably modifying the SHH to coordination games.

We conducted experiments under two conditions that differed in how time pressure was implemented. In *Experiment 1* subjects were given a total amount of time to be used for reading the instructions, thinking about what to do, and for making a decision. They had either 180 seconds (low Time Pressure) or 45 seconds (high).[2] So in Experiment 1 the "clock starts ticking" as soon as one is introduced to the task. We think this is a simple and realistic model of real-world decision making under time pressure: there is no free lunch, in the sense that time spent on *any* part of a decision task implies less time available for other parts, and the decision maker decides how much of the total time to allocate to the each of the decision making phases (reading, thinking, and deciding).

Our *Experiment 2* is a control, where the understanding phase is not made subject to time pressure. The clock only starts ticking *after* subjects had read the instructions and have had opportunities to ask questions, and where it was thus plausible to assume that each subject had understood the task, and felt confident that others had understood it as well.[3] In Experiment 2 subjects had either 15 seconds (high Time Pressure) or 180 seconds (low) to make a decision. If the effects of time pressure on behavior in Experiment 2 and 1 are qualitatively similar, we have evidence that task understanding is not much of an issue in our setting, and hence that the results are robust to the exact 'time

[2] The selection of these parameters is discussed in section 3.

[3] Of course, it is very difficult if not impossible to cleanly separate the understanding and the reasoning phases, since a subject can start to think about what he/she should do as soon as (or even before) the task has been fully understood. We believe we managed to obtain a reasonable separation by first giving subjects a general description of the coordination task; subjects were not told what the specific game payoffs were, so they could not reason about and decide what they should do. Only when all questions about the task had been answered did the experiment proceed to the second phase where the specific payoffs were announced and the clock started to count down.

pressure technology'.[4]

Our main findings are as follows. In the symmetric coordination game, there is no effect of time pressure on coordination behavior. The vast majority of subjects (more than 90%) choose the label-salient action, A, regardless of how much time they have.[5] These findings are similar to the ones from the existing literature, see e.g. Parravano and Poulsen (2015) and Crawford et al. (2008), and with those found in bargaining experiments (see Isoni et al., 2013), that purely contextual and payoff-irrelevant features can be highly salient in symmetric settings.

In the asymmetric games, we observe in both Experiment 1 and 2 that higher time pressure makes it significantly more likely that coordination is due to both players having chosen A rather than B. Thus, different levels of time pressure significantly affect the *distribution* of the surplus between the players. Nevertheless, there is no significant effect on the *overall* expected coordination rate (ECR).[6] While higher time pressure weakly significantly increases the ECR in Experiment 1, there is no discernible effect in Experiment 2. The latter finding is due to the fact that the increase in the subjects' A choices is not large enough to cause a significant increase in overall coordination.

A closer look at the data shows that in the asymmetric game Player 1 and 2 react differently to changes in time pressure. Call the player role for whom the label-salient equilibrium is also the payoff-preferred equilibrium the 'favoured' player, and call the other player 'unfavoured'.[7] We observe in both Experiment 1 and 2 that higher time pressure induces a bigger increase in the choice of the label-salient action among the favoured than the unfavoured players. We conjecture that time pressure affects the players' reasoning (how intuitive it is relative to being deliberative) and, moreover, due to the payoff asymmetries, these effects are role-specific. The analysis of subjects' response times are consistent with this conjecture.

This explanation is similar to the social heuristics hypothesis for explaining reasoning in social dilemma and public goods games (see Rand et al., 2012, 2014), according to whether variations in time pressure affects the extent to which reasoning is instinctive or deliberative. We return to this in Section 6. Our data, as well as findings in the existing literature, suggest a simple explanation for the observed difference between how time pressure affects reasoning in social dilemma and coordination games. While in social dilemma situations more deliberation tends to make a player more likely to defect, in a coordination game with payoff asymmetries it leads to greater uncertainty and ambivalence about what the other player will do, and less confidence in and hence reliance on a focal point. Moreover, when the game is asymmetric, these effects are role-specific.

The rest of the paper is organized as follows. Section 2 describes some related literature. In Section 3 we describe the coordination games, the experimental design, and the logistics. Theories and hypotheses are described in Section 4. The findings are described in Section 5. Section 6 describes a con-

[4] We discuss additional design choices regarding time pressure in section 7.

[5] All symmetric data were collected for Experiment 1 only. Since these data were so unequivocal, we decided there was no need to collect data for symmetric games in Experiment 2.

[6] ECR is the probability that, given the empirical choice behavior, a randomly selected pair of players achieve coordination. More details are given below.

[7] This terminology was introduced in Isoni et al. (2013); see also Isoni et al. (2014).

jecture for the data, and relate it to the social heuristics hypothesis. Section 7 discusses some limitations and possible future research. Section 8 concludes. The instructions and various additional findings can be found in the Online Appendix.

2 Related Literature

There are several experimental studies of focal points in coordination games (see Bardsley et al., 2009; Bett et al., 2016; Blume and Gneezy, 2000, 2010; Crawford et al., 2008; Van Huyck et al., 1992; Isoni et al., 2013, 2014; Mehta et al., 1994; Parravano and Poulsen, 2015; Schelling, 1960). None of these studies gave subjects an explicit amount of time for making a decision, and none report subjects' response times.[8] Thus we do not currently know if and how different degrees of time pressure affect the power of focal points in such situations.

There has recently been extensive research on how time pressure and subject response times are related to contribution decisions in public goods and social dilemma games (see Spiliopoulos and Ortmann, 2018). A broader investigation is reported in Rubinstein (2007). Much of this work is motivated by the issue of whether self-regarding (conversely, pro-social behavior) is mainly a spontaneous and instinctive reaction, or rather a result of deliberate reasoning. Some findings suggest the former, see for example Rand (2016), Cappelen et al. (2015), Lotito et al. (2013), Rand et al. (2014), Rand et al. (2012), Evans et al. (2015), and Krajbich et al. (2015).[9]

Time pressure and response times have also been investigated in a variety of other well-known strategic games, see for example Rubinstein (2007). In Dictator Games, Cappelen et al. (2015) observe that fairness seems to be an intuitive phenomenon: fair dictators make their decisions faster than unfair ones. In the Ultimatum Game, Sutter et al. (2003) find that severe time pressure makes Responders more likely to reject offers, but this effect tends to become smaller over time. See also Cappelletti et al. (2011) and Brañas Garza et al. (2017). Kocher and Sutter (2006) compare behavior in the beauty contest under high and low time pressure and find that time pressure reduces decision quality if it is implemented as a hard deadline (as it is in our experiment). However, in a third treatment, in which the payoff continuously falls the longer a decision takes ('shrinking pie'), decisions were made faster and their average quality even improved.

3 Experimental Design and Logistics

3.1 The Coordination Games

The coordination games were one-shot simultaneous move games, and without any communication. Each experimental subject played only one game.

In the symmetric game, both players get the same payoff, €10, if they both choose A, and the same if both choose B, and otherwise each player gets no

[8] A few bargaining experiments, such as Isoni et al. (2014) and Galeotti et al. (2018), give people an explicit time budget for reaching an agreement, but the time available is not varied.

[9] There are however also findings that suggest that the opposite can be true – see Døssing et al. (2017), Lohse (2016), Piovesan and Wengström (2009), and Tinghög et al. (2013).

money (see Table 1a). In the asymmetric coordination game, Player 1 (2) gets €12 (€10) from (A,A), the opposite from (B,B), and a failure to coordinate on A or B again means that no one gets anything. There is thus conflict of interest, in that Player 1 prefers coordination on A while Player 2 prefers coordination on B (see Table 1b).

Table 1: The coordination games

	P2	
P1	A	B
A	10, 10	0, 0
B	0, 0	10, 10

(a) symmetric

	P2	
P1	A	B
A	12, 10	0, 0
B	0, 0	10, 12

(b) asymmetric

Notes: The numbers are money amounts in Euros.

3.2 The Task

Subjects were shown two cards on their computer screens, one labelled "A", and the other "B". The "A" ("B") card was always shown to the left (right).[10] Subjects were informed they each had to choose one of the cards without knowing the other subject's choice. All money payoffs were common knowledge.

The decision screens are shown in Figure 1. In Experiment 1 (see part *a* of the figure), subjects saw a single screen that showed how much time was remaining, the instructions, and subjects made their decision by clicking on the desired option at the bottom of the same screen. Thus everything was made subject to time pressure (reading instructions, understanding, thinking, and deciding).

In Experiment 2 (see part *b* of Figure 1), subjects were first on a separate screen (see Online Appendix) presented with the instructions and they read these under no time pressure. The instructions explained that there would be a card selection task and that subjects would earn money only if they chose the same card, but subjects were not told what the exact payoffs were. When all subjects had understood the instructions and had asked any questions, the group were presented with a decision screen where, with time counting down, they saw the specific money payoffs for each card, and they made their decision. Thus the difference between Experiment 1 and 2 is whether the reading and understanding phase of the game was subjected to time pressure (Experiment 1) or not (2). As already mentioned in the Introduction, we see Experiment 1 as the more externally valid implementation of time pressure, and Experiment 2 as controlling for the potential objection/issue (to inference drawn from Experiment 1 data) that in Experiment 1 subjects may have rushed

[10]Thus the properties of 'being labelled A' and 'being shown on the left' were perfectly correlated. A possible control is one where there are no letters; here only 'leftness' and 'rightness' properties can act as potential label based focal points. We suspect this framing would be much weaker than using letters. Another control would show the option 'A' and 'B' on the right and left side, respectively. Nevertheless, the latter seems quite artificial: given that the framing of the options is in terms of letters, it seems natural that these should be listed in the order of the alphabet.

through the instructions (or believe others had), which could have affected their understanding and coordination behaviour.

After subjects had chosen the card (but before they knew what the other subject had done and thus whether they had managed to coordinate or not), they were asked a number of questions, such as age and gender, and whether they thought they had time enough, and whether they believed they had understood the task (see Online Appendix). In Experiment 2 we also asked them to estimate what card they thought the other subject had chosen.

As a measure of cognitive sophistication, we also asked them in both Experiment 1 and 2 to do the Raven task (Raven, 1941) – for details, see Online Appendix, Section 2.2. As an additional measure of cognitive sophistication, subjects in Experiment 2 also took part in a version of the Cognitive Reflection Test (Frederick, 2005); see again the Online Appendix.[11]

3.3 Time Available

The time available was exogenously set.

- In Experiment 1, subjects had 180 seconds in the *low* time pressure condition, and 45 seconds in the *high* time pressure condition.
- In Experiment 2, subjects had 180 seconds in the *low* time pressure condition, and 15 seconds in the *high* time pressure condition.

We decided on these parameters based on informal pre-testing. We sought to establish an environment where low time pressure allowed for plenty of time to decide such that, in effect, there was no time pressure (see Lindner and Sutter, 2013, for a similar design choice).[12] In fact, the data show that in the low time pressure condition all subjects, also in Experiment 1, decide well before the 180 seconds deadline. We of course wanted high time pressure to be clearly relevant, yet we also had to avoid giving participants so little time that they could not properly reflect on what to do. We seem to have succeeded in balancing these opposing considerations, since we do indeed observe that subjects under low time pressure on average need more time to decide than what they have available (45 or 15 seconds) under in the high time pressure condition; so the time in the high time pressure condition is "binding". At the same time, the answers to our survey questions indicate that participants felt they had been given enough time to understand the task. See Figures 4 and A.1 as well as Table 3 below for more details on response times.

3.4 Experimental Logistics

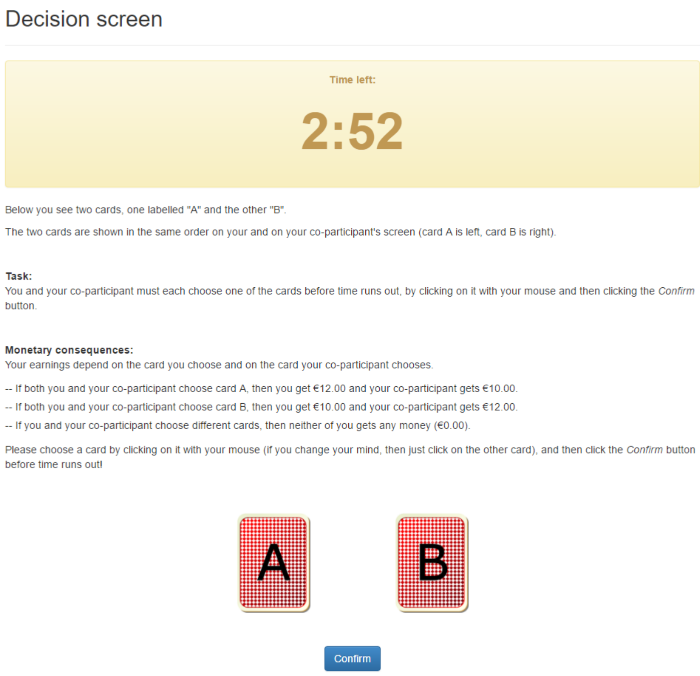
The experiment was conducted at the Vienna Center for Experimental Economics (VCEE) lab of the University of Vienna and was implemented using oTree (Chen et al., 2016). In total 336 subjects participated in 17 sessions and earned an average of €9.70 for about 40 minutes of their time. As already mentioned, each subject played one game only.

[11] We used the 3 original items, but added 3 new items (Primi et al., 2016) because the original items – due to their frequent use – might had become known by the subjects.

[12] In our data the slowest subject in a 180 second condition took 124 seconds to make his/her choice, i.e., the time limit of 180 seconds was indeed not restricting our subjects.

Figure 1: Decision screens

(a) Experiment 1



(b) Experiment 2

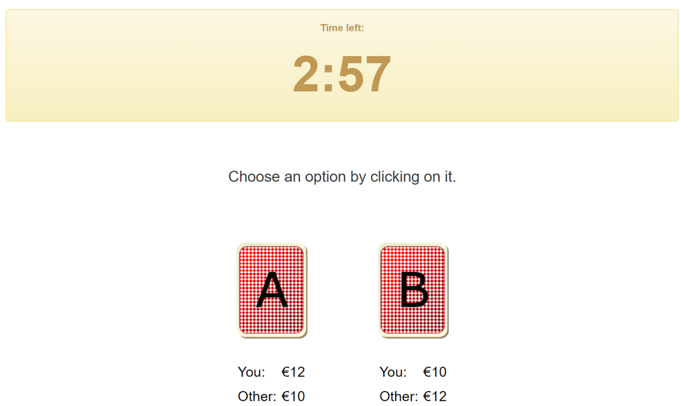


Table 2: Treatments and observations

	Time pressure	
Symmetry	Low	High
Sym (exp.1)	48	50
Asym (exp.1)	48	68
Asym (exp.2)	62	60

4 Hypotheses

As already stated in the Introduction, the main hypothesis that motivated our experiment was that having less time available for deciding could increase coordination on a focal point.

Hypothesis 1. *The proportion of subjects in either role choosing A is decreasing in time given to decide (increasing in time pressure), in both the symmetric and the asymmetric game.*

Our intuition was that focality is primarily intuitive and spontaneous, such that players more or less immediately notice and perceive choosing the A option as being more attractive and obvious than B, in both the symmetric and the asymmetric game. However, with enough time players invariably start to pay attention to the payoffs, and in the asymmetric game note that there is a conflict of interest. This tends to make them unsure about what the other player will do. This in turn may make some players more likely to choose the action that, if coordinated on, would give them the higher money earnings, or it may make other subjects more likely to choose the action they think the *other* subject will choose. Or it increases the amount of random behavior. Thus we would expect a dispersion in behavior away from the focal point.

The above hypothesis can be contrasted with the (null) hypothesis that changes in time pressure have no effect on behavior whatsoever. This is the Nash equilibrium prediction, which is silent on what the effects of time pressure should be, since time to think and decide play no role.

An alternative hypothesis is that more time is beneficial. Subjects need time to understand and fully appreciate the multiplicity of equilibria in the coordination game, and the equilibrium selection problem they face. They will then eventually realise that coordination on the label-salient outcome (A,A) is the best way to avoid coordination failure. This will be true in both the symmetric and the asymmetric game, and in both roles, although we naturally expect more coordination on (A,A) in the symmetric than in the asymmetric game. This hypothesis appears similar to a hypothesis that subjects are "team reasoners" (Sugden, 2003; Bacharach, 2006; Bardsley et al., 2009), according to which subjects reason as a team and identify the behavior that is jointly optimal. Since it takes time to go through this reasoning, it seems intuitive that more time is beneficial. This approach predicts that lower time pressure makes it more likely that players achieve achieve coordination on the label-salient (A,A) equilibrium.

We can also consider the effects of changes in time pressure on the expected coordination rate and players' welfare. Let p (q) denote the proportion of Player 1s (2s) who play A, where $p, q \in [0, 1]$. Then the expected coordination rate (ECR) is the probability of coordination on A plus the one on B, that is, $ECR = pq + (1 - p)(1 - q)$. At (p, q), the sum of both players' total earnings in the asymmetric game equal $ECR \times$ €22.[13]

ECR, and total earnings, are high whenever both player populations are concentrated on A, or on B. It follows that if both Player 1 and 2s become more likely to choose A, then the effect on coordination and overall earnings is beneficial only if sufficiently many players in each role are already playing A; otherwise the effect is negative (suppose as an extreme example that almost everyone initially play B; an increase in play of A then clearly lowers the expected coordination rate).[14] We must therefore not draw the false conclusion that any increase in play of A (or on B) is automatically beneficial; it depends on the initial behavior. It follows that an increase in both players' choice of A is beneficial only when sufficiently many players are already choosing A. Our second hypothesis was that the increase in time pressure causes a sufficiently large increase in play of A by both Player 1 and 2 such that this condition is satisfied.

Hypothesis 2. *A decrease in time available raises the expected coordination rate and players' total earnings.*

5 Experimental Findings

5.1 Choice Data

Table 3 provides some descriptive statistics on choices, coordination rates, and response times.[15]

Finding 1. *In the symmetric treatments, almost everyone chooses 'A', irrespective of whether the decision was made under low or high time pressure.*

[13]Equivalently, the sum of total earnings in the symmetric game is $ECR \times$ €20.

[14]As a hypothetical example, let p (q) denote the probability that Player 1 (2) chooses A, and suppose that in the no time pressure condition, $(p, q) = (.4, .4)$. Then $ECR = .52$. If higher time pressure raises play in each population to $(p, q) = (.6, .5)$, then $ECR = .5$, so coordination drops.

[15] The data from the Raven Progressive Matrices and Cognitive Reflection Test can be found in the Online Appendix. It turns out that neither of these are correlated with choices. The same turns out to be true for subjects' age and gender. See Appendix A.2 for details.

Table 3: Summary statistics

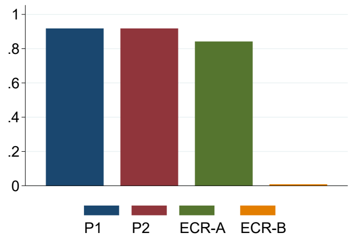
	Exp 1 - Symmetric		Exp 1 - Asymmetric		Exp 2 - Asymmetric	
Time pressure	Low	High	Low	High	Low	High
N	48	50	48	68	62	60
Choices made in time	48	49	48	66	62	59
Number choosing A (%)	44 (91.67%)	46 (93.88%)	27 (56.25%) pooled 14 (58.33%) P1 13 (54.17%) P2	47 (71.21%) pooled 26 (78.79%) P1 21 (63.64%) P2	29 (46.77%) pooled 13 (41.94%) P1 16 (51.61%) P2	33 (55.93%) pooled 20 (66.67%) P1 13 (44.83%) P2
ECR on ECR_A on ECR_B	84.72% 84.03% 0.69%	88.33% 88.00% 0.33%	50.69% 31.60% 19.10%	57.85% 50.14% 7.71%	49.74% 21.64% 28.10%	48.28% 29.89% 18.39%
MSNE ECR	50%	50%	49.59%	49.59%	49.59%	49.59%
Exp. payoff (in EUR, excl. part. fee)	8.47	8.85	5.70 P1 5.45 P2	6.79 P1 5.94 P2	5.41 P1 5.54 P2	5.43 P1 5.20 P2
Av. response time (secs)	46.29	31.18	56.79 P1 47.29 P2	33.76 P1 32.38 P2	18.00 P1 20.19 P2	8.23 P1 9.13 P2
Av. response time (secs) cond. on A	46.59	31.13	57.85 P1 43.76 P2	33.92 P1 29.90 P2	21.62 P1 18.56 P2	7.95 P1 8.69 P2
Av. response time (secs) cond. on B	43.00	27.66	55.30 P1 51.45 P2	31.71 P1 35.67 P2	15.39 P1 21.93 P2	8.80 P1 9.13 P2

Notes: N: number of observations, ECR: expected coordination rate, ECR_A: expected coordination rate on outcome (A,A), ECR_B: expected coordination rate on outcome (B,B), MSNE ECR: expected coordination rate according to the mixed strategy Nash equilibrium (MSNE), and Exp. payoff: Expected Payoff in Euros

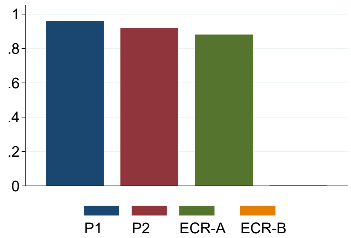
In the symmetric games over 90% all players chose A (see Table 3). Moreover, the number of A choices is not significantly different between the high and the low time pressure condition (χ^2-test: $p = 0.674$).

Figure 2: Proportions of A choices and expected coordination rates

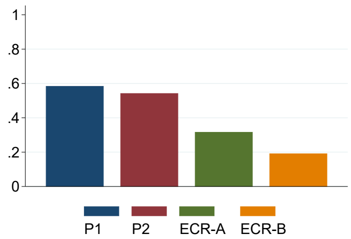
(a) Exp 1, symmetry, low time pressure



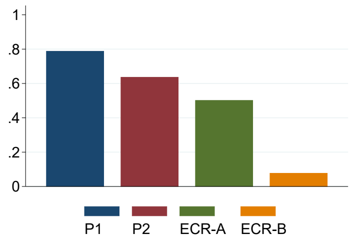
(b) Exp 1, symmetry, high time pressure



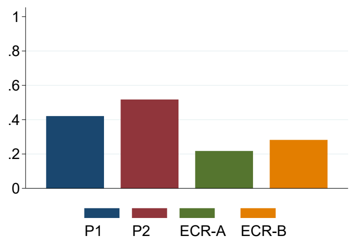
(c) Exp 1, asymmetry, low time pressure



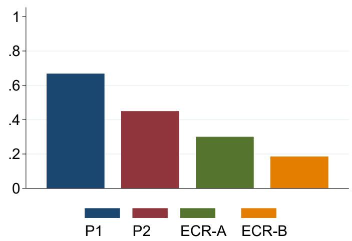
(d) Exp 1, asymmetry, high time pressure



(e) Exp 2, asymmetry, low time pressure



(f) Exp 2, asymmetry, high time pressure



Notes: P1 and P2 denote the proportion of 'A' choices of players 1 and 2, respectively. ECR-A and ECR-B denote the expected coordination rates on option 'A' and 'B', respectively.

Finding 2. *In the asymmetric games, and for both Experiment 1 and 2, higher time pressure increases the likelihood of A being chosen for Player 1s, but not Player 2s.*

In Experiment 1, for the asymmetric game under low time pressure Player 1s choose A in 58.33% of cases. Under high time pressure this increases to 78.79%, which is marginally significantly (χ^2-test: $p = 0.096$). However, for Player 2 this difference is not significantly different (χ^2-test: $p = 0.472$). A similar pattern can be observed in Experiment 2: under low time pressure Player 1s choose A in 41.94% of all cases, and under high time 66.67% do so, which is statistically significantly different (χ^2-test: $p = 0.053$). Again, for Player 2 this difference is not significantly different (χ^2-test: $p = 0.599$).[16]

5.2 Expected Coordination Rates

The expected coordination rate (ECR) measures the probability that two different participants selected at random from the set of all participants of a condition choose the same action (see Section 4 for how we calculate the ECR).[17] We compare the ECR between our experimental conditions.

In the symmetric treatments very high choice propensities for 'A' result in overall expected coordination rates of over 84% which is much higher than the expected coordination rates resulting from a MSNE type of play (i.e., 50%, see Table 3).

In the asymmetric treatments we find ECRs much closer to MSNE play than in the symmetric treatment. In particular, under low time pressure, in experiments 1 and 2, we find ECRs of 50.69% and 49.74%, respectively. Under high time pressure, in experiment 1 and 2 we find ECRs of 57.85% and 48.28%, respectively (MSNE prediction: 49.59%, see Table 3). In fact, these expected coordination rates do not seem to be affected by time pressure, too much.

However, a clear pattern of time pressure can be detected if we decompose the overall ECR into its parts, ECR-A and ECR-B (recall that ECR = ECR-A + ECR-B). In the asymmetric games, we observe in both Experiment 1 and 2 that the difference ECR-A – ECR-B is larger under high than low time pressure (see also Figure 2 panels c-f). This is not the case in symmetric games (see Figure 3 below).

Finding 3. *In the asymmetric games, and for both Experiment 1 and 2, the overall expected coordination rate ECR does not seem to be affected by time pressure, but we observe a clear shift towards coordination on A rather than on B becoming much more likely under high than under low time pressure.*

5.3 Response Times

In this section we consider subjects' response times (cf. Table 3; histograms can be found in the Online Appendix).[18] We first observe that the response times are significantly longer, the more time subjects have to decide ($p < 0.001$). That is, giving people less time to decide, makes them decide faster. This, combined with the fact that very few subjects run out of time when making a decision, show that subjects in the low time pressure condition find the less time available behaviourally relevant. Furthermore, subjects made decisions (marginally) faster in symmetric than in asymmetric games (Ranksum tests: low time pressure: $p = 0.048$, high time pressure: $p = 0.095$).

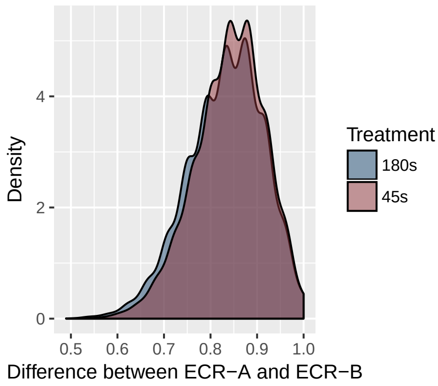
[16] Pooling role 1 and role 2 players' A choices and analysing them jointly reveals a marginally significant difference across time pressure conditions in experiment 1, but no significant difference in experiment 2 (χ^2-tests: $p = 0.098$ and $p = 0.314$ for experiment 1 and 2, respectively).

[17] Whether or not a pair of subjects actually coordinates in the lab does not only depend on their choices, but also on their specific random matching of the subjects. Thus we follow the standard approach by calculating expected rather than the actually observed coordination rate.

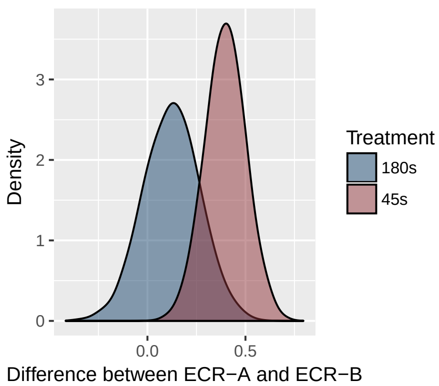
[18] As was the case for choices (see footnote 15), neither performance in the Raven Progressive Matrices nor in the Cognitive Reflection Test add much insight into the determinants of response times – see Appendix A.2

Figure 3: ECR bootstrapping

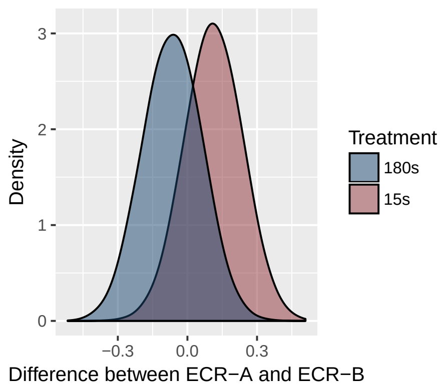
(a) Experiment 1 - symmetric



(b) Experiment 1 - asymmetric

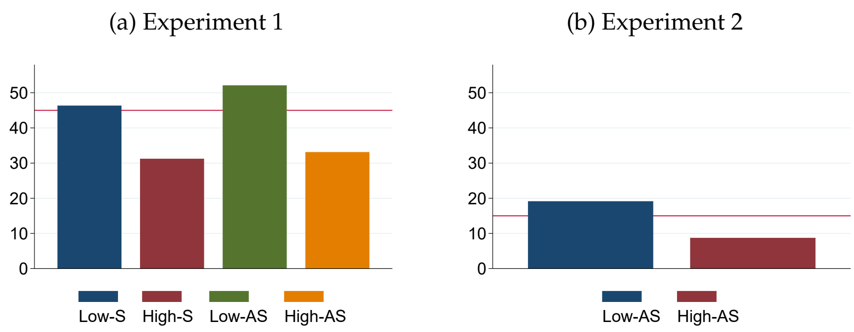


(c) Experiment 2 - asymmetric



In addition to the above, there are some noteworthy features regarding different response times by player role (see Figure A.1 in the Appendix). For example, in Experiment 1, it takes longer for Player 1 than 2 to choose A under low time pressure (57.85 versus 43.76 seconds, Ranksum test: $p = 0.042$). It also takes longer for Player 2 to choose B than A (51.45 versus 43.76, Ranksum test: $p = 0.072$). A qualitatively similar pattern of response times can be observed in Experiment 2, but this is not significant (P1-A: 21.62, P2-A: 18.56, ranksum test: $p = 0.453$; P2-B: 21.93, P2-A: 18.56, ranksum test: $p = 0.127$). In the next section, we reconcile these role specific response time patterns with the role specific choice patterns identified earlier and speculate on how subjects made their choices in our experiment.

Figure 4: Response times



6 A Conjecture

How can we explain the finding that it is especially Player 1 who becomes more likely to choose the salient action A when time pressure increases? Our conjecture is that there are two decision phases, and that one tends to take place before the other.

Phase 1: Spontaneous/instinctive thinking The players first notice and consider the labels (A and B), and if this was the end of the story, both players would be very likely to choose A.

Phase 2: Best reply thinking As time passes, players start to note and consider the money payoffs from each option, and in the asymmetric games it thus gradually dawns upon the subjects that they prefer different options. It becomes more and more likely that the players become predominantly engaged in best reply thinking, that is choosing the action they think their counterpart is likely to choose. Moreover, and crucially, due the role asymmetries of the game, the players hold different beliefs about their counterparts' behavior. Recall that Player 1 is the one who prefers coordination on the label salient (A,A) outcome. Intuitively, Player 2 has two 'good reasons' to expect Player 1 to choose A: (A,A) gives 1 more money than (B,B), and it is label-salient. To the contrary, Player 1 has only one good reason to expect 2 to choose A: it is label-salient. This suggests that Player 2 is more likely than 1 to believe that the counterpart will choose A.

This intuition suggests that going from spontaneous to best reply thinking decreases Player 1's likelihood to choose A by more than 2's. It follows that giving players less time, which makes it more likely that players are spontaneous thinkers instead of best responders, causes a greater switch from B to A by Player 1s than 2s. This is what our data show.

This conjecture also helps to organize subjects' response times (Section 5.3). We would predict that when people have more time available, more become deliberate (best reponse) reasoners; assuming that deliberate reasoning takes more time than intuitive reasoning, response times should be higher. This is what we find.Second, let us assume not only that it takes more time to think deliberately than intuitively, but also that, within the group of deliberate reasoners, the more 'thinking steps' are involved the more time it takes. In this case our conjecture suggests that it would take longer for Player 1 than 2 to choose A. Recall our argument that a best responding Player 1 has fewer "reasons" to choose A than 2, so those Player 1s who ended up choosing A must have spent more time agonizing over their decision than 2. Put differently, it is "easier", and hence quicker for Player 2 to choose A than it is for Player 1, and we expect this to lead to a differences in response times across player roles similar to those observed.

Our conjecture is similar to the social heuristics hypothesis (SHH, see Rand, 2016), according to which people bring automatic, intuitive responses that have worked well in the real life situations people repeatedly face (such as an infinitely repeated prisoners' dilemma game where cooperation is optimal and possible to sustain) into the lab, where the situation is often quite different (such as a one-shot prisoner's dilemma game, where defection is now optimal). Intuitive thinking based on the real world repeated game then leads people to cooperate in the one-shot version played in the lab. On the other hand, more reflective and deliberative processes will override this automatic behavior and make people adopt a behavior that is more appropriate for the situation at hand (defection).

A common feature of our conjecture and the SHH is that initial early thinking is mostly intuitive and spontaneous (and hence in a coordination game drawn to choosing the label salient action); in the asymmetric game more deliberate thinking, promoted by having more time available, leads players to consider the conflict of interest present in the coordination problem (in the symmetric game this is not present, so more time does not make players less likely to choose the label-salient action). This in turn makes them less likely to choose the focal action, which can lower the coordination rate. Moreover, and this is an important difference from social dilemmas (which are typically modeled as symmetric games – but see Lotz (2015) for an exception), in an asymmetric coordination game with a focal point time pressure generates role-specific effects, due to players reasoning differently about the other players' expected behavior.

7 Discussion

Our experimental design was meant to have high internal validity and thus invariably suffers from low external validity in some obvious respects. First, many real coordination situations are likely to have a much larger action set; second, it is unlikely that players' payoffs are common knowledge. Finally, the players may be able to engage in pre-play communication. All these aspects can be investigated in future work.

One objection is that the time amount we gave our subjects have no connection with how much time people have to think and decide in the real world. People may have several days, weeks or months to decide; thus there is in terms of our setup no or very little time pressure, so our investigation might not be seen as very relevant for the real world. However, we point out that in the so-called real world, people are typically at any point in time engaged in a multitude of tasks, while in our setup subjects only have a single task to focus on; so even though in real life there may be days or weeks to decide on any given task, given the task congestion the effective time pressure on each individual task may be much higher and not that different from the parameters chosen in our experimental environment.

8 Conclusion

This paper is the first to consider the effects of time pressure on the power of a label-based focal point in payoff symmetric and asymmetric coordination games. We find that as time pressure increases in games with payoff asymmetries (conflict of interest), a greater proportion of the observed coordination is on the label-salient outcome. We offer a conjecture, similar to the social heuristics hypothesis (Rand, 2016), for our findings, namely that in games focality based on label salience is primarily an intuitive concept – something people are spontaneously attracted to and act upon, while more lengthy and deliberative thinking makes people abandon label-based focality in favour of more best-reply based thinking.

Acknowledgments

We are grateful to the Graf Hardegg'sche Stiftung for financial support. We thank Bob Sugden for thoughtful comments, and we received many useful comments and suggestions from colleagues attending the European ESA meeting in Vienna and the seminar of the Vienna Center for Experimental Economics.

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A Appendix

A.1 Instructions

All instructions were displayed on computer screens and were also read aloud by the experimenters. Screenshots can be found in the Online Appendix.

A.2 Further Results

A.2.1 Regressions

Table A.1: Probability of choosing A

	Experiment 1		Experiment 2	
	(1)	(2)	(3)	(4)
High time pressure	0.0436	0.0510	0.0918	0.0291
	(0.104)	(0.108)	(0.0911)	(0.106)
Asymmetric game	-0.331***	-0.324***		
	(0.0844)	(0.0851)		
Asymmetric game x high time pressure	0.0650	0.0468		
	(0.123)	(0.123)		
Raven score		-0.0196		0.00469
		(0.0130)		(0.0223)
CRT score				-0.0164
				(0.0303)
Age		-0.00630		0.0199*
		(0.00502)		(0.0118)
Male		0.0147		0.182*
		(0.0559)		(0.101)
Swiftness		0.000953		-0.00647*
		(0.00283)		(0.00390)
Decision time		-0.0000383		0.000737
		(0.00210)		(0.00404)
Observations	211	211	121	121
Log.Likelihood	-97.56	-95.73	-83.33	-78.82
Chi-squared	28.68	32.35	1.016	10.02

Notes: This Table contains marginal effects from Probit regressions. CRT scores were only measured in experiment 2. Standard errors in parentheses; levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.2: Response times

	Experiment 1		Experiment 2	
	(1)	(2)	(3)	(4)
High time pressure	-15.37***	-15.21***	-10.52***	-10.60***
	(2.763)	(2.737)	(2.155)	(2.264)
Asymmetric game	5.750**	5.683**		
	(2.777)	(2.870)		
Asymmetric game x high time pressure	-3.941	-3.554		
	(3.781)	(3.770)		
Raven score		0.565		0.154
		(0.432)		(0.509)
CRT score				0.750
				(0.698)
Age		0.402**		-0.149
		(0.172)		(0.247)
Male		0.714		2.698
		(1.875)		(2.369)
Swiftness		0.125		0.0631
		(0.0912)		(0.0882)
decision_a		-0.201		0.421
		(2.400)		(2.265)
Constant	46.29***	25.95***	19.10***	17.65**
	(1.964)	(7.808)	(1.505)	(8.888)
Observations	211	211	121	121
Adjusted R^2	0.289	0.310	0.160	0.146
Log. Likelihood	-848.2	-842.5	-469.8	-468.2

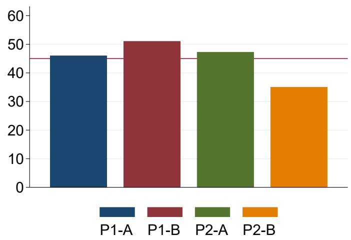
Notes: This Table contains coefficients from linear regressions. CRT scores were only measured in experiment 2. Standard errors in parentheses; levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A.2.2 Graphs

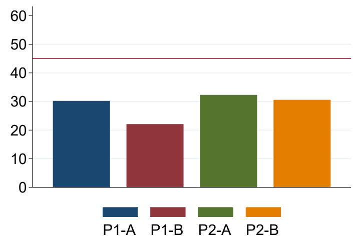
Figure A.1 shows the response times per action and player role. Histograms of response times can be found in the Online Appendix.

Figure A.1: Average response times by choice and player role

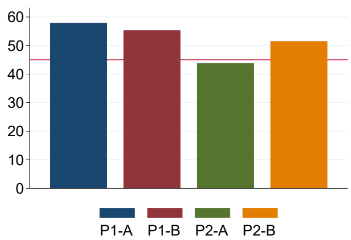
(a) Low time pressure, symmetric, Exp 1



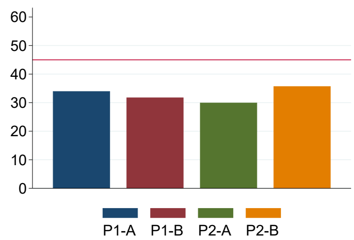
(b) High time pressure, symmetric, Exp 1



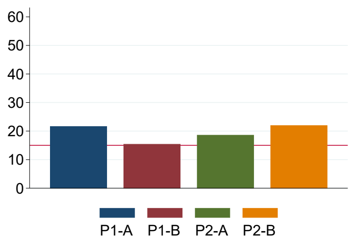
(c) Low time pressure, asymmetric, Exp 1



(d) High time pressure, asymmetric, Exp 1



(e) Low time pressure, asymmetric, Exp 2



(f) High time pressure, asymmetric, Exp 2